FINAL REPORT

Death following a first time, isolated coronary artery bypass graft

The heart of the matter

A report of the National Confidential Enquiry into Patient Outcome and Death (2008)

NCEPOD

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Foreword

There is an expectation that coronary artery disease can be effectively treated. Whether the sufferer presents with the intermittent symptoms of angina or is in the course of a full blown heart attack, we have tried and tested means of restoring and maintaining the coronary blood flow such that symptoms are alleviated, destruction of heart muscle is minimised, and death is averted. One of the ways of safeguarding the future of the heart is with coronary artery surgery - the subject of this report. Coronary surgery will not always succeed and death comes to us all in the end but if the means at our disposal are not deployed effectively and in a timely way, appropriate to the circumstances, lives that might have been saved will be lost. This NCEPOD report analyses the care of a sample of patients who in the majority did not survive to leave hospital following their operation. It takes a critical look at the selection of the surgery and the strategy and the organisational factors involved in its implementation.

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The last third of the twentieth century was an era of great change in the treatment of coronary artery disease, culminating in the publication of the Coronary Heart Disease National Service Framework in 2000. At the outset of this epoch there were agreed clinical diagnoses of stable angina and myocardial infarction. By the end a whole new set of diagnostic frames emerged, including evolving infarction, STEMI (ST segment elevation myocardial infarction) and non-STEMI heart attacks, hibernating and stunned myocardium and the catchall working diagnosis - acute coronary syndrome.

Coronary artery disease provides an example of how the emergence of new options for treatment themselves resulted in a reconsideration of the "framing" of the disease[1]. It is usual to attribute the description of angina to Heberden in 1768. The historian Christopher Lawrence[2] finds a much less straightforward story. There was considerable difficulty in defining associations between the structural findings in the heart at autopsy and the symptoms experienced by the living patient. A standard teaching text of 1914 on angina opens with the words: "A feeling of discomfort or constriction, or a sense of suffocation, is a symptom frequently present where the action of the heart is deranged by functional or structural diseases – oftener perhaps by functional"[3]. The distinction between angina (whether deemed functional or related to structure) and the recognition of acute infarction, was made sometime later. In 1928 the physicians of the day, John Parkinson and Evan Bedford wrote that if a patient "is seized when at rest with severe pain across the sternum which continues for several hours and which is accompanied by shock, collapse, and dyspnoea he has had an anginal attack of no ordinary kind. It is only reasonable to suppose that something definite and material has happened to the heart, and investigation is actually proving that such attacks are the result of acute infarction of the heart muscle from coronary occlusion."[4]

Lawrence explains that these clinical diagnostic frames of angina and infarction were only arrived at after considerable professional negotiation. It all became a lot simpler to categorise when coronary angiography became commonplace but there may still be some professional negotiation to come on the optimal intervention at the different stages of coronary disease.

It was in the late 1960s that an effective operation, coronary artery bypass grafting (CABG), was developed which could successfully and reliably deliver blood beyond narrowings (stenoses) in the coronary arteries. Within ten years CABG had entered practice throughout the developed world. Initially bypass grafts were constructed with leg veins but from the mid 1980s the use of an artery for at least one of the grafts became the norm; a typical patient would have three or four grafts and look forward to many years of relief from angina. More or less in this form, CABG has been performed in very large numbers for the past twenty years, both to relieve the symptom angina and to reduce the future risk of heart attack and death.

The value of CABG was explored in the early phase of a heart attack, dubbed "evolving" infarction. Some surgeons reported impressive survival rates attributed to this strategy of emergency surgery[5] but the organisational challenge of having a full surgical team available to start work at any time of the day or night, within an hour or so of the onset of the attack, was difficult to replicate. Furthermore, the added hazards of an operation and the disturbance to an already compromised heart and circulation put emergency CABG in this context outside of routine consideration. The idea of surgery in the acute phase of a heart attack was shelved.

About ten years after the inception of coronary artery surgery, a new technology called angioplasty, arrived on the scene. At first tentatively but with rapidly increasing confidence, cardiologists extended their role in the cardiac catheter laboratory from diagnosis to treatment by using a balloon to dilate the stenosis itself. At first only single vessel disease was regarded as amenable to angioplasty, and then only one artery at a time was tackled, but multi-vessel angioplasty has become commonplace. To the disappointment of both doctor and patient, in about a third of cases the vessel would narrow down again quite soon afterwards but with refinements of technique, in particular placing stents within the vessel, lower risk, predictable and more sustained restoration of blood flow is achieved. However, its place was seen rather firmly as in the elective setting in a hospital which could supply surgical back-up and this too was set aside for a time as a means of halting a heart attack in progress.

After a further ten years came the report of the GISSI (Gruppo Italiano per lo Studio della Streptochinasi nell'Infarto Miocardico)[6]. The thrombolytic agent, streptokinase, injected intravenously in the course of a heart attack reduced the three week death rate from 13% to 10.7% and better heart function amongst the survivors. After GISSI reported we no longer had to just sit it out, knowing heart muscle was dying. We had drugs of proven efficacy and could do something to halt the process.

Having halted the process, and put death off for the time being, cardiac teams were able to reconsider the place of interventions in the acute phase to do something about the underlying coronary disease with surgery or angioplasty. Indeed with growing confidence in our knowledge and technology, primary angioplasty is increasingly being used. Interventions in the acute phase are now common. A half of all patients operated on within the sample of this NCEPOD report were operated on urgently (compared with about 30% in contemporary registry data) and many of these patients fit somewhere in the diagnostic frame of acute coronary syndrome.

Apart from the acute interventions there are several strategies that reduce the likelihood of future trouble including modification of platelet activation and cholesterol metabolism. In this epoch prospects for the patient have changed radically from their being in the hands of fate to having access to a range of highly effective means of sparing heart muscle and preserving the duration and quality of their lives. For the individual patient the difference between success and failure, that is life and death, may come down to organisation of the service. NCEPOD has explored the workings of this very changed world in the time-critical care of coronary artery disease. Organisation, co-operation, communication and teamwork are at the very core.

Professor Tom Treasure
NCEPOD Chairman

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Principal Recommendations

Referral and admission process

Cardiothoracic units need to adhere to the requirement of the National Service Framework for Coronary Artery Disease and use protocols for referrals to their unit. These protocols should be standardised nationally for patients who require coronary artery bypass graft surgery. The degree of urgency of referral should be emphasised within these protocols (Clinical Directors).

Cardiothoracic units need to ensure that monitoring systems are in place to record nationally agreed audit data on referrals and the decision to operate. These systems need to identify patients who are in danger of breaching national agreed waiting times so that surgery can be expedited (Clinical Directors).

Multidisciplinary case planning

Each unit undertaking coronary artery bypass grafting should hold regular pre-operative MDT meetings to discuss appropriate cases. Core membership should be agreed and a regular audit of attendance should be performed (Clinical Directors).

Patient investigations

There must be a system in place to ensure that pre-operative investigations are reviewed by a senior clinician and acted upon (Clinical Directors).

Medical management

NCEPOD supports the guidance of the American College of Cardiology and the American Heart Association that clopidogrel should be stopped prior to surgery wherever practicable.

Non-elective, urgent, in-hospital cases

There should be a protocol to ensure timely and appropriate review of unstable cases that involves both cardiologists and cardiac surgeons (Clinical Directors).

A “track and trigger” system should be used to provide early recognition of clinical deterioration and early involvement of consultant staff (Clinical Directors).

Comorbidities

Where pre-operative comorbidity exists, there should be a clear written management plan which is followed in order to optimise the physical status of the patient prior to surgery, and identify the need for specific postoperative support to be available (Clinical Directors).

Peri-operative management and postoperative care

Cardiac recovery areas/critical care units are best suited to managing the majority of patients who recover uneventfully. Patients who are developing critical illness and additional organ failure should be managed in an environment with sufficient throughput of such patients to have the resources and experience to provide optimum outcomes (General Critical Care Units).

Senior clinicians should be readily available throughout the peri-operative period in order to ensure that complications (which occur commonly) are recognised without delay and managed appropriately (Clinical Directors and Consultants).

Appropriateness of surgery

Where unexpected events occur during surgery, surgeons should have an adaptable approach, and modify the operation to suit the circumstances of the case (Cardiothoracic Surgeons).

Communication, continuity of care and consent

Protocols must exist for handover between clinical teams and patient locations to ensure effective communication and continuity of care (Clinical Directors).

A consultant should obtain consent for coronary artery bypass grafting (Consultant Cardiothoracic Surgeons).

Multidisciplinary review and audit

Morbidity and mortality audit meetings should be held in all cardiothoracic units. The majority of units should hold meetings at least monthly. If the numbers of cases performed in a unit are small, alternative arrangements should be made to incorporate these cases in other surgical audit meetings (Clinical Directors and Audit Leads).

A common system for grading of quality of care of patients should be employed for all patients discussed in morbidity and mortality audit meetings. The peer review scale used by NCEPOD provides such a system (Clinical Directors).

1. Introduction

Coronary artery bypass grafting (CABG) must be the most thoroughly researched operation in the history of surgery. This single operation has dominated the work of most adult cardiac surgical units and represents over 80% or even 90% of the work in many busy cardiac surgery services. While there has been much research performed to identify clinical risk factors associated with outcome there has been limited research conducted on the impact of organisational factors. In this sample of cases associated with CABG we have found half of operations were performed as urgent procedures. That is to say, amongst these were patients with clinical manifestations of cardiac ischaemia, processed through the stages of invasive diagnostic procedures and scheduled for percutaneous or surgical interventions. This is a considerable feat of organisation requiring excellent team work and communication if it is to routinely go well. It is this process which is the subject of this NCEPOD report.

CABG is a technically demanding but commonly performed surgical procedure. A recent meta-analysis estimated there to be 800,000 procedures worldwide each year[1]. Surgeons accepting a greater proportion of patients at increased risk of peri-operative death may have a higher mortality rate but these are the very patients who stand to gain the most from having surgery. Unless mortality rates are adjusted for risk on a case-by-case basis they may give a false picture of the performance of a surgeon and the surgical unit. Proper use of risk prediction also helps to reduce avoidance of the very deserving but high-risk patients.

A great deal of work has been done and much is known about the patient-related risks. The system used throughout the era of this study is the European System for Cardiac Operative Risk Evaluation (EuroSCORE)[2]. This is the most established and tested international risk stratification system. With greater public awareness of performance there needs to be transparent and open systems in place, that acknowledge strengths and weaknesses of the methods used for risk stratification of patients, especially with respect to high-risk patients[3].

A good understanding and meticulous implementation of systems to make fair comparisons is imperative. It is likely that as older patients with more morbidity are operated upon there will be a commensurate rise in mortality rates. So far this has not been demonstrated in UK data from the Society for Cardiothoracic Surgery in Great Britain and Ireland (SCTS). Data published in 2003 showed that while the number of procedures performed over the previous five years had remained relatively stable at around 25,000 per annum, the associated mortality rate has also remained stable at about 2%[4]. Since then, and within the time frame of the NCEPOD study, the number of CABG procedures performed annually has in fact decreased. In 2004/2005 just under 23,000 bypass procedures were carried out, for the period 2005/2006 this dropped to 20,773 bypass operations, of which 98.4% patients survived the procedure[5, 6] and in 2006/2007 this further reduced to 19,444[7].

What is clear is that elective waiting times have come down and more operations are being performed in less stable patients at almost certainly increased risk. There remains an anxiety that in a modern era of transparency and accessible data, surgical teams may want to avoid high risk cases unless increasing risk and the organisational factors in caring for more acute cases are fully appreciated.

Cardiothoracic surgeons have been under increasing pressure to publish surgeon-specific mortality rates to enable the public and the profession to make comparisons between surgeons and units, but it is recognised that simple outcome data are open to misinterpretation. In 2003, the SCTS approached the National Confidential Enquiry into Patient Outcome and Death (NCEPOD), to carry out a study to investigate the impact of organisational factors on outcome following first time isolated CABG. By determining areas of care that influence patient outcome, other than just the surgical procedure, factors that lie behind surgical mortality rates may be more clearly understood and defined; this is an essential step in refining systems of care for these patient groups. In this study NCEPOD aimed to review all in-hospital deaths following first time isolated CABG surgery to identify the effect of such organisational factors on patient outcome.

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2. Methods

Study aim

The aim of the study was to examine whether there are identifiable changes in care processes, including the functioning of cardiac teams, that impact on patient outcome following a first time isolated coronary artery bypass graft (CABG).

Expert group

Prior to commencement of the study an expert group was formed comprising cardiothoracic surgeons, cardiothoracic anaesthetists, cardiologists, a pathologist, an intensivist and a lay representative. NCEPOD also worked with the Clinical Operational Research Unit (CORU) at University College London (UCL) who provided independent scientific advice.

Consensus method

Prior to the start of the study, the expert group and CORU undertook a consensus exercise, the aim of which was to identify which factors of care should be examined in the study. An initial postal survey of the expert group identified 95 potential topics, from which a list of 27 topics related to remediable features of the care process was identified. A meeting was held during which the expert group discussed and amended this list of topics before ranking them in priority order. The top 13 topics (Figure 1) were then chosen to form the basis of the study. Full details of the consensus process used can be found in Utley at al, 2007[1].

1	To what extent does variation in referral and admission process affect outcome?
2	To what extent do institutional approaches to retrospective multidisciplinary case review and audit vary?
3	To what extent does the scheduling of operation affect outcome?
4	To what extent does the in-hospital process of reviewing unstable cases affect outcome?
5	Was the operation performed appropriate for the patient and the circumstances?
6	To what extent does variation in the anaesthetic process affect outcome?
7	To what extent does variation in prospective multidisciplinary case planning affect outcome?
8	To what extent does variation in the patient investigation process affect outcome?
9	To what extent does the identification and management of peri-operative complications affect outcome?
10	To what extent does the appropriateness of postoperative facilities and support affect outcome?
11	To what extent does variation in medical or interventional management pre-operatively affect outcome?
12	Is continuity of care and communication a factor that affects outcome?
13	Are there identifiable changes in care processes that could reduce the influence of comorbidities on outcome?

Figure 1. Study questions.

Population

All sites that perform this surgery were asked to report all in-hospital deaths over a three year period, 1st April 2004 to 31st March 2005 – Year 1; 1st April 2005 – 31st March 2006 – Year 2; 1st April 2006 - 31st March 2007 – Year 3, following first time isolated CABG; this included patients admitted directly to the unit as well as patients transferred between and within units. All units in England, Wales, Scotland and Northern Ireland, from both the NHS and the Independent sector participated. Based on data from the Central Cardiac Audit Database (CCAD), it was estimated there would be approximately 500 deaths per year.

In order to control for factors already known to impact on outcome following a first time isolated CABG, a control sample of patients was selected. This sample of patients who survived to discharge was matched to deceased patients according to a number of clinical factors. A download of all patients who underwent first time isolated CABG and survived the procedure, between 1st April 2004 – 31st March 2007, was gathered from the CCAD. Where these data were not available via CCAD, the units were requested to send the data directly to NCEPOD; the patients who survived to discharge were then selected from this data pool. This was done on an annual basis, (April 1st 2004 – 31st March 2005, April 1st 2005 – 31st March 2006, and 1st April 2006 – 31st March 2007).

Unit participation

All units in the UK, and for this study uniquely Scotland, from both the NHS and independent sector were included in the study. In year 1, 54 sites participated, of which 39 were NHS and 15 independent. In year 2, participation increased to 60 sites of which 39 were NHS and 21 independent; this participation increase was as a result of an increase in the

independent sector's participation in NCEPOD studies. In the final year of the study, 58 sites took part, of which 19 were independent and 39 NHS. This reduction was due to two independent sites ceasing to carry out CABG. It is believed all NHS hospitals who carry out CABG participated in the study.

Exclusions

Patients undergoing a repeat coronary artery bypass graft, or undergoing another procedure at the same time were not included in this study. The study did not include patients under the age of 16.

Sample size

Cases were identified via a nominated main point of contact in each unit; this could have been the cardiothoracic audit lead, the cardiothoracic database manager or the NCEPOD Local Reporter (a local contact who supplies NCEPOD with data for most of their studies). The patients were identified either by the Office of Population Census and Surveys (OPCS) codes (Figure 2), or by defining the operation as CABG only as defined in the minimum data set of the Society for Cardiothoracic Surgery in Great Britain and Ireland (SCTS[2]).

- **K40** – Saphenous vein graft replacement of coronary artery
- **K41** – Other autograft replacement of coronary artery
- **K42** – Allograft replacement of coronary artery
- **K43** – Prosthetic replacement of coronary artery
- **K44** – Other replacement of coronary artery
- **K45** – Connection of thoracic artery to coronary artery

Excluding K44.2, K45.6 and those with an ICD10 code of Z95.1

Figure 2. OPCS codes.

Advisor groups

A multidisciplinary group of advisors was recruited to review the casenotes and associated questionnaires. This group comprised cardiothoracic surgeons, cardiothoracic anaesthetists and cardiologists. For each case an assessment form was completed by both NCEPOD researchers and the advisors. NCEPOD researchers extracted information from the casenotes with regard to dates of referral, admission and review, the mode of admission and the consenting process. Advisors gave their expert opinion on the timeliness of the admission and review process, transfers, the scheduling of the operation, patient investigations, peri-operative management and the appropriateness of surgery.

All questionnaires and casenotes were anonymised by non-clinical staff at NCEPOD. All patient, clinician and hospital identifiers were removed. Neither clinical staff at NCEPOD, nor the advisor group had access to any information that would enable patients or clinicians to be identified. After being anonymised each case was reviewed by one advisor within a multidisciplinary group. At regular intervals throughout the meeting, the chair allowed a period of discussion for each advisor to summarise their cases and ask for opinions from other specialties or raise aspects of a case for discussion. The following grading system was used by the advisors.

- **Good practice** – a standard that you would accept for yourself, your trainees and your institution
- **Room for improvement** – aspects of **clinical** care that could have been better
- **Room for improvement** – aspects of **organisational** care that could have been better
- **Room for improvement** – aspects of both **clinical and organisational** care that could have been better
- **Less than satisfactory** – several aspects of **clinical and or organisational** care that were well below satisfactory
- Insufficient information submitted to assess the quality of care

"Cause for concern" process

Where any case was identified by the advisors as a "cause for concern"; that is well below the expected standard of care, so that it is likely that current and future patients will be at risk; NCEPOD followed their existing protocol. The Chief Executive of NCEPOD contacted the Medical Director of the hospital concerned and asked them to review the case and take local action as appropriate. This method has been agreed with the GMC but under no circumstances is the GMC notified of these cases. More recently the consultation document 'Making Amends'[3] issued by the Chief Medical Officer highlighted the fact that in such cases there is an obligation to make a cause for concern known.

In this study six cases were reported as a "cause for concern" which was a consistent number associated with similar sized NCEPOD studies.

Quality and confidentiality

Each case was assigned a unique NCEPOD number so that cases could not be easily linked to a hospital.

The data from all questionnaires received were electronically scanned. Prior to any analysis taking place, the data were cleaned to ensure there were no duplicate records, and that erroneous data had not been entered during scanning. Any fields that contained spurious data that could not be validated were removed.

References

1 Utley M, Gallivan S, Mills M, et al. *A consensus process for identifying a prioritised list of study questions, Health Care Management Science,* 2007;10:105-110.

2 Keogh B, Kinsman R. (2004). *Fifth national adult cardiac surgical database report 2003.* London: Society for Cardiothoracic Surgery in Great Britain and Ireland.

3 Department of Health. (2003). *Making amends.* Crown Copyright. *http://www.dh.gov.uk/assetRoot/04/07/23/28/04072328.pdf*

3. Data returns

Questionnaires

Three questionnaires were used to gather data in this study, two clinical questionnaires per patient – a surgical and an anaesthetic, and one organisational questionnaire per site.

Surgical questionnaire

A surgical questionnaire was sent to the consultant cardiothoracic surgeon involved in each patient's care; this was sent directly to the surgeon unless otherwise requested. This questionnaire was used to gather clinical data concerning the pre-, intra- and postoperative period. Clinicians were given six weeks to complete the questionnaire in the first instance. Outstanding questionnaires were followed up with a number of reminders.

Anaesthetic questionnaire

An anaesthetic questionnaire was sent to the consultant anaesthetist responsible for the care of each patient; this was again sent directly to the anaesthetist unless otherwise stated. This questionnaire was used to gather clinical data concerning the pre-, peri- and postoperative period. Clinicians were given six weeks to complete the questionnaire in the first instance. Outstanding questionnaires were followed up with a number of reminders.

Organisational questionnaire

Each site was required to complete an organisational questionnaire for the first year and third year of the study. In the second year of the study sites were simply requested to inform NCEPOD if there had been any changes in organisational facilities. Where new sites were participating in the second or third year they were asked to complete the whole questionnaire. This questionnaire was used to gather data concerning facilities and protocols for the care

of patients undergoing coronary artery bypass grafts (CABG). The organisational questionnaire was sent to the study main point of contact at each site, to pass on to the audit lead, or to someone in the department with knowledge to complete the questionnaire. NCEPOD requested one organisational questionnaire per site be returned rather than one per Trust, so that we had an accurate idea of what happened in each site.

Whether questionnaires were sent directly to the clinician or whether they were disseminated via the main point of contact, it was requested that completed questionnaires were returned directly to NCEPOD to ensure confidentiality of the data returned.

Casenotes

Alongside the completed questionnaires NCEPOD also asked that copied extracts of the casenotes be returned. These included:

- **Admission notes**
  - Initial clerking assessment
  - Emergency Department records
  - Medical Assessment Unit records
  - Pre-assessment clinic records
  - Any relevant referral letters, especially those from:
    - GP or transfer letter from referring hospital (if applicable)
    - Clinic letter from surgeon
- **EuroSCORE scoring sheet**
- **Medical casenotes for the duration of the hospital stay (admission to death or discharge) including:**
  - Records of multidisciplinary team (MDT) decisions
  - Any separate notes/charts relating to the surgical procedure
  - Any separate anaesthetic records
- **Consent form**
- **Copy of autopsy report if performed, and any relevant minutes of mortality audit meetings relating to this case (for deceased patients)**
- **Discharge summary (for surviving patients)**

NCEPOD also requested data to be sent back to accompany the organisational questionnaire where applicable; this included:

- **Written policy for clinical review of unstable, urgent, in-hospital cardiothoracic patients**
- **Records of attendance for/minutes of MDT case planning meetings**
- **Patient information sheet for cardiac surgery**
- **Record of attendance for/minutes of MDT review and audit meetings**

Cases

Figure 3 shows the data return for the cases over the three year study period.

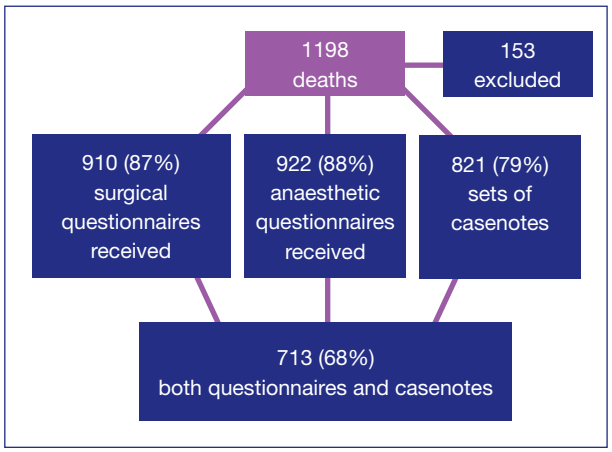

Figure 3. Data returns (cases).

Data returns	Year 1	Year 2	Year 3
Cases included	**410**	**327**	**308**
Surgical questionnaires returned	373 (91%)	284 (87%)	253 (82%)
Anaesthetic questionnaires returned	367 (90%)	297 (91%)	258 (84%)
Casenotes returned	345 (84%)	259 (79%)	217 (70%)
Complete data set returned	310 (76%)	222 (68%)	181 (59%)

Table 1. Data returns by year (cases).

Over the three year period, 1198 deaths were reported to NCEPOD, of which 153 were excluded. The main reasons for exclusion included the case being misreported because of a data coding error (117 cases). There were also a number of cases reported on more than one occasion (17). Six patients were excluded from the sample of deaths as they were discharged alive, and a further nine because they died outside of the study period.

The returns for the first and second year of the study were higher for the return of casenotes and a complete data set, as clinicians and units had three years to return these data. Table 1 also highlights a reduction in the number of deaths following first time isolated CABG over the three year period.

Controls

This study was initially designed as a case control study. The case control aspect of the study will be presented in a later report; for interest in this report, the data return over the three years for the control data is shown in Table 2.

Figure 4 shows the total data return for the controls over the three year study period.

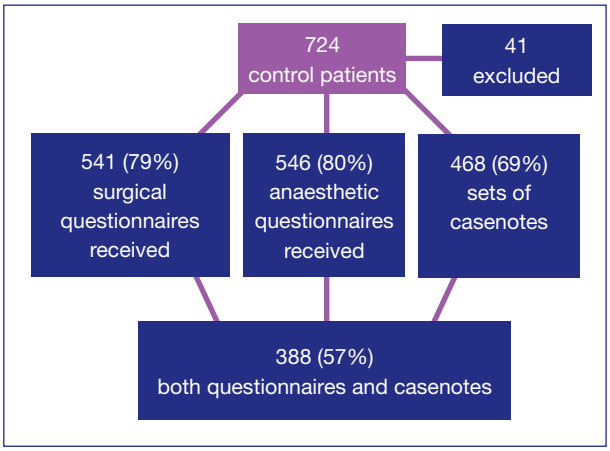

Figure 4. Data returns (controls).

Over the three year period 724 patients who died following first time isolated CABG were matched to a patient who survived to discharge. Of these patients 41 were excluded; reasons for exclusion were a lack of case information to confirm the patient was correctly matched (23); exclusion of the corresponding patient that died (9) and procedure coding errors (4). There were also four patients reported as surviving the procedure who actually died. The return rates for the questionnaires were comparable with previous NCEPOD studies.

Data returns	Year 1	Year 2	Year 3
Controls included	**247**	**240**	**196**
Surgical questionnaires returned	214 (87%)	184 (78%)	143 (73%)
Anaesthetic questionnaires returned	217 (88%)	190 (79%)	139 (71%)
Casenotes returned	197 (80%)	147 (61%)	125 (64%)
Complete data set returned	171 (69%)	122 (51%)	95 (48%)

Table 2. Data returns by year (controls).

The return rates for the first year of the study were higher than those for the second and third year, and for the second year higher than for the third year. It is assumed this was a reflection of the time available to return data. Where the casenotes were returned they were not always of a standard for an advisor to review; amongst the control sample, the casenotes of 37/469 patients were graded as having insufficient data to assess the case.

The final date for the return of data to NCEPOD was 10th September 2007 for casenotes and the 14th September for the return of questionnaires. Data returned after this point were not included in the analysis.

Data analysis

Following cleaning of the quantitative data, descriptive analysies were carried out. Where appropriate, the qualitative data from the assessment form, and the clinical questionnaires, were coded according to content and context. These data were reviewed by NCEPOD clinical staff to identify the nature and frequency of recurring themes. Case studies have been used throughout the report to highlight any key themes. Some data were analysed with assistance from CORU using Microsoft Access and Excel by the staff at NCEPOD. The findings of the report were reviewed by the expert group, the advisors, and the NCEPOD steering group prior to publication.

4. Results & data overview

Results

Except where specified, all data presented throughout the report concern data collected on the cases where the patient died following the CABG procedure.

Data overview

Hospital participation

As previously stated, 54 sites participated in the first year of the study, 60 in the second and 58 in the final year. Every site returned an organisational questionnaire for at least one year of the study. In two instances a Trust returned one organisational questionnaire to cover two sites. Therefore any organisational analysis presented in the report has been carried out using data from 58 questionnaires.

Population

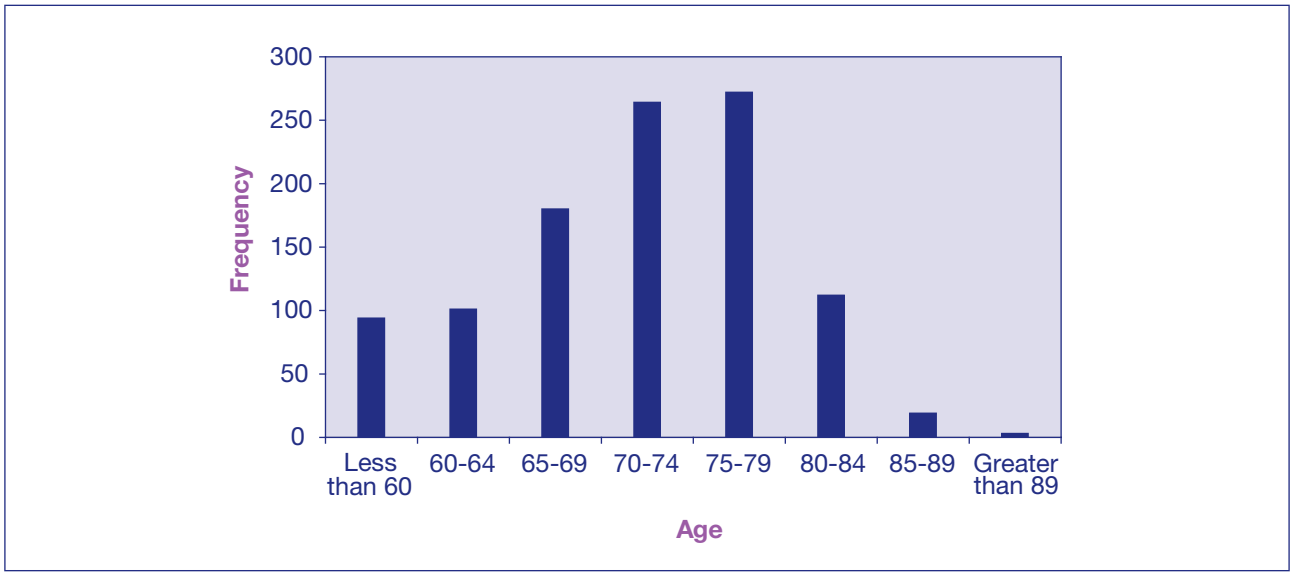

Figure 5. Age range.

Median age range was 73 years for cases. Just over half of patients were aged between 70 – 79 years, (n=536, 51%). In terms of gender, 68% of the sample were male (n=705) and 32% female (n=340).

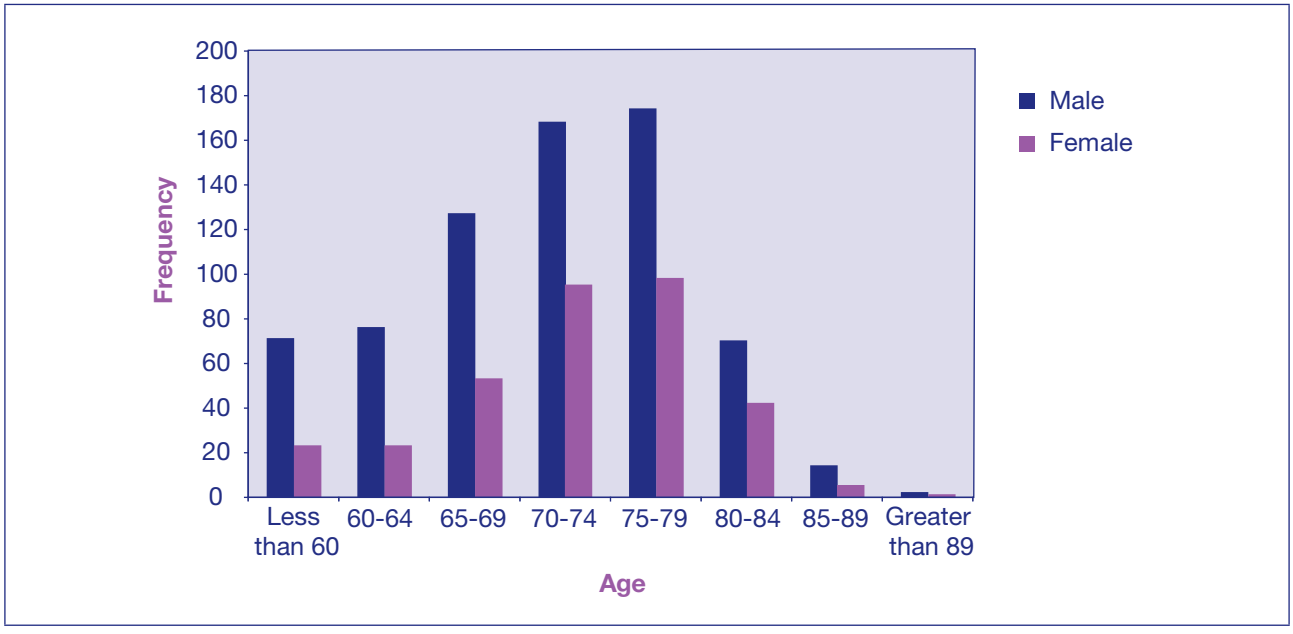

Figure 6. Age range by gender.

Figure 6 demonstrates age range by gender.

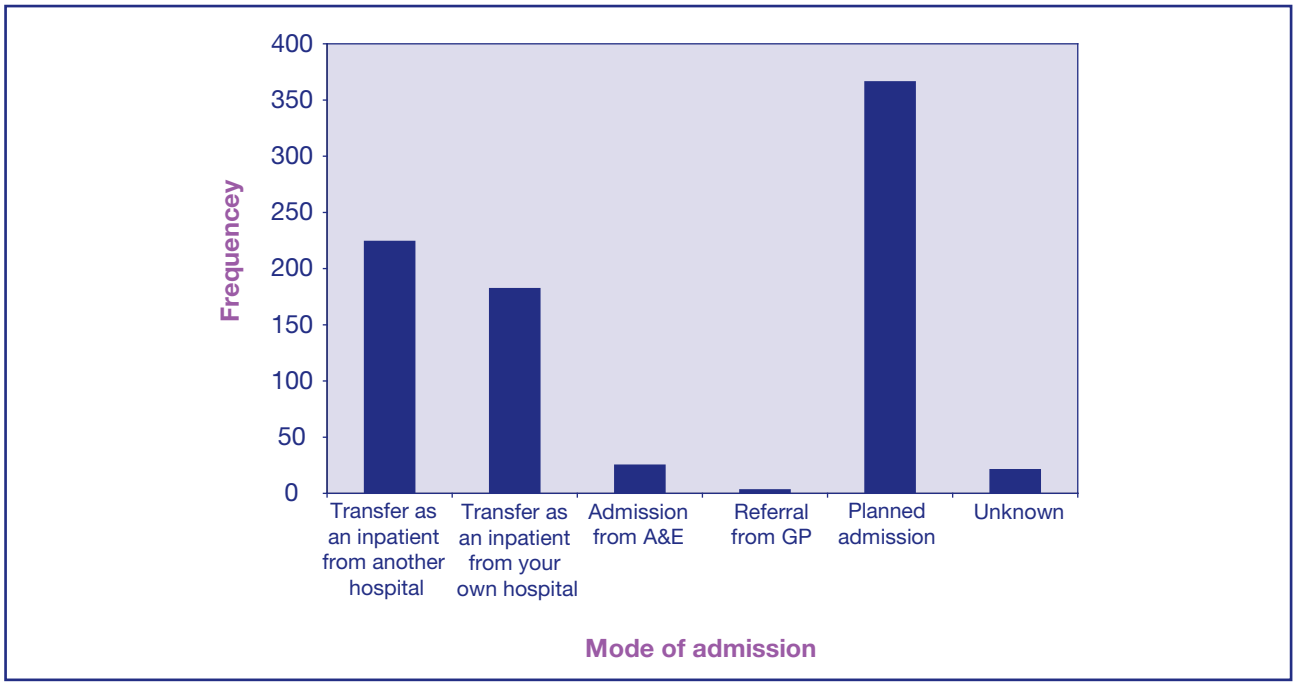

Figure 7. Mode of admission

Mode of admission

Based on data taken from the casenotes 49.5% of patients were admitted as transfers, either as an inpatient from another hospital or as an inpatient from another unit within the operating hospital. A further 44.6% of patients were admitted on an elective basis (Figure 7).

In terms of the category of the operation, as classified by the Society for Cardiothoracic Surgery in Great Britain and Ireland (SCTS)[1], and shown in Figure 8, the majority of patients in this study were operated on as an urgent case, (n=408, 44.8%), or as an elective case, (n=372, 40.9%). Fourteen percent of patients (n=130) were admitted as an emergency or salvage case (Figure 9).

- **Elective** – Routine admission from the waiting list. The procedure can be deferred without risk.
- **Urgent** – Patients who have not been scheduled for routine admission from the waiting list but who require surgery on the current admission for medical reasons. They cannot be sent home without surgery.
- **Emergency** – Unscheduled patients with ongoing refractory cardiac compromise. There should be no delay in surgical intervention irrespective of time or day.
- **Salvage** – Patients requiring cardiopulmonary resuscitation (CPR) en-route to the operating theatre or prior to anaesthetic induction. CPR following anaesthetic induction should not be included.

Figure 8. Category of operation.

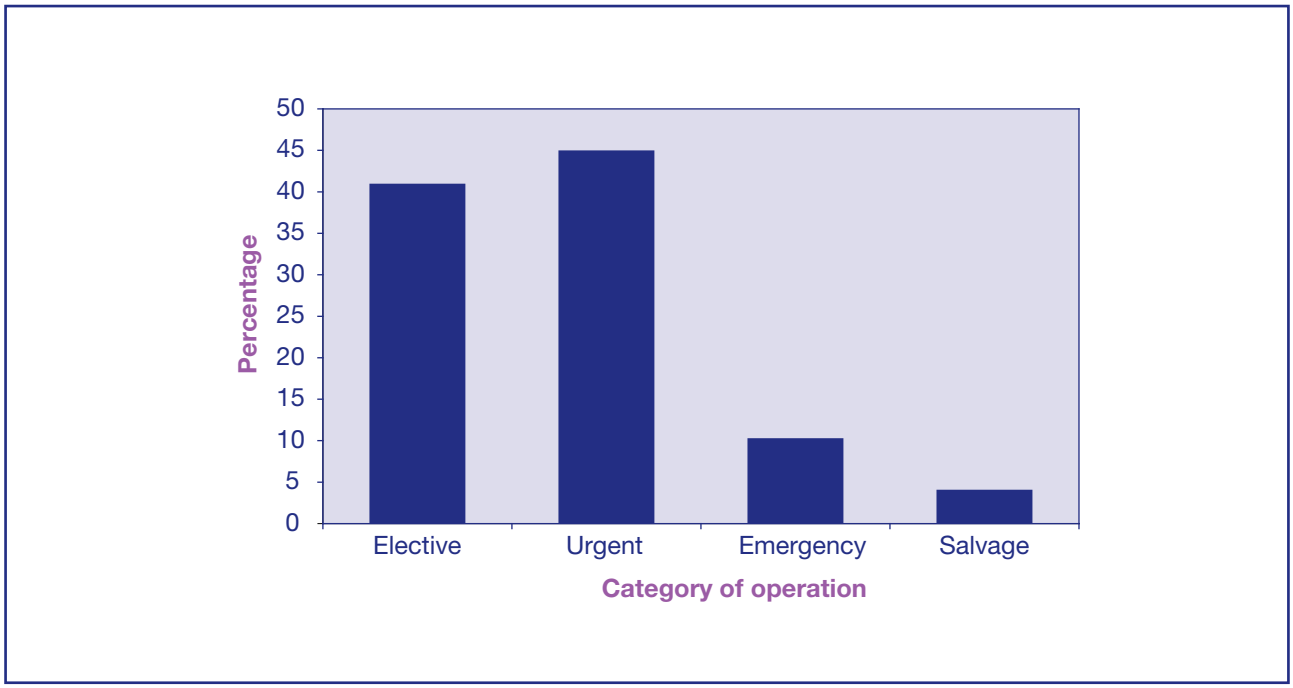

Figure 9. Category of operation.

Overall assessment of cases

Figure 10 demonstrates the advisors' overall assessment of care among the deceased patients (cases). In only 311 (38%) cases did the advisors feel that patients had received a level of care they considered to be good practice. In 282 (34%) cases, the advisors judged that there was room for improvement in the clinical care of the patient. In 54 (7%) cases, advisors believed there was room for improvement in the organisational care of the patient and in 75 (9%) cases, advisors believed there was room for improvement in the clinical and organisational care of the patient. In 41 (5%) cases the level of care was judged to have been less than satisfactory. In 58 (7%) cases there was insufficient data to allow advisors to assess the case.

Amongst the patients who survived to discharge (controls), in 341 (73%) patients, the advisors judged the patient had received a level of care considered to be good practice. The advisors judged in 90 (19%) patients there was a room for improvement in either the clinical or organisational, or both clinical and organisational care received. In one (<1%) instance the advisors judged that the care a patient had received was less than satisfactory, (Figure 11). In the remaining 37 (8%) cases there was insufficient data for advisors to assess the level of care received.

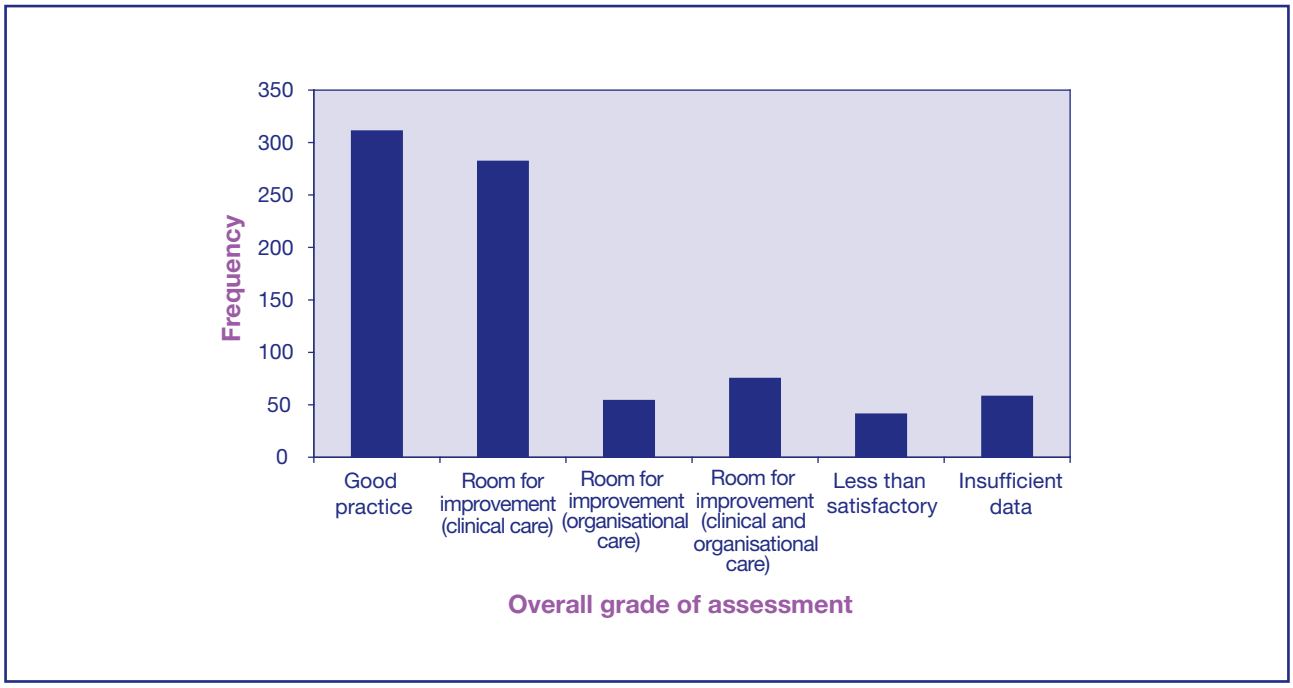

Figure 10. Overall assessment of care (cases).

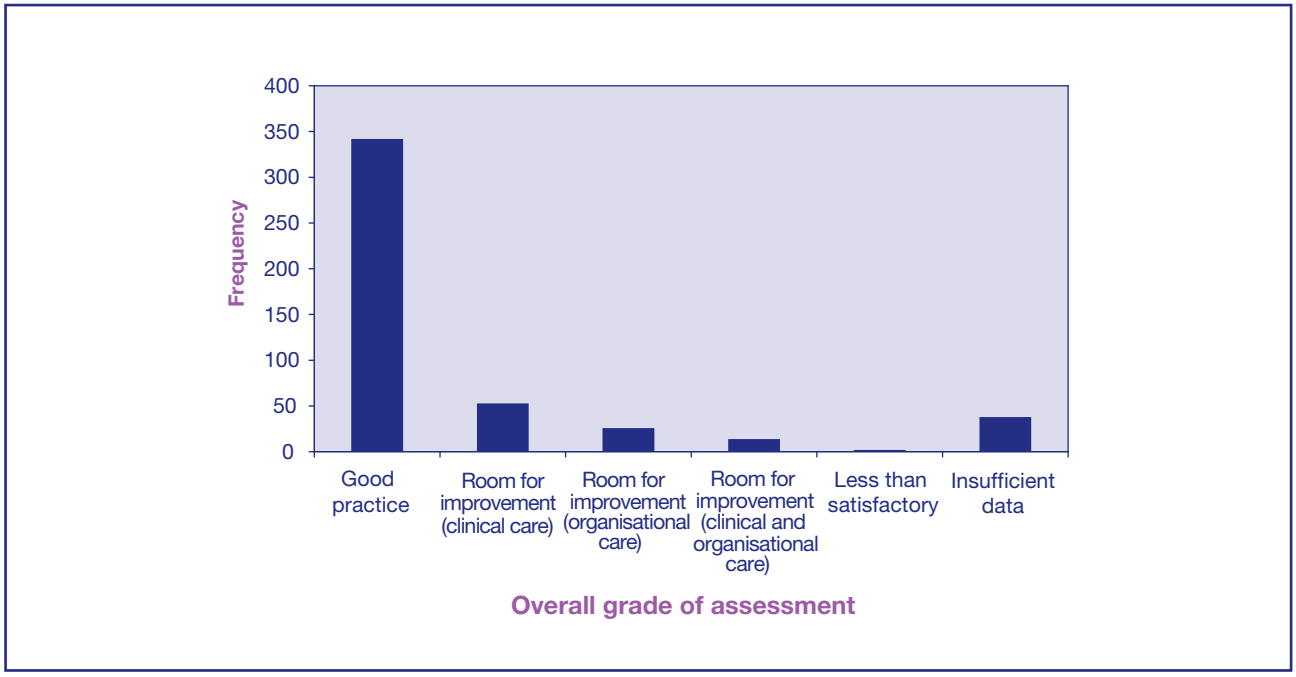

Figure 11. Overall assessment of care (controls).

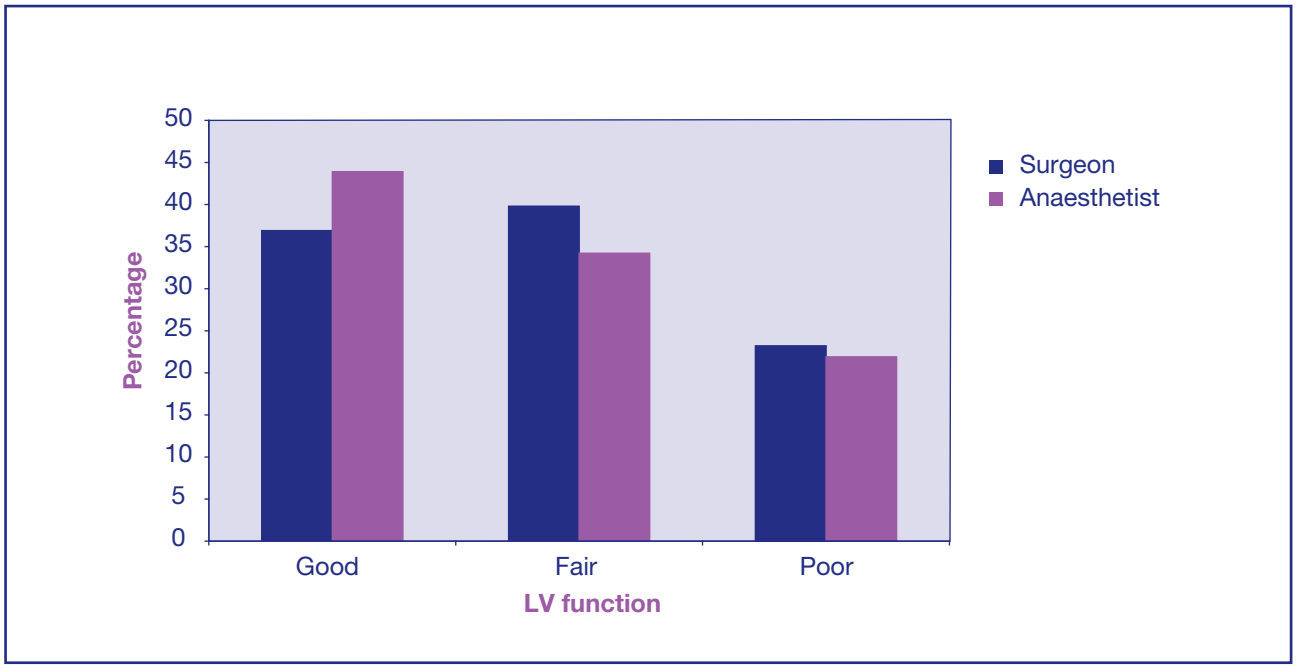

Figure 12. LV functions as recorded by surgeon & anaesthetist.

It is clear from Figures 10 and 11 there was a difference in the assessment of care received by the cases and controls. This may be due to the fact the advisors were aware of the outcome prior to assessing the case, or may be a true reflection of the difference in care between those patients who died, and those who were discharged alive following first time CABG. NCEPOD recognises the potential bias in this method.

Left ventricular function

The second interim report[2] discussed the measurement of left ventricular function (LV function), and the discrepancies within this. Surgeons and anaesthetists were asked to provide a level of measurement of LV function prior to surgery.

Overall rates reported by the surgeons were 36.9% of patients with good, 39.8% with fair and 23.2% of patients with poor LV function.

As reported by the anaesthetists 43.9% of patients had a good LV function, 34.2% fair and 21.9% poor LV function, (Figure 12).

There were 791 cases where both the surgical and anaesthetic questionnaires were returned completed. Within these there were discrepancies in the answers given by the surgeon and the anaesthetist for 232 (29%) patients. It has been suggested that this difference may be due to the sourcing of the information, with the surgeons and anaesthetists extracting the data from different locations in the casenotes; data being extracted and decisions being made at different times; and the assessment difficulty of deciding a percentage at the boundaries between good/fair and fair/poor. It is important to re-state the importance of accurate measurement and recording of LV function, as a component of EuroSCORE.

Comorbidities

The number of cases of diabetes, hypertension, renal disease, and respiratory disease reported in the surgical questionnaire are presented in Table 3.

Comorbidity	Yes	
	n=	%
Diabetes	302	33.6
Hypertension	643	72.2
Renal disease	102	12.1
Respiratory disease	225	26.3

Table 3. Incidence of comorbidities.

Discrepancies between the answers given in the surgical and anaesthetic questionnaires were examined. There were substantial discrepancies in all comorbidities within the answers given by the surgeons and anaesthetists. For example in 9.5% of cases there was a discrepancy in the answer given by the surgeon and anaesthetist as to whether the patient was diabetic (Table 4).

Comorbidity	Presence of comorbidity
Diabetic status	9.5%
Hypertension	22.9%
Renal disease	4.4%
Respiratory disease	29.3%

Table 4. Discrepancies in the answers given by the surgeons and anaesthetists.

It is important to highlight the importance of accurate assessment and recording of these comorbidities.

EuroSCORE

The first interim report[3] discussed the calculation and recording of the EuroSCORE; the risk stratification system used in cardiac surgery. At the time of publication of the first report a measure of EuroSCORE was available in 90% of cases. However, where both an overall score was given and the EuroSCORE matrix was completed (see Appendix1), the value was the same in only 146/223 (65%) cases.

These data have been examined for all the data on a yearly basis. In year one, overall EuroSCORE was calculated in the surgical questionnaire, either globally or as the matrix, in 373 cases. Where an overall score was given and the matrix completed, the answer given matched in 222 (59.5%) cases; there was a discrepancy in 59 (15.8%) cases. In the remaining 92 (24.7%) cases, the global EuroSCORE was blank or the matrix had not been completed properly. In year two, out of 283 patients, the global EuroSCORE and EuroSCORE matrix matched in 181 (64%) cases; there was a discrepancy in 41 (14.5%) cases and incomplete data in the remaining 21.5% cases. In year three, of 254 patients, the answer given by the surgeon in the global EuroSCORE and the matrix matched in 179 (70.5%) cases; there was a discrepancy in the answer given in 30 (11.8%) cases. The global EuroSCORE was blank or the matrix had not been completed properly in the remaining 45 (17.7%) cases.

NCEPOD staff also extracted the EuroSCORE from the casenotes where available; this could be taken from the notes in 325/821 (40%) of the sets of casenotes sent in.

Table 5 demonstrates how well completed the EuroSCORE matrix was in the surgical questionnaire for both those patients that died and those patients that survived to discharge. The first column shows the number of cases where an answer was given in any format, i.e. a number, a letter, a tick, or a 'O'. The second column shows the number of cases where the answer given in the surgical questionnaire was actually recorded correctly, i.e. in the format specified by the EuroSCORE criteria.

For example, if the patient was female they would be given one point in the matrix. As the table shows, the range of score accurately record in the matrix was between 0.4% - 94.8%: this will impact on confidence in the decision making process, and in the accuracy of the recording of EuroSCORE. Where it may be valid to give a tick if a patient is female, these data are meaningless if a tick is given for LV function.

Variable	Total		
	Answered	Answered according to EuroSCORE specifications	
	n=	n=	%
Age	1288	1221	94.8
Sex	630	407	64.6
Chronic pulmonary disease	458	221	48.3
Extracardiac arteriopathy	571	295	51.7
Neurological dysfunction	314	47	15.0
Previous cardiac surgery	258	1	0.4
Serum creatinine	335	78	23.3
Active endocarditis	253	4	1.6
Critical pre-operative state	398	149	37.4
Unstable angina	581	288	49.6
LV dysfunction	859	656	76.4
Recent myocardial infarct	711	462	65.0
Pulmonary hypertension	264	20	7.6
Emergency	366	106	29.0
Other than isolated CABG	252	5	2.0
Surgery on thoracic aorta	248	0	NA
Post infarct septal rupture	248	0	NA

N=1457

Table 5. Accuracy of EuroSCORE matrix completion.

References

1 Keogh B, Kinsman R. (2004). *Fifth national adult cardiac surgical database report 2003.* London: Society for Cardiothoracic Surgery in Great Britain and Ireland.

2 National Confidential Enquiry into Patient Outcome and Death. (2007). *Death following a first time isolated coronary artery bypass graft; Interim report – Data Year 2005/2006.* NCEPOD.

3 National Confidential Enquiry into Patient Outcome and Death. (2006). *Death following a first time isolated coronary artery bypass graft; Interim report – Data Year 2004/2005.* NCEPOD.

5. Referral and admission process

Study question

"To what extent does variation in referral and admission process affect outcome?" The consensus exercise identified variation in referral as the highest priority area for examination in this study.

Patients who have coronary artery disease and require coronary artery bypass grafting may be referred via a variety of different routes. The final admission to hospital for surgery may also follow a range of admission processes. This is dependent on the extent and severity of the coronary artery disease. Patients referred for coronary artery bypass surgery should follow local networks of cardiac care using a 'hub and spoke' model where links to a tertiary referral cardiac centre exist from cardiac units in district hospitals and primary care. Referral protocols, treatment protocols and quality improvement methods should be in place within these networks. These should be agreed by the tertiary referral centres, the relevant district general hospitals and primary care groups[1].

In this study NCEPOD reviewed the mechanisms by which patients were referred to the cardiothoracic service and admitted as an inpatient in preparation of surgery. When reviewing these data it is important to appreciate the select nature of this group of patients.

Referral process

Methods of referral

Of the 58 cardiothoracic units that returned organisational questionnaires, 28 indicated that a written protocol for referrals was used. Five units, that did not have a protocol in the first year, had one in the third year of the study. It is of note that compliance with the National Service Framework (NSF) for Coronary Heart Disease recommendation for the use of referral protocols to cardiothoracic units was so poorly met. It was

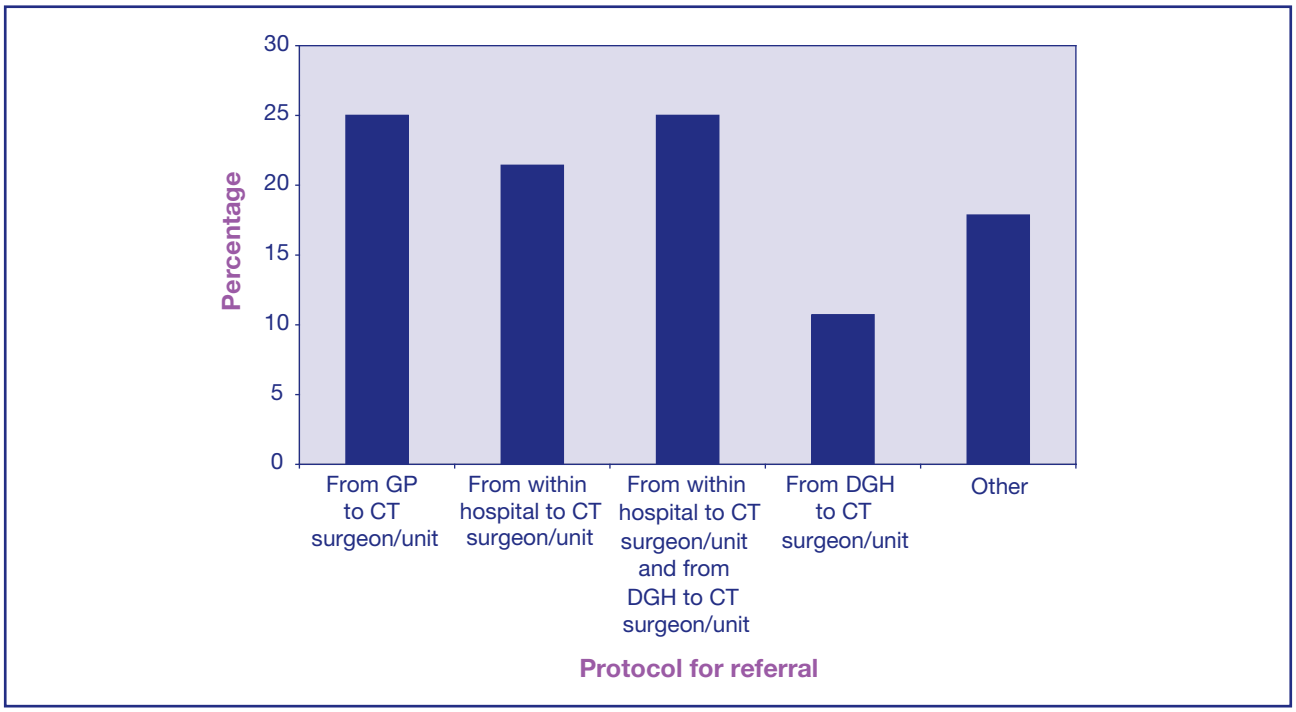

Figure 13. Types of referral protocol used by cardiothoracic units.

encouraging that some units introduced referral protocols during the three years of the study. However, the fact that in the seven years since the NSF was published that nearly half the cardiothoracic units in the UK still do not have these protocols requires urgent attention.

Of the 28 cardiothoracic units that had written protocols for referral NCEPOD asked for the types of protocol that existed (Figure 13).

NCEPOD asked the clinician completing the surgical questionnaire if a written referral protocol was used. For 673 (74%) of these patients a standard written protocol was reported to have been used. There was a 7.8% increase in use of written protocols over the three years of the study (Table 6).

Written protocol	Year 1	%	Year 2	%	Year 3	%
Yes	265	71.6	207	73.9	201	79.4
No	91	24.6	57	20.4	42	16.6
Unknown	14	3.8	16	5.7	10	4.0
Subtotal	**370**		**280**		**253**	
Not answered	3		3		1	
Total	**373**		**283**		**254**	

Table 6. Number of patients referred using a written protocol (surgical questionnaire).

However, there was some disagreement between data obtained from the surgical and organisational questionnaires in that 349 of these patients came from units that reported that they did not have written referral protocols. It is difficult to explain the reason for this discrepancy. It is possible that surgeons completing clinical questionnaires may have interpreted the question differently from the persons completing the organisational questionnaires, many of whom were unit audit leads. Regardless of the cause, these inconsistencies would indicate that greater clarity is required within the cardiothoracic teams regarding the presence and use of referral protocols.

The use of written protocols for referral for each category of operation is shown in Figure 14. For those patients who had elective and urgent surgery, referral protocols were reported to be used in 80% and 75% of occasions respectively. In emergency cases this was reduced to 61%. Although the number of salvage cases was small, just under half of these patients were reportedly referred to the surgical team using written protocols.

From the casenotes the route of referral of patients was determined (Figure 15). In this group of patients, 49.2% (405/821) were transferred as an inpatient from either another hospital or from within the hospital in which the cardiothoracic unit was situated. The majority of the remaining patients, 44.6% were planned admissions.

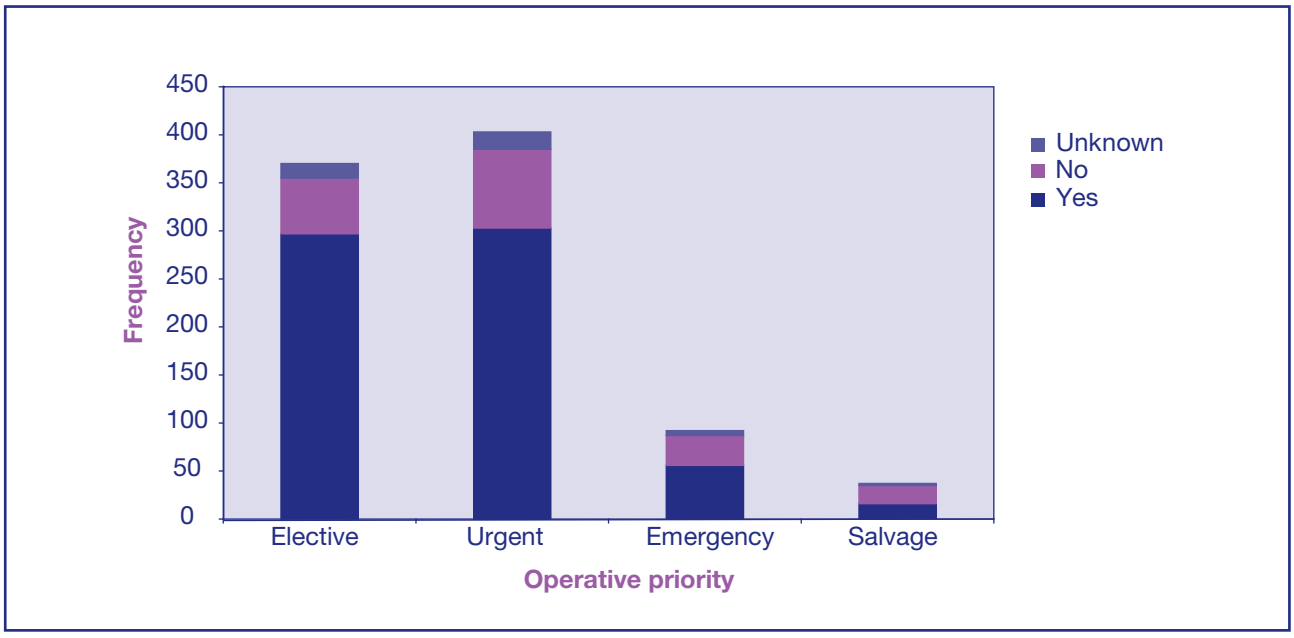

Figure 14. Use of referral protocol by operative priority.

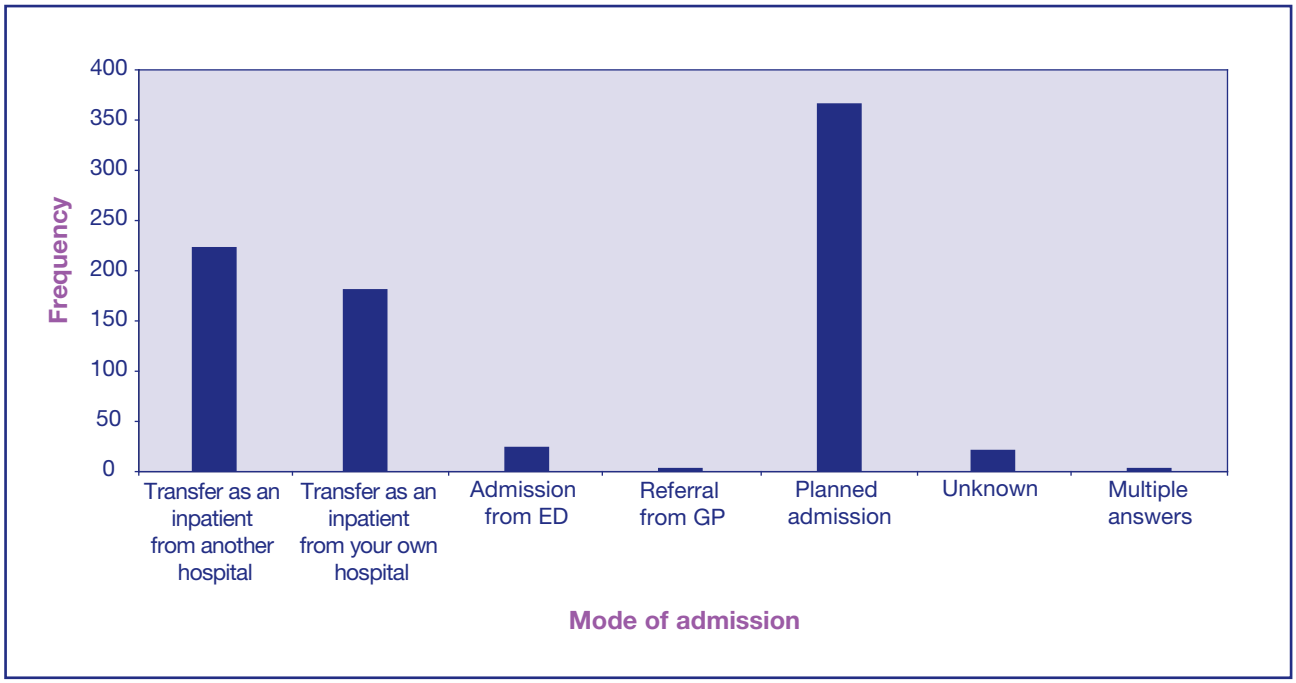

Figure 15. Route of patient referral.

The specialty and grade of clinician who referred the patient to the cardiothoracic unit was obtained from the surgical questionnaire. In 99% of cases the referral was from a cardiologist. The grade of personnel who made the referral is shown in Table 7.

While the majority of referrals were made by consultants, 11% were made by trainees and non consultant career grades. It was unknown whether a consultant was also involved in these referrals. The methods used to make referrals were also investigated. Table 8 shows the methods employed.

Grade of referring personnel	n=	%
Consultant	781	86.2
SpR	90	9.9
Staff Grade/Associate Specialist/SHO	10	1.1
Unknown	25	2.8
Subtotal	**906**	
Not answered	4	
Total	**910**	

Table 7. Grade of referring personnel.

Method of referral	n=	%
Written	667	73.8
MDT	53	5.9
Verbal	182	20.1
Other	2	<1
Subtotal	**904**	
Not answered	6	
Total	**910**	

Table 8. Method of referral.

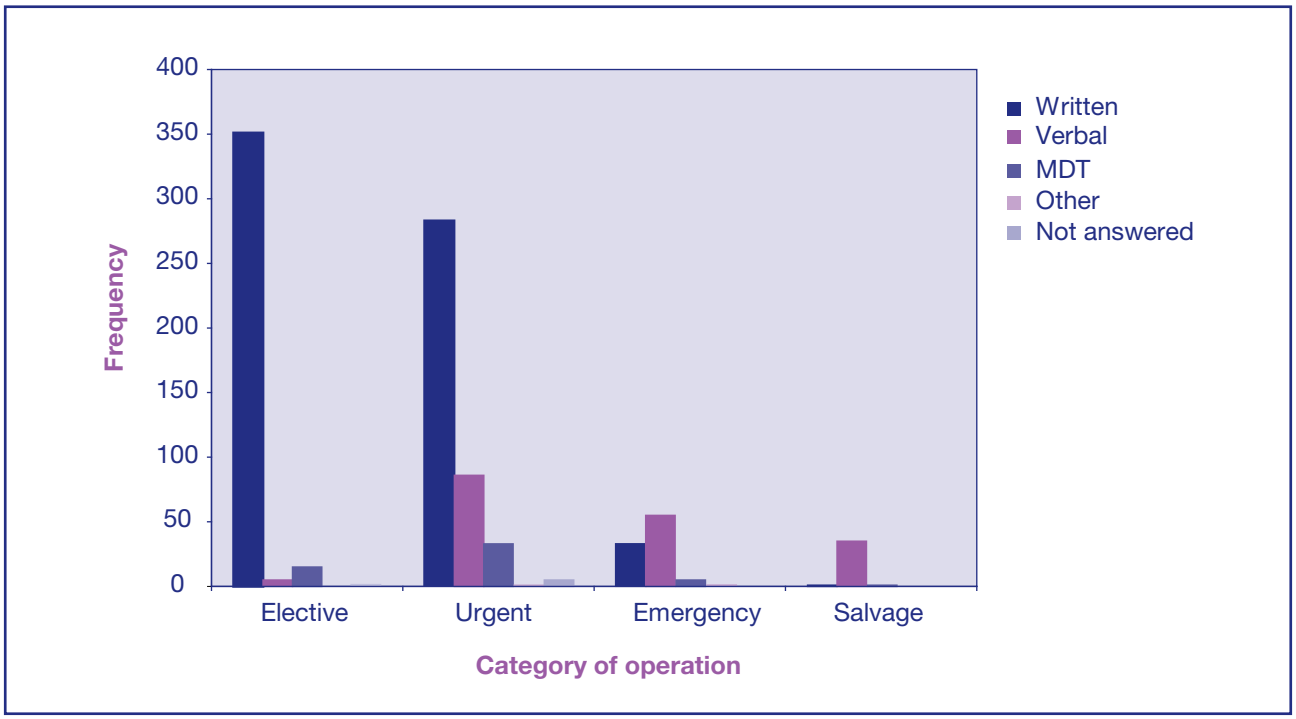

Figure 16. Method of referral by category of operation.

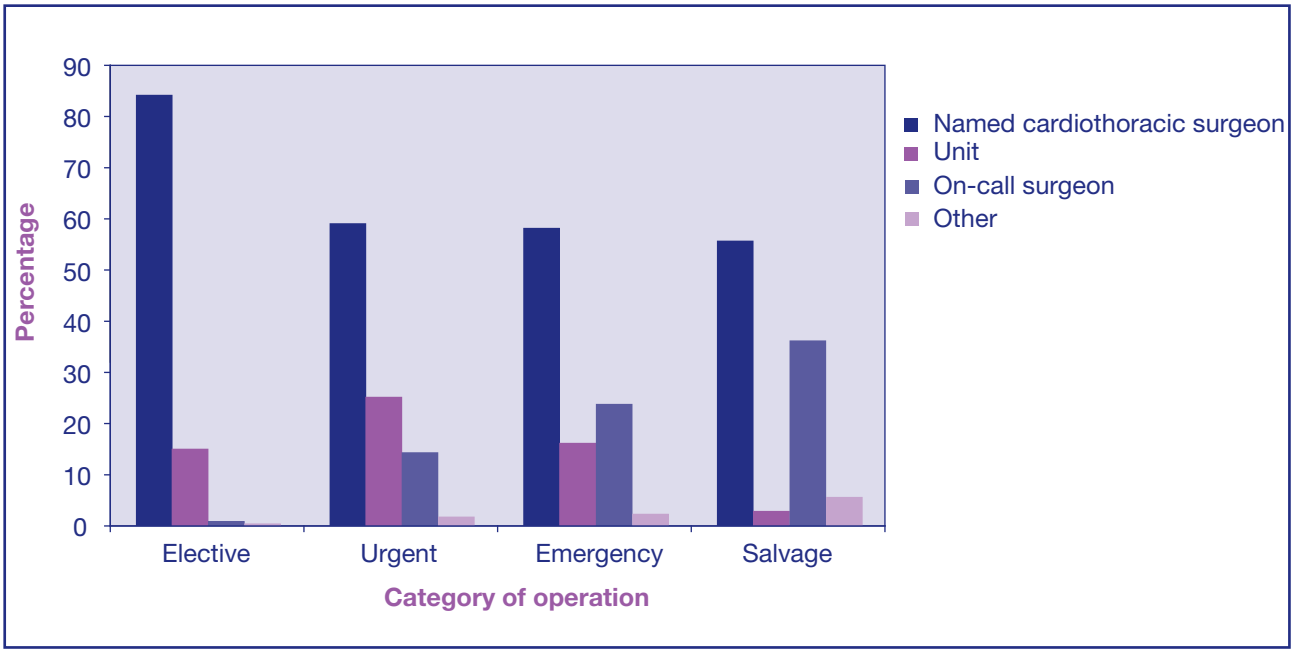

Figure 17. To whom referrals were addressed by category of operation.

A further analysis of these methods of referral by the category of operation is shown in Figure 16.

The most frequent method of referral was in written form and this predominated for the elective and urgent cases. However 21% of urgent and 59% of emergency cases referrals were in verbal form. Of the salvage cases 35 patients out of 37 patients were verbal referrals to the cardiothoracic team. These proportions would be expected in view of the degree of urgency of surgery. It is of interest that relatively few patients were referred via multidisciplinary team meetings, 54 (5.9%). It is possible that only the more complex cases were referred using this forum.

It is important that a referral is made to a member of the cardiothoracic team who has sufficient authority and or knowledge to action the necessary processes to accept a patient on the cardiothoracic service. In 623 (69%) patients the referral was made to a named cardiothoracic surgeon (Table 9).

To whom referral addressed	n=	%
Named cardiothoracic surgeon	623	69.1
Unit	172	19.1
On-call surgeon	95	10.5
Other	12	1.3
Subtotal	**902**	
Not answered	8	
Total	**910**	

Table 9. To whom the referral was addressed.

Generic referrals to the "cardiothoracic unit" were made in 19% (172/902) cases and 10.5% (95/902) cases were referred to an on-call surgeon. Further to this a breakdown of the addressee of the referral by the category of the operation was obtained (Figure 17).

Although the number of patients referred to an on-call surgeon increased with the degree of urgency of the case even in the more urgent cases the majority of referrals were made to named cardiothoracic surgeons. When referrals are made to inappropriate members of the cardiothoracic team delays can occur which will affect patient care. Case study 1 provides such an example.

Case study 1

An elderly patient with severe triple vessel coronary artery disease, with acute coronary syndrome and cardiac failure was transferred as an inpatient from another hospital directly to the cardiac ICU. The referral was made between a cardiology SHO to a senior nurse on the ICU without the knowledge of the cardiothoracic team. By the time that the consultant cardiothoracic surgeon learnt of the patient's existence the patient had developed renal failure, had an ejection fraction of <20% and required the use of an IABP with inotropic support. Remarkably the patient was conscious. A decision to undertake CABG was made despite a stated mortality of >50%. The patient died five days postoperatively from multi-organ failure. No autopsy was performed.

The advisors expressed the view that there was a lack of senior level communication between the referring cardiologists and cardiothoracic surgeons for this urgent high risk patient. Furthermore, it was inappropriate for a nurse to accept such a patient on to the ICU. Was the surgeon put under undue peer pressure to proceed with surgery in view of the likely outcome? The advisors wonder whether palliative care would been more appropriate for this patient.

Admission process

The use of pre-operative assessment clinics has become popular in recent years[2, 3].

The function and objectives of these clinics needs to be clearly defined and designed to fit the requirement of each surgical service. The basic aims should include:

- **"Assessment of the patient's fitness for surgery and anaesthesia and provide an assessment of the risks and benefits of the proposed surgery and anaesthesia, and confirm the patient wishes to have the operation in the light of these risks and benefits"**
- **"Provide the opportunity for further explanation and discussion of the information given by the surgeon. This should minimise any fears or anxieties by ensuring the patient fully understands the proposed procedure"**
- **"Identify any condition that may require intervention prior to admission and surgery and take appropriate action"**
- **"Ensure any necessary investigations are performed, results are available and any necessary action taken"**
- **"Prepare the multidisciplinary peri-operative documentation"[4]**

From the organisational questionnaire NCEPOD determined whether some of these requirements had been met. Forty nine cardiothoracic units ran pre-admission clinics. Of these, 44 used pre-admission proforma documents and 34 used integrated care pathway (ICP) documentation. NCEPOD reviewed these documents. While many of these were well structured and easy to follow, several were found to be overly complicated and disjointed in terms of the information included. Examples of well designed ICPs included:

- **Clear, easily identifiable sections for each part of the patient admission process and for each member of the multidisciplinary team**
- **Logical sequence of clinical information**
- **Stated goals of patient care with an appropriate time line for the peri-operative period**

Examples of poor design included:

- **Fragmentation of clinical information**
- **Repetition of sections**
- **Large expanses of uncompleted sections between clinical information**

The advisors commented that many of these documents were not fit for purpose because they did not contribute to the patient care pathway. The lack of standardisation and use of a minimum data set of information permits a degree of variation between units that may be detrimental to patient care.

These deficiencies in the quality of proforma documents and ICPs were exacerbated by the general poor standard of note keeping found in the casenotes by the advisors. As in previous NCEPOD studies[5] the lack of dated and timed entries along with a lack of the designation of the person making an entry greatly hampered the ability of the advisors to interpret the sequence and timing of the events that occurred.

The ability of pre-admission clinics to achieve the aims suggested previously is dependant to some degree on the personnel involved. NCEPOD found that of the 49 cardiothoracic units that had a pre-admission clinic, 23 had at least a cardiothoracic surgeon and a nurse completing the

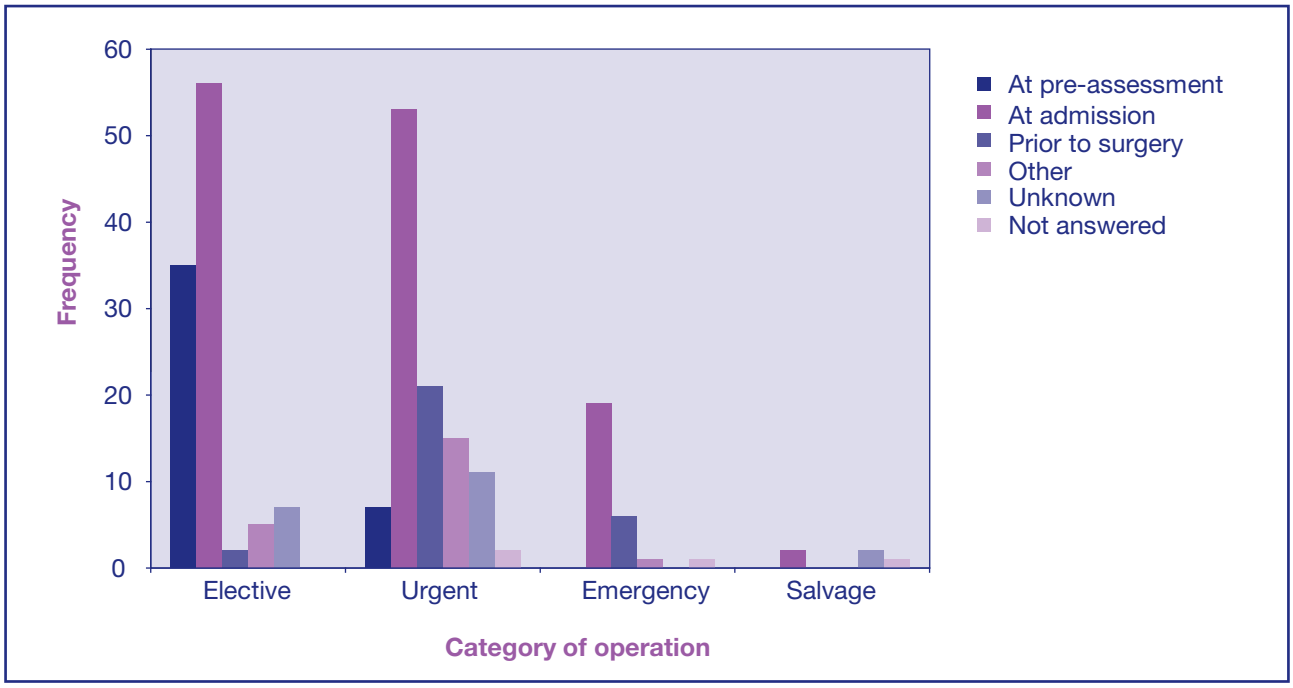

Figure 18. When ICPs were started by category of operation.

pre-admission assessment. In nine this role was performed by a nurse alone and in five units a surgeon undertook the assessment alone. Anaesthetists were included in nine units that had pre-admission clinics. It is likely in those units that had a true multidisciplinary approach to pre-admission assessment that the majority of the stated aims could be achieved. Although NCEPOD did not ask specifically as to the purpose of the pre-admission clinics, in units that had a single healthcare professional (if not a surgeon) making the assessment it would be difficult to envisage that these patients could have an adequate assessment and have the opportunity to further explore risks and benefits of the proposed surgery.

Using the casenotes, NCEPOD established whether patients were incorporated into an integrated care pathway. Of the 821 sets of casenotes returned, in only 272 (33%) patients were ICPs used. This low figure may reflect the greater proportion of non elective patients in the study sample. Even so, over 60% of patients did not follow ICPs which could have been commenced once the patient was referred to the cardiothoracic service.

Figure 18 shows those patients that did have ICPs and where it was started depending on the category of their operation. Again, care should be taken in interpreting these data due to the sample of patients included who all died following first time coronary artery bypass grafting.

First cardiothoracic review

The NSF for Coronary Artery Disease provides goals for times that patients should be expected to wait during the processes of care leading up to coronary artery bypass grafting. Following referral by a GP to a specialist consultant it has been suggested that a patient should be seen within 13 weeks

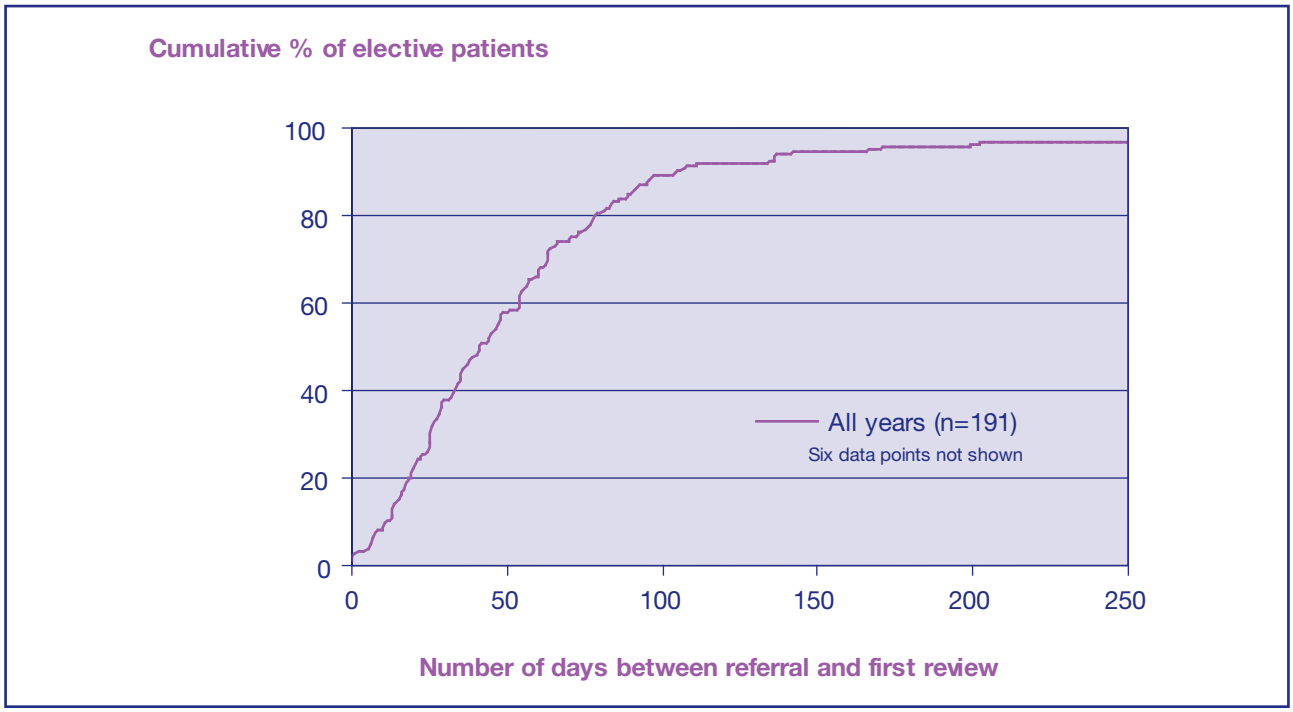

Figure 19. Time to first cardiothoracic review for elective patients (Six patients had intervals >250 days).

(first stage) and four weeks (second stage). However, the NSF does not provide any recommendations concerning the patient waiting times when a patient is referred by a cardiologist to a cardiothoracic surgeon[1].

The two stages refer to "the direction of travel towards longer term goals" as the NSF is implemented. It would not be unreasonable to assume when the first year (2004) of this study commenced that the second stage waiting times should have been the accepted norm.

While NCEPOD was not able to establish the time interval from GP referral to patients being seen by a specialist consultant it was possible, using the casenotes, to determine the times from when patients were referred to the cardiothoracic service to the first review by a cardiothoracic surgeon. Of the 821 cases returned, a referral to the cardiothoracic unit was made in 794 cases. It was only possible to ascertain this time interval in 428 (53.9%) cases. Of the remaining 366 (46.1%) cases, it was not possible to establish the date of referral in 92 (25.1%), the first cardiothoracic review in 148 (40.4%) or neither of these in 126 (7.1%). These data on waiting times are important for audit purposes and although this information may be recorded separately from the casenotes it is important to note that NCEPOD could not determine this information.

For the 428 patients where the times from referral to being seen by a cardiothoracic surgeon could be derived, the proportion of elective cases seen within a given time was determined, (Figure 19).

These data show that 80% of patients for whom data were available were seen within 11 weeks and 90% by 15 weeks. The numbers for each year were relatively small but there does appear to be a reduction of the proportion of elective patients experiencing lengthy time intervals from year 1 to year 3,

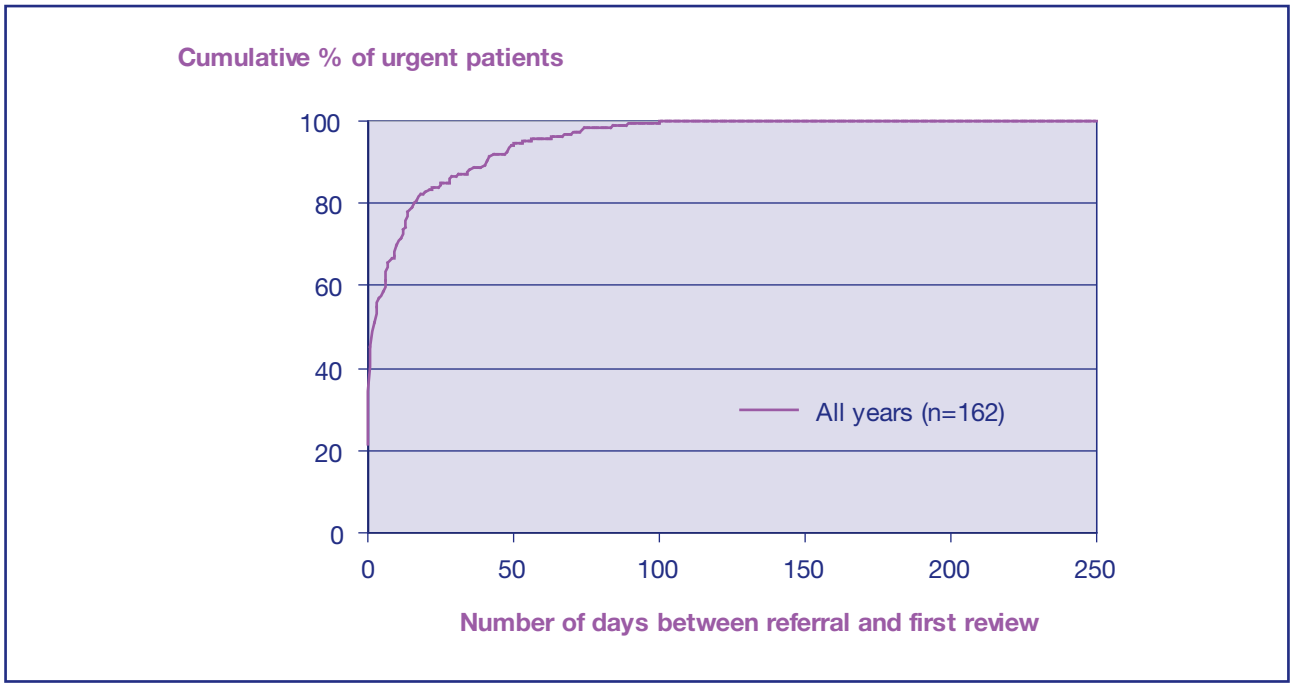

Figure 20. Time to first cardiothoracic review for urgent patients.

10% >20 weeks and 10% >13 weeks respectively. This would indicate that there had been a reduction in the waiting time over the three years of the study.

The times from referral to being seen by a cardiothoracic surgeon for urgent cases is shown in Figure 20.

These data show that for urgent cases, where data were available, 65% were seen within seven days of referral by a cardiothoracic surgeon. Over the three years of the study there was a reduction of the proportion of urgent patients waiting prolonged periods of time to see a cardiothoracic surgeon, 12% >48 days in year 1 and 3% >48 days in year 3. It is difficult to draw any direct inferences from this data because it is unknown how many patients may have initially presented as elective cases but subsequently became urgent.

NCEPOD collected further information regarding delays to the first cardiothoracic review. The surgeons completing the clinical questionnaires were asked if there had been an unnecessary delay to the first cardiothoracic review. In 4.5% (41/910) cases the surgeon indicated that there had been such a delay. Some examples of the reasons for these delays included:

- **Referral made to named consultant cardiothoracic surgeon who was not available**
- **Insufficient outpatient capacity**
- **Backlog of urgent cases**
- **Patient initially declined surgery**

Furthermore, in the opinion of the advisors 7% (57/821) of patients were considered to have had a prolonged time to the first cardiothoracic surgical review. However, it was not possible to assess 102 (12.5%) cases due to poor documentation in the casenotes. The advisors were asked if in their opinion the delay affected the diagnosis (Table 10) or outcome (Table 11).

Did delay to review affect diagnosis?	n=
Yes	8
No	40
Unknown	2
Subtotal	**50**
Not answered	7
Total	**57**

Table 10. Did the delay to the first cardiothoracic review affect the diagnosis?

Did delay to review affect outcome?	n=
Yes	33
No	11
Unknown	5
Subtotal	**49**
Not answered	8
Total	**57**

Table 11. Did the delay to the first cardiothoracic review affect the outcome?

Examples of the delays reported included:

- **"Poor communication between cardiologist and cardiothoracic surgeon"**
- **"Referral to a named cardiothoracic surgeon who was unavailable, on holiday"**
- **"This patient had acute coronary syndrome and referred as an urgent case. He then waited 13 days during which time he had an infarct. The level of urgency was not increased. He should have been revascularised more quickly"**
- **"Difficulties experienced in referring to hospital of first choice. Eventually referred elsewhere. Need for network approach"**
- **"Urgent" opinion requested but took over three months to be seen in cardiothoracic outpatients"**

Although a relatively small number of patients were deemed to have had a prolonged time to the first cardiothoracic review, in 33 patients the advisors were of the view that the outcome of the patient was adversely affected. Many of the delays were due to poor communication at various stages in the referral process particularly in relation to urgency of referral.

For those cases that were judged by the advisors to have had a prolonged time to first cardiothoracic review there was no difference in the proportion of cases compared with those that had an acceptable time to the review regardless of the category of surgery, method referral, addressees of referral or pathways of referral.

Case studies 2 and 3 provide examples of delay to the first cardiothoracic review.

Case study 2

A written referral was made by a consultant cardiologist from a district general hospital regarding an elderly patient to a consultant cardiothoracic surgeon during the summer. The surgeon was on annual leave. Four weeks after the referral the cardiologist contacted the surgeon again by letter. The surgeon denied knowledge of the patient. It subsequently transpired that the referral letter had been misfiled awaiting the return of the surgeon. However, in the mean time the patient's condition had deteriorated and they were referred to another cardiothoracic centre. The patient underwent CABG which was complicated by postoperative cardiac failure and they died after a protracted period on the intensive care unit.

The advisors commented that although it was not possible to determine whether the delay in the referral of this patient affected the clinical course they were concerned that no formal cross cover arrangements had been arranged for new referrals during the surgeon's absence. Furthermore they wondered if a generic team system for referrals to cardiothoracic units should be considered using a cardiac network approach.

Case study 3

An elderly patient was admitted under the cardiologists as an emergency via the Emergency Department with acute coronary syndrome. They had multiple comorbidities including diabetes, hypertension and morbid obesity. The patient was stabilised on the coronary care unit and had angiography two days later which showed extensive coronary artery disease which was not suitable for PCI. The patient was referred to the on-call cardiothoracic consultant and then waited 13 days before being seen by the cardiothoracic team during which time the patient had an infarct. Surgery was performed three weeks following referral. Three days postoperatively they had a VF arrest from which they could not be resuscitated.

It was unclear from the casenotes why this patient waited such an extended period to be seen following referral to the cardiothoracic team. Although there was a comment in the casenotes "waiting to be reviewed by the surgeons" no apparent measures were taken by the cardiology service to expedite the cardiothoracic review. The advisors considered that the level of urgency was not adequately expressed and the patient should have been revascularised more quickly.

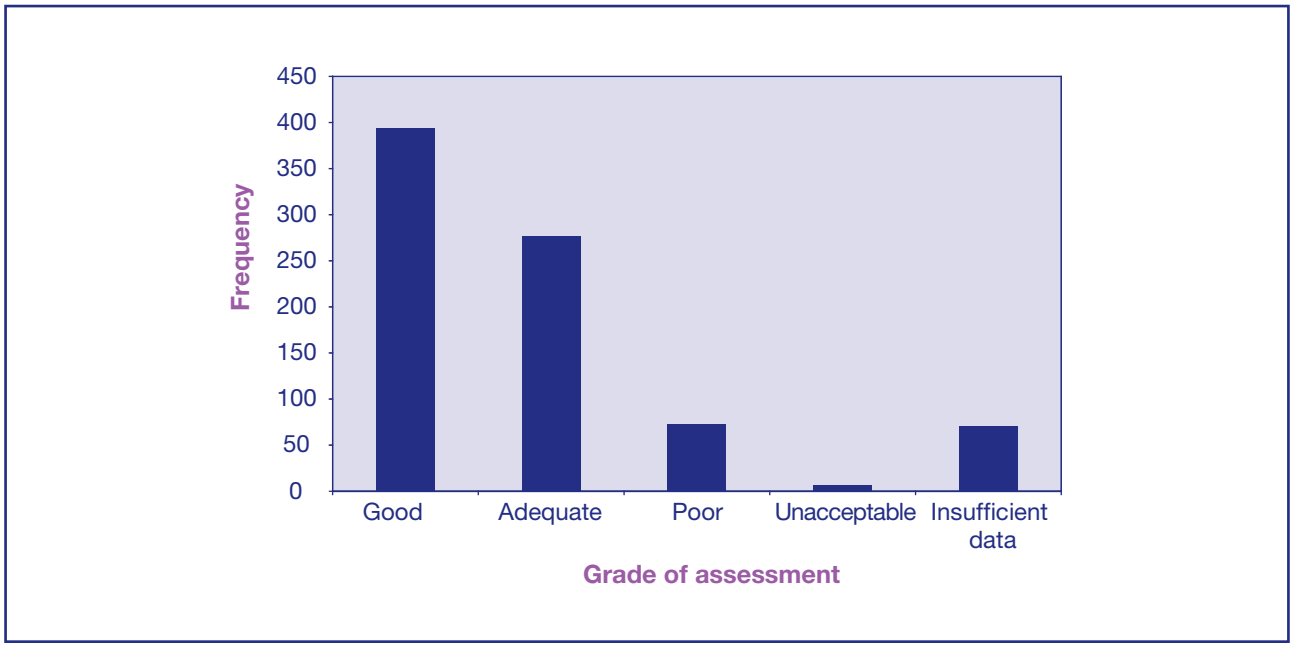

Figure 21. Quality of initial assessment.

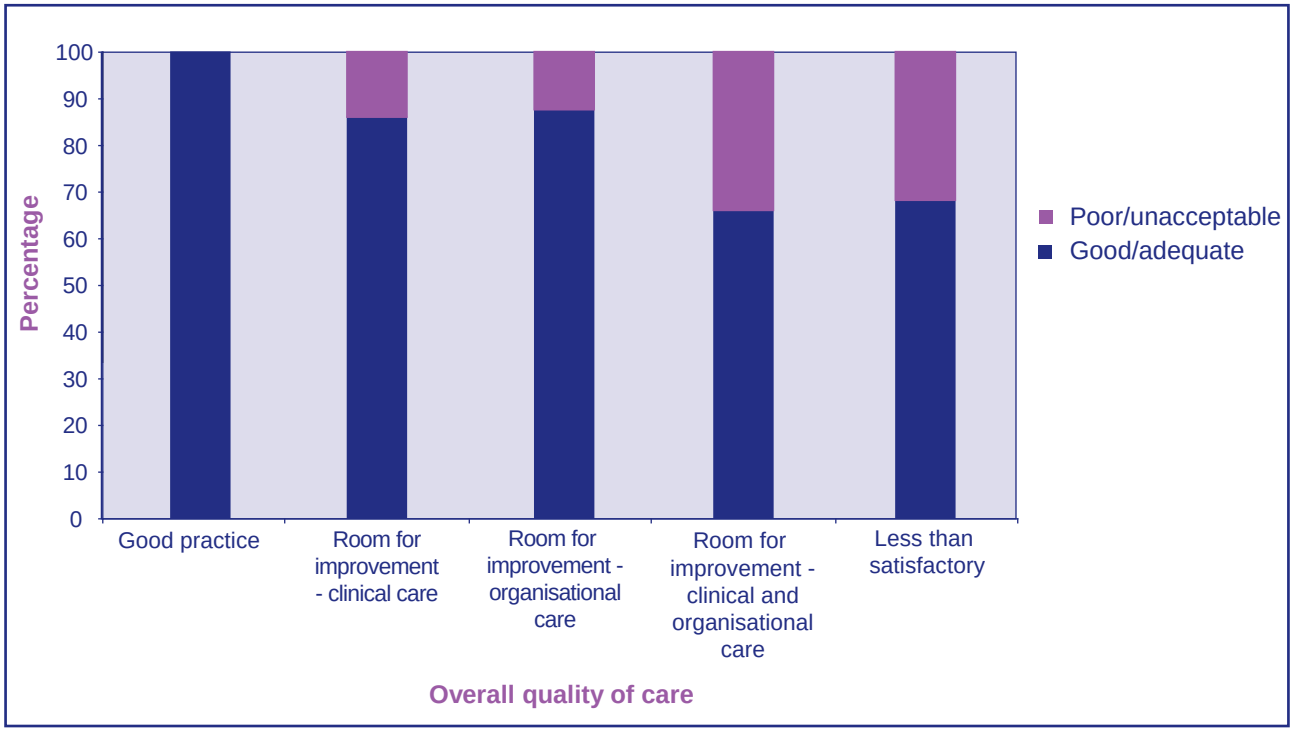

Figure 22. Overall quality of care of patients with poor or unacceptable initial assessments.

Initial cardiothoracic assessment

The advisors were asked to judge the quality of initial assessment which included all the information assimilated on the patient leading up to surgery.

While the majority of patients were scored as good or adequate, 80/820 (10%) were considered poor or unacceptable (Figure 21).

Of those patients where the initial assessment was poor or unacceptable none were considered by the advisors to have received a good overall quality of care (Figure 22).

These findings would be expected in view of the importance placed upon the initial assessment as part of the processes of care for patients who present for coronary artery bypass grafting.

Time from decision to operate to surgery

The NSF for Coronary Artery Disease sets the expected maximum waiting times from the decision to operate to the surgical procedure; for elective cases this waiting time should be 12 months (stage one) and six months (stage two). For urgent cases the patient should not leave the hospital before surgery[1]. More recently the department of health has introduced an 18 weeks (4.5 months) waiting time target for elective procedures[6].

From the casenotes and clinical questionnaires NCEPOD collected information related to these key waiting times. The surgeons completing the clinical questionnaire were asked to provide the date of the decision to operate. NCEPOD was able to extract the date of the operation from the database and then calculate the time interval from the decision to operate to surgery (Figure 23). In 149/910 (16.4%) cases returned it was not possible to establish this time interval due to the surgeon not entering the decision to operate date in the questionnaire.

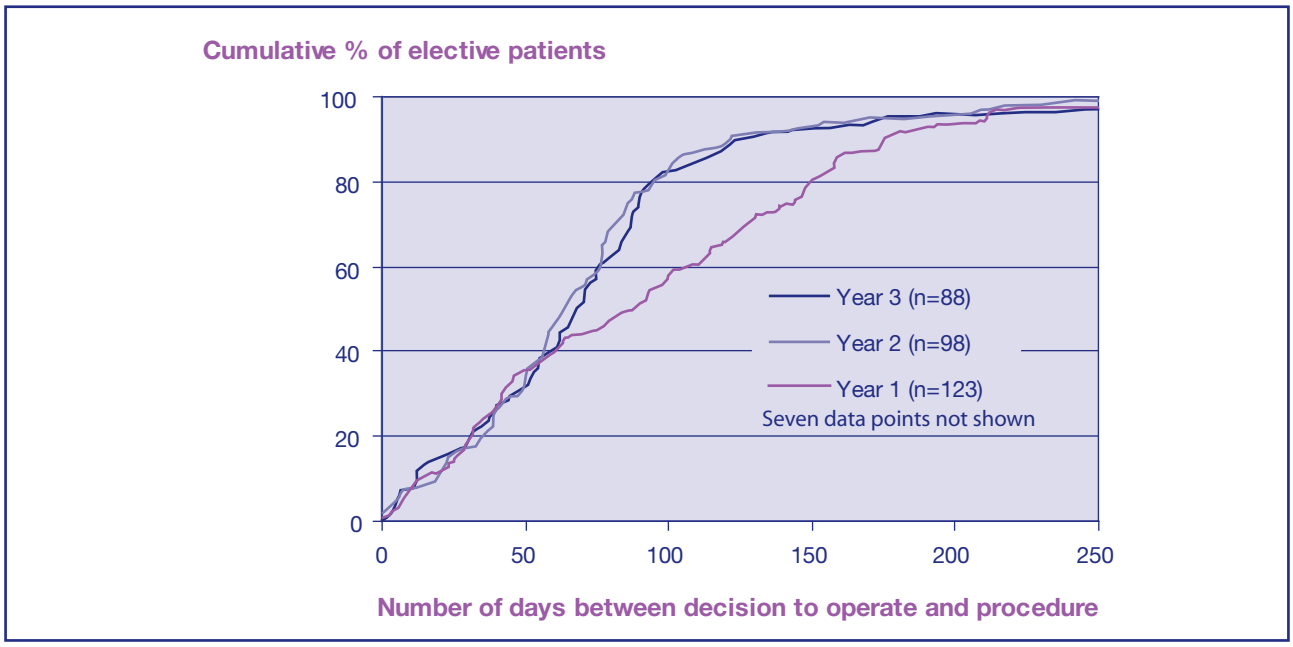

Figure 23. Time from decision to operate to surgery for elective patients by each year of study (seven patients had intervals >250 days).

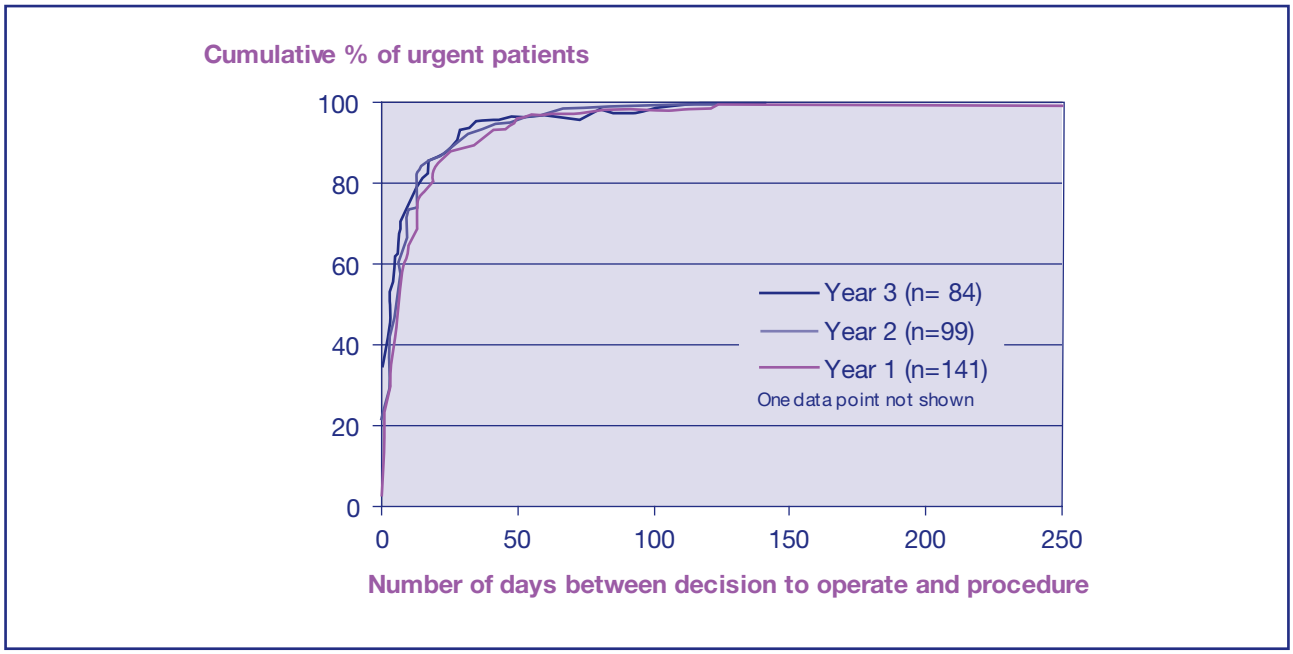

Figure 24. Time from decision to operate to surgery for urgent patients by each year of study (one patient had an interval >250 days).

These missing data accounted for approximately 20% of cases for each year of the study. It is unknown whether the surgeon completing the questionnaire did not know the date of the decision to operate or whether they forgot to complete this section.

Assuming the maximum time from the decision to operate to surgery should be no longer than six months for elective patients, from this sample of patients in year 1, 13% of elective patients waited more than this time period; in years 2 and 3, only 6% of elective patients for whom data were available waited more than six months. However, if one uses the 18 weeks (4.5 months) target, 32% of patients waited longer than this time in year 1 while this decreased to approximately 10% in years 2 and 3 of the study. Although some patients appeared to have waited extended periods in all years, there had been a reduction in these waiting times.

For urgent cases the time from the decision to operate until surgery was also determined (Figure 24).

In the view of the advisors, urgent patients should not wait longer than 10 days from the decision to operate to surgery. The proportion of urgent patients for whom data were available that had surgery within 10 days of the decision to operate was 64% in year 1, 73% in year 2 and 75% in year 3. This shows an improvement year on year although it is unclear for those patients with longer time periods whether this was appropriate based on their clinical condition. In patients who are non-elective, urgent in-hospital cases it might be appropriate to improve their clinical condition before embarking on surgery. Even so some patients had prolonged periods between a decision to operate and surgery, 25% >14 days in year 1, 18% >14 days in years 2 and 3.

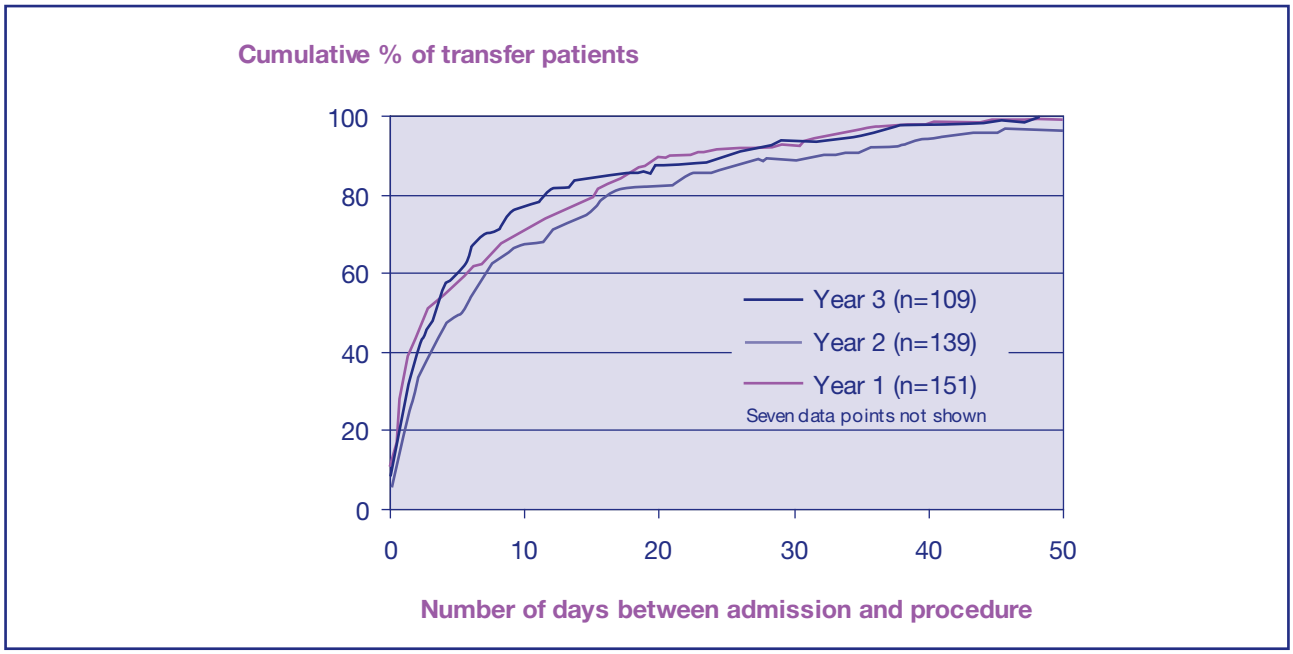

Figure 25. Time from admission to surgery for intra and inter-hospital transfers (seven patients had intervals > 50 days).

Transfers to the cardiothoracic unit

The transfer of patients with acute cardiac conditions between secondary hospitals and tertiary centres for coronary artery bypass grafting (CABG) is a complex area of care. There has been comment that the number of patient transfers is increasing and that they may be managed sub-optimally[7]. An audit of non elective transfers of patients with coronary artery disease has suggested that patients who require CABG should have their surgery within seven days of admission to the cardiothoracic centre[7].

Of the patients 405 (49%) that were transferred from either another hospital or from within the hospital, the time interval from admission to the cardiothoracic unit until surgery was derived from the database (Figure 25).

These data show there was little difference between the three years of the study in the time intervals between admission and surgery. In year 1, 63% of patients for whom data were available were operated upon within seven days, in year 2, 60% were operated upon within seven days and in year 3, 70% were operated upon within seven days. As stated previously while the overall picture is promising there were still patients included in this sample who waited extended periods for their surgery following transfer, 22% >14 days in year 1, 25% in year 2 and 17% in year 3 of the study. Although some of these patients may have required further investigation and treatment to optimise their clinical condition for surgery during this period these prolonged inpatient periods do not adhere to the seven days suggested waiting time.

To investigate these issues further the advisors were also asked for their opinion on whether there was any deterioration in the patients' condition during transfer. Advisors commented that it was frequently difficult to determine if the transfer caused deterioration due to the poor quality of documentation. However, there was sufficient evidence, in the view of the advisors that 27 (7%) patients had deteriorated during the transfer. The majority of these patients had evolving infarcts with recurrent chest pain and raised troponin levels some of whom developed cardiac failure.

Case studies 4 and 5 illustrate some of the problems in relation to poor communication caused by an inadequate referral process which caused delayed decision making and surgical intervention.

Case study 4

A middle-aged patient was transferred as an emergency from another hospital to the cardiology service, with acute coronary syndrome. The patient underwent urgent angiography which showed severe stenosis of the right coronary artery. A verbal message was left by the cardiologists for the cardiothoracic team that this patient required urgent CABG. Although blood for a troponin level had been taken the result was not available prior to surgery. It transpired postoperatively that the patient had an evolving myocardial infarct. They developed a low cardiac output state following surgery and subsequently died.

The advisors were of the opinion that the communication between the cardiologists and surgeons was very poor and no formal referral process occurred with insufficient information given regarding the potential evolving infarct. If the troponin level had been available would this have changed the decision for surgery? Should the surgeon have made more effort to check information on the patient's condition was correct before operating?

Case study 5

An elderly patient presented as an elective patient with a history of two episodes of acute coronary syndrome in the previous two years. Angiography had been performed eight months prior to admission which showed severe diffuse triple vessel disease. In the six months prior to admission the patient complained of increasing shortness of breath on mild exertion and had become house bound. The patient had uncomplicated CABG surgery.

While this patient's inpatient clinical course was uncomplicated the advisors considered that they had an undue wait from the angiography to surgery in view of increasing symptomatology. The case was judged to be "room for improvement - aspects of organisational care that could have been better".

Key findings

- Written protocols for referral of patients were available in 28/58 of cardiothoracic units. However there were discrepancies in the use of protocols as described by surgeons and those reported to be present in each unit.
- 99% of patients were referred by a cardiologist. Of these, 86% were referred by a consultant.
- Of the sample of patients included in the study, in 272/821 (33%) integrated care pathways were used. Variation in the quality of proforma and integrated care pathways documentation was found. Furthermore there was lack of clarity on the purpose of these documents and how they contributed to patient care pathways.
- In the opinion of the advisors for 57/821 (7%) of cases there was a delay from referral to the first cardiothoracic review and in 33 of these patients outcome was adversely affected.
- In (80/820) 10% of patients the initial cardiothoracic assessment was poor or unacceptable in the advisors' opinions.
- It was difficult to assess, from the casenotes, whether patients deteriorated during transfer. However, of the 405 patients transferred to a cardiothoracic unit 27 (7%) were judged by the advisors to have deteriorated during the transfer.

Recommendations

Cardiothoracic units need to adhere to the requirement of the National Service Framework for Coronary Artery Disease and use protocols for referrals to their unit. These protocols should be standardised nationally for patients who require coronary artery bypass graft surgery. The degree of urgency of referral should be emphasised within these protocols (Clinical Directors).

Cardiothoracic units need to ensure that monitoring systems are in place to record nationally agreed audit data on referrals and the decision to operate. These systems need to identify patients who are in danger of breaching national agreed waiting times so that surgery can be expedited (Clinical Directors).

If cardiothoracic units use integrated care pathways (ICPs) for patients requiring CABG surgery these should be fit for purpose. A standard minimum data set of information that should be included in these ICPs needs to be developed (Clinical Directors).

Pre-admission clinics have an important place in assessing and determining patient requirements for surgery. Cardiothoracic units need to review the function of these clinics to ensure that they meet nationally agreed requirements (Clinical Directors).

Patients who have acute myocardial ischaemia and require CABG require special attention. Many of these patients are intra or inter-hospital transfers. This group of patients should have surgery performed as soon as their clinical condition permits based on appropriate investigation and pre-operative therapeutic optimisation (Clinical Directors).

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6. Scheduling of operations

Study question

"To what extent does the scheduling of operations affect outcome?" The consensus exercise identified scheduling of operations as the third highest priority area for examination in this study.

Timing

For the purpose of this study the standard NCEPOD definition of "out of hours" operating was used. This was defined as: "Any time between 17.59 and 8.00am on weekdays, and at any time on Saturdays or Sundays"[1].

In the 821 cases where the casenotes were available it was possible to determine the time of operation in 760 cases; only 68 (9%) of these cases were operated upon out of hours. Thirty one of the cases operated upon out of hours were non-elective, in-hospital cases categorised as urgent operations. Where a surgical questionnaire was also returned, in all but one of the 64 out of hours cases, patients were operated upon by consultants. One case was operated upon by a Specialist Registrar (SpR).

It can be seen from Table 12 that a much higher proportion of patients were operated upon by SpRs or other grades during normal working hours.

Grade of clinician	Out of hours					
	Yes		No		Unknown	
	n=	%	n=	%	n=	%
Consultant	63	98.4	530	82.6	47	82.5
SpR	1	1.6	108	16.8	8	14
Staff Grade/Associate Specialist	0		4	0.6	2	3.5
Subtotal	**64**		**642**		**57**	
Not answered	0		3		0	
Total	**64**		**645**		**57**	

Table 12. Grade of clinician and "out of hours" procedures.

In all but one of the 60 cases operated upon out of hours for which data were available, the most senior anaesthetist present at induction was a consultant. For in hours cases for which data were available, in 585/604 (97%) cases a consultant was present at induction.

There was no evidence of any lack of availability of suitable postoperative critical care facilities for patients operated upon whether in or out of normal hours. Of the 57 patients operated on out of hours, for whom data were available, 53 went to level 3 care, and three went to level 2 care. In all the out of hours cases, the level of critical care was appropriate.

Critical incidents	Surgeons				Anaesthetists			
	In hours		Out of hours		In hours		Out of hours	
	n=	%	n=	%	n=	%	n=	%
Yes	182	28.9	18	28.1	168	26.8	23	37.1
No	447	71.1	46	71.9	460	73.2	39	62.9
Subtotal	**629**		**64**		**628**		**62**	
Unknown/ Not answered	16		0		12		2	
Total	**645**		**64**		**640**		**64**	

Table 13. Critical incidents reported in and "out of hours" by surgeons and anaesthetists.

NB - This is only overall numbers, critical incidents reported by surgeons and anaesthetists may not represent the same case.

Standard of care	Out of hours		In hours		Unknown
	n=	%	n=	%	n=
Good practice	34	53.1	246	38.1	17
Room for improvement - clinical care	16	25.0	225	34.9	17
Room for improvement - organisational care	3	4.7	43	6.7	5
Room for improvement - clinical and organisational care	5	7.8	65	10.1	2
Less than satisfactory	3	4.7	35	5.4	2
Insufficient data	3	4.7	31	4.8	14
Total	**64**		**645**		**57**

Table 14. Overall assessment of care in and out of hours.

While surgeons did not report any greater number of critical incidents in those operated upon out of hours, the anaesthetists reported nearly a 10% greater number of critical incidents in those patients operated upon out of hours (Table 13). It was not possible from the data available to identify a reason for this; however it may reflect a difference of interpretation of the definition of a critical incident between surgeons and anaesthetists.

There is little point in reporting on complication rates for the cases where, by selection they had died; indeed 5.7% of cases were reported as not having suffered a complication. However, in the control patients who survived to discharge, the reported level of complications (which by definition did not include death) was 199/537 (37.1%) where data were available. There was no difference in the level of postoperative complications between control patients operated on in or out of hours.

Patients operated upon out of hours were more likely to receive an overall assessment of "good practice" than those operated upon during normal hours (53% v 38%), but there was little difference in the percentage of patients receiving an overall assessment of "less than satisfactory" (both approximately 5%) (Table 14).

Cancellations (postponement) of operations

Evidence of previous cancellation was obtained from the surgical questionnaire. Whilst the term "cancellation" was used as it is the term used to collect NHS performance data, it might be more accurate to describe the operation as having been postponed as all patients eventually received an operation. Reasons for postponement were not recorded.

The operation had been previously postponed on one or more occasions in 78/909 (8.6%) of the cases. The range of number of previous postponements was 1-3. Twelve patients had operations postponed on more than one occasion.

The cases undergoing elective surgery were more likely to have their operation postponed than those having urgent, emergency or elective procedures (Table 15). In contrast, there was no difference observed in the percentage of postponements by urgency in the control group (Figure 26).

Operation previously postponed	Category of operation							
	Elective		Urgent		Emergency		Salvage	
	n=	%	n=	%	n=	%	n=	%
Yes	45	12.1	31	7.6	1	1.1	1	2.7
No	314	84.4	367	90.4	90	96.8	36	97.3
Unknown	13	3.5	8	2.0	2	2.1	0	
Subtotal	**372**		**406**		**93**		**37**	
Not answered	0		1		0		0	
Total	**372**		**407**		**93**		**37**	

Table 15. Postponements by urgency of operation.

As previously stated, it was not possible to identify any difference in complications in the cases which all died. However, there was a small increase in the complication rate in those control patients who had their operations postponed; 13/29 (just under half) compared with 182/490 just over a third for those who did not have their operation postponed.

Critical incidents were reported by both surgeons and anaesthetists a little less frequently in those cases postponed, compared with those cases not postponed (n=15, 19.7% v n=61, 28.5% and n=13, 18.6% v n=57, 25.8% respectively).

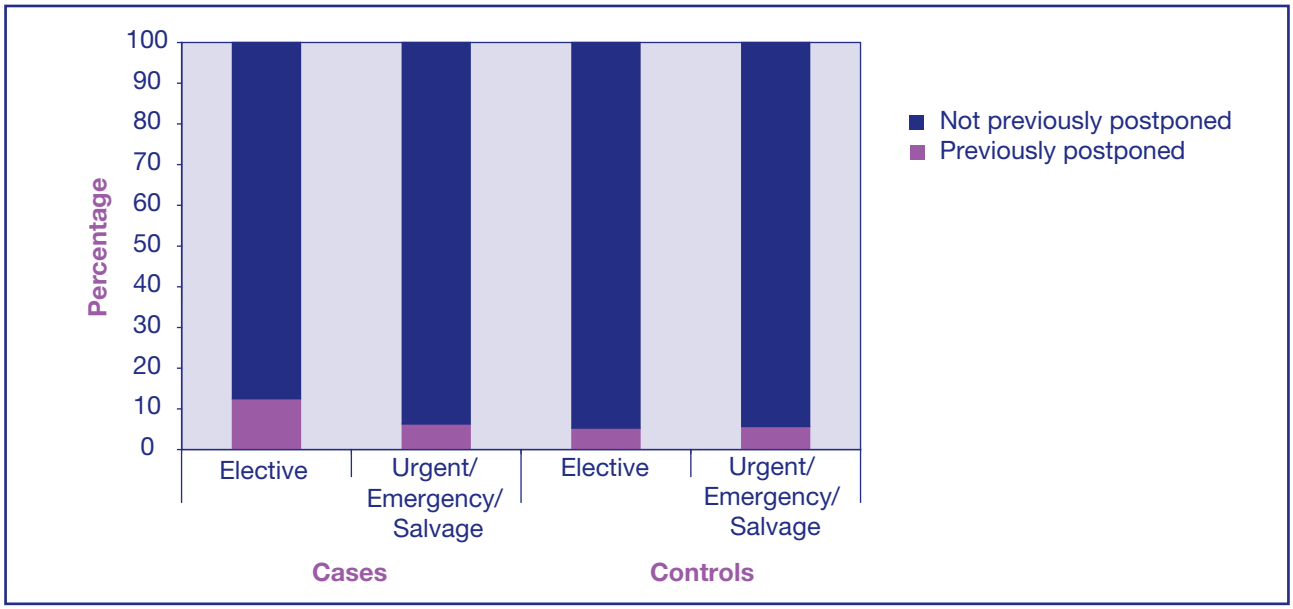

Figure 26. Comparison of proportions of cases with previous postponements by urgency for cases and controls.

Key findings

- Less than 10% of cases were operated upon outside normal hours.
- Consultant involvement in out of hours cases was higher than during normal working hours.
- Patients operated upon out of hours were judged to have received an overall standard of care rated as "good practice" more frequently than those operated upon during normal hours.
- The scheduling of operations does not appear to have had any clinically significant detrimental impact on the quality of care. Out of hours facilities and availability of senior clinicians were at least as good as availability during normal hours.

References

1 National Confidential Enquiry into Peri-operative deaths. (2003). *Who operates when? II* NCEPOD.

7. Multidisciplinary case planning

Study question

"To what extent does variation in prospective multidisciplinary case planning affect outcome?" The consensus exercise identified scheduling of operations as the seventh highest priority area for examination in this study.

Arriving at the best treatment plan for each individual patient is an increasingly complex challenge. Changes in available treatments, increasing patient age and comorbidities aligned with increasing patient expectations and information must be taken into account in reaching a treatment plan. For coronary artery disease there are different surgical options (the mix of arterial and venous grafts) and different techniques to facilitate surgery (cardiopulmonary bypass versus off-pump surgery). There is more use of interventional cardiology (percutaneous intervention (PCI)) and the use of PCI as opposed to surgical methods must be considered. It should also be remembered that sometimes no intervention is appropriate and that palliative care, rather than a potentially futile intervention, is in the best interests of the patient.

Multidisciplinary case planning should provide a clear written record of whatever treatment plan has been decided upon. This brings clarity to the care being delivered and also should give guidance and help in the event that treatment does not proceed smoothly. This information should be available to the patient so that they are aware of the treatment they are consenting to and the process that has been followed to arrive at this treatment plan.

Organisational aspects

Protocol for multidisciplinary case planning

Only four of the 58 units had a written protocol that described the role of multidisciplinary case planning in the management of patients (Table 16). A small number either did not know of the existence of such a protocol or did not answer this question.

Written protocol for MDT planning	Number of units
Yes	4
No	49
Unknown	4
Subtotal	**57**
Not answered	1
Total	**58**

Table 16. Presence of a written protocol for multidisciplinary case planning.

Multidisciplinary case planning is an essential component of high quality health care. The importance of multidisciplinary case planning increases as the range of options to treat specific conditions, in this case coronary artery disease, grows. Furthermore, as the patient population becomes older and comorbidities more prevalent multidisciplinary team (MDT) meetings will have a growing part to play in forming the optimum treatment options.

However, it is recognised that the volume of coronary artery bypass surgery and PCI is significant and that to discuss every case at an MDT meeting would be very time consuming. What is required is a method to distinguish cases that are not straightforward, either due to the nature of the coronary artery disease or the patient's comorbid conditions, so that these can benefit from the structured input of a well-constituted multidisciplinary team.

Presence of multidisciplinary case planning meetings

Despite the high percentage of units that did not have a protocol for multidisciplinary case planning 21 units stated that they held pre-operative MDT meetings (Table 17).

MDT meetings held	Number of units
Yes	21
No	37
Total	**58**

Table 17. Occurrence of multidisciplinary team meetings.

Thirty-nine units returned an organisational questionnaire in both year 1 and year 3. Thirteen of those units did not have formal pre-operative MDTs in year 1 but did undertake formal pre-operative MDT meetings by year 3. However, three units who initially had MDT meetings had stopped this by year 3.

As only 21 out of 58 units actually held MDT meetings the remaining 37 units had no formal structure to decide on best treatment options. Furthermore as only four units had a protocol describing the use of MDT meetings it is not clear how the decision to discuss a particular case at an MDT meeting was made. If no formal mechanism exists then there is the possibility that not all patients who should be discussed at an MDT meeting can benefit from this opportunity.

Frequency of multidisciplinary case planning meetings

Seventeen of the 21 units who held MDT meetings held these meetings on at least a weekly basis. Three units held meetings monthly or less frequently and one unit did not respond to this question.

The frequency of meetings must be sufficient to allow all suitable cases to be discussed in a timely fashion. It may well be that the few units who met less frequently (monthly) were performing relatively few procedures.

Staff members attending multidisciplinary case planning meetings

Table 18 shows the staff who attended MDT meetings (answers may be multiple). The majority of units had contribution from cardiologists (19/21) and cardiothoracic surgeons (17/21). Other members of the team were less well represented.

Staff attending MDTs	Number of units
Cardiologists	19
Cardiothoracic surgeons	17
Anaesthetists	1
Nurses	3

Table 18. Staff attending MDT meetings (answers may be multiple).

Composition of the MDT meeting is also important. In the 21 units that had regular MDT meetings, cardiologists were not members in two units and cardiothoracic surgeons in four units. It is difficult to understand how meaningful treatment decisions can be made without these contributors. During expert group and advisor meetings it was raised that time for cardiologists and cardiothoracic surgeons to attend MDT meetings was frequently not protected within the job plan.

Anaesthetists were members of the MDT meeting in only one unit – despite having a key role in assessing comorbidities and fitness for anaesthesia, which may well favour a less invasive treatment plan. It may well be that the expert opinion from anaesthesia was obtained through a different mechanism. This issue was debated at both expert group and advisor group meetings and produced polarised views. Some believed that the presence of an anaesthetist for discussion of all cases at an MDT meeting may not be a good use of valuable time whilst others felt that this was the correct forum for anaesthetic input.

Documentation of attendance at multidisciplinary case planning meetings

Table 19 shows whether the units who held regular MDT meetings kept a record of attendance. As can be seen only seven units had a record of who attended the MDT and contributed to the case planning.

Records of attendance held	Number of units
Yes	7
No	12
Unknown	1
Subtotal	**20**
Not answered	1
Total	**21**

Table 19. Record of attendance at MDT meetings.

The structure and function of the MDT meeting is crucial to success. MDT meetings have become a standard part of the management of cancer patients and guidelines exist as to the structure, function and audit of these MDT meetings[1]. One key element is attendance of the core members of the team and documentation of who contributed to the clinical decisions. In this respect it was very disappointing that only seven of the 21 units who undertook MDT meetings kept a record of attendance. Clearly there is room for improvement in this aspect of the MDT meeting.

Protocol for reviewing non-surgical coronary interventions

As previously mentioned many patients now undergo non-surgical coronary intervention to treat coronary artery disease. It can sometimes be difficult to decide whether PCI or traditional surgical techniques are the best course of action. Units were asked whether a protocol existed to ensure that patients who underwent PCI were reviewed prior to PCI to ensure that the best treatment plan was followed. It can be seen from Table 20 that only three units out of 58 had a protocol for this purpose.

Protocol held for non-surgical techniques	Number of units
Yes	3
No	47
Unknown	3
Subtotal	**53**
Not answered	5
Total	**58**

Table 20. Protocol for reviewing patients undergoing non-surgical techniques.

Individual cases

Use of MDT meetings for individual cases

Table 21 shows whether individual cases were discussed at an MDT meeting prior to surgery. Only 225/910 (24.9%) cases were presented at an MDT meeting.

Case discussed at pre-op MDT	Number of patients	%
Yes	225	24.9
No	639	70.6
Unknown	41	4.5
Subtotal	**905**	
Not answered	5	
Total	**910**	

Table 21. Discussion at pre-operative MDT meeting.

Age and use of pre-operative MDT meetings

Table 22 shows the data for age and pre-operative MDT meetings. Overall 25% of patients were discussed at MDT meetings. This figure does not vary greatly in the over 55 years of age groups. However, it would appear that in the younger age group (55 years or younger) there were slightly more cases brought to MDT meetings.

Age	Discussion at MDT meeting					
	Yes		No		Unknown	Total
	n=	%	n=	%	n=	n=
<56	16	36.4	28	63.6	1	**45**
56 - 65	38	27.1	102	72.9	3	**143**
66 - 75	103	25.4	303	74.6	19	**425**
76 - 85	64	24.7	195	75.3	18	**277**
>85	4	26.7	11	73.3	0	**15**

Table 22. Influence of age on discussion at MDT meetings.

Gender and use of pre-operative MDT meetings

Gender had no influence on the use of pre-operative MDT meetings – 151 males and 74 females were discussed at pre-operative MDT meetings (25% and 25% respectively).

EuroSCORE and use of pre-operative MDT meetings

Figure 27 shows the use of pre-operative MDT meetings broken down by EuroSCORE. It does not appear that there is any strong relationship between the EuroSCORE and the use of pre-operative MDT meetings. The mean EuroSCORE in the patients who were discussed at an MDT meeting was 7.4 compared to 7.6 in the patients who were not discussed at an MDT meeting.

Within the cases only 225 (24.9%) were discussed at an MDT meeting. It should be remembered that all the patients reported here ultimately died and do not reflect the operative urgency profile of the total coronary artery surgery population (There is a skew towards urgent, emergency and salvage operations within this study: Elective – 40.9%, Urgent – 44.8%, Emergency – 10.2%, Salvage – 4.1%). However, despite this caveat there were substantial numbers of patients in the elective and urgent categories that were not discussed at MDT meetings. It appears that age, gender and even EuroSCORE did not form part of the decision making process on who to discuss at MDT meetings – strengthening the impression that these meetings were not robust in structure or function.

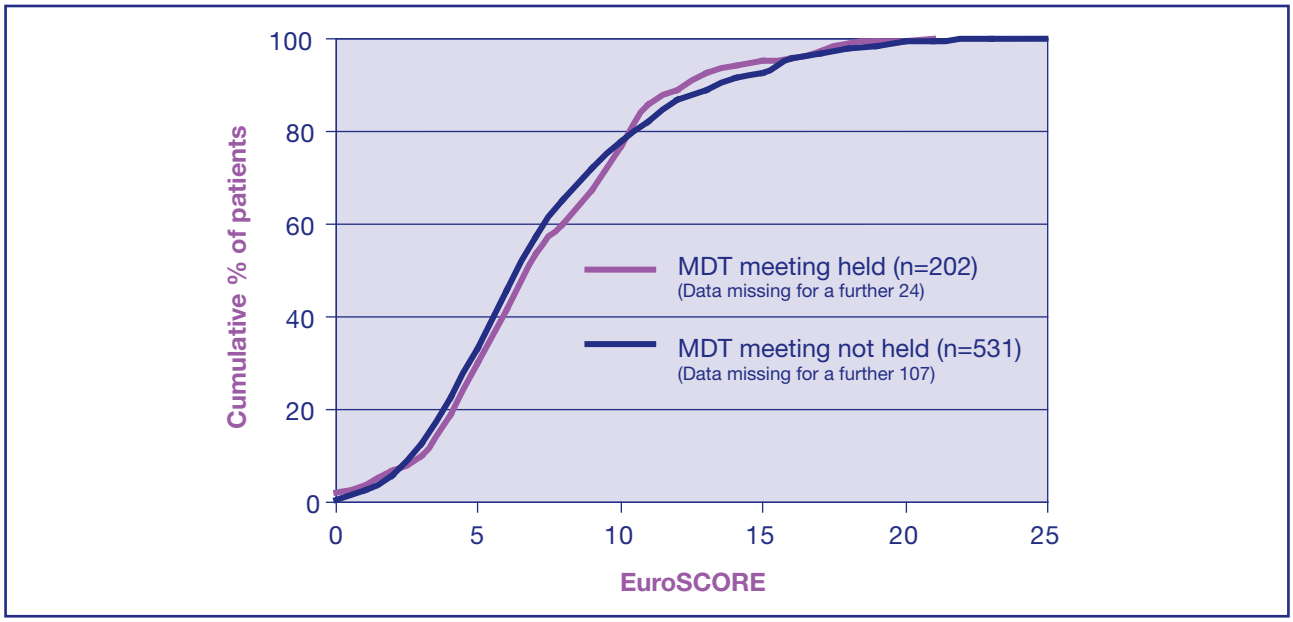

Figure 27. MDT meetings by EuroSCORE

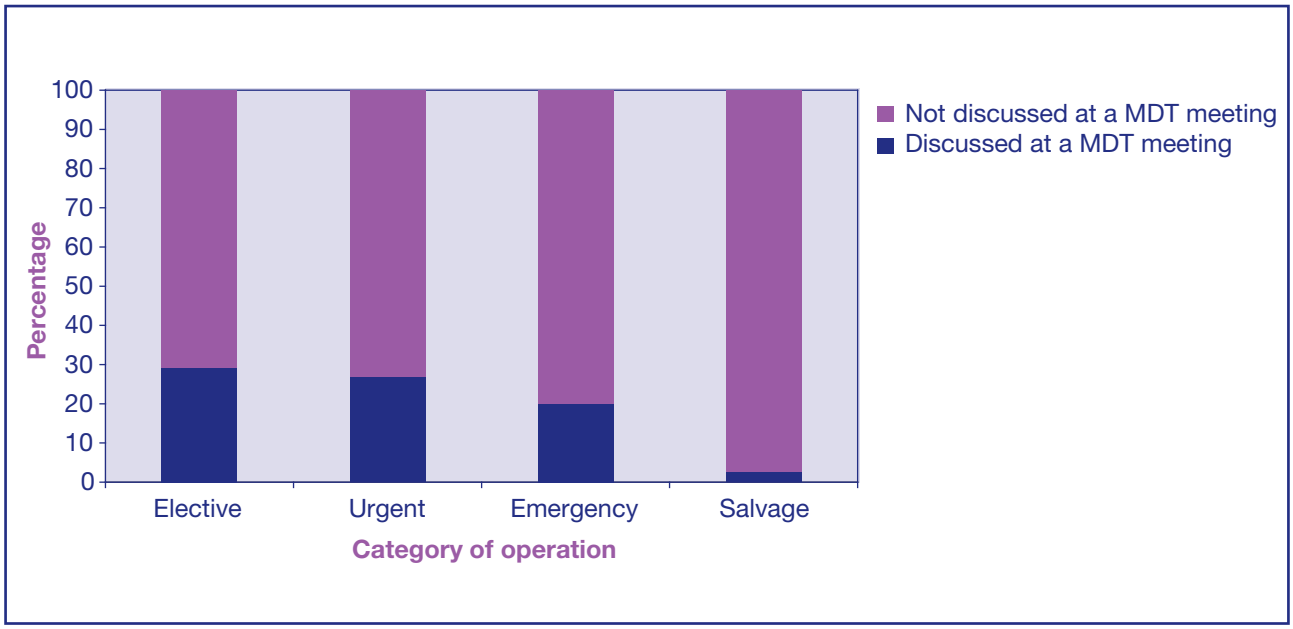

Figure 28. Category of operation and use of MDT meetings.

Influence of operative category on use of MDT meetings

Figure 28 shows the category of operation and whether the patient was discussed at an MDT meeting.

The percentage of patients discussed varied slightly by operative urgency between Elective (29.1%), Urgent (27%) and Emergency (19.6%). Salvage cases were rarely discussed due to the extreme urgency of the cases (2.8%).

Decision making in patients undergoing PCI

Whilst this study focused on patients undergoing coronary artery bypass grafting it is clear that some patients underwent PCI techniques during the same admission and prior to surgical intervention. Within this study 182 such patients were found. Table 23 shows whether the decision to initially undertake PCI was made jointly by a cardiologist and cardiothoracic surgeon or alone by a cardiologist.

Joint decisions made	Number of patients	%
Yes	36	19.8
No	138	75.8
Unknown	8	4.4
Total	**182**	

Table 23. Joint decision making in patients undergoing PCI.

In 36/182 cases (19.8%) there was joint decision making that PCI was considered to be the best initial management strategy. However, in 138/182 (75.8%) cases where coronary artery surgery was subsequently required there was no involvement of cardiothoracic surgery in the choice of initial management.

Many patients undergoing diagnostic coronary artery angiography will be found to have disease that is amenable to immediate PCI – it would be undesirable to document the findings, discuss a straightforward case and have to proceed to a second catheterisation to complete the treatment, as this would expose the patient to greater interventional risk. However, there are some difficult cases where the balance of risks of PCI versus surgery needs to be considered. As shown earlier only three units had a protocol to address the issue of decision making in patients undergoing PCI (Table 5) and it is likely that this allows significant variation in practice that may not be desirable.

Use of MDT meetings and pre-operative planning

Table 24 shows whether a clear operative plan was recorded prior to surgery and whether the case had been discussed at an MDT meeting.

The output of the MDT meeting should be a clear written plan of proposed management. In cardiac surgical practice this should be a clear plan for the extent and method of coronary artery bypass grafting. Slightly greater than one in ten patients did not have a clear written operative plan prior to commencement of surgery. The use of MDT meetings appeared to reduce this finding; of the patients who were discussed at a MDT meeting only 17 out of 225 (7.8%) did not have a written operative plan compared to 100 out of 639 patients (16%) who were not discussed at a MDT meeting.

Use of MDT meetings and overall assessment of care

The overall assessment of care for the entire population was shown earlier (page 34). There was no substantial change to this assessment of care whether the patient was or was not discussed at a pre-operative MDT meeting; good practice was scored in 72/184 patients discussed at an MDT meeting (39.1%) compared with 212/545 patients not discussed at an MDT meeting (38.9%).

Multidisciplinary team meeting	Clear written operative plan						
	Yes		No		Unknown	Not answered	Total
	n=	%	n=	%	n=	n=	n=
Yes	201	92.2	17	7.8	7	0	225
No	524	84	100	16	14	1	639
Unknown	30		2		9	0	41
Subtotal	**755**		**119**		**30**	**1**	**905**
Not answered	4		0		1	0	5
Total	**759**		**119**		**31**	**1**	**910**

Table 24. Clear operative plan recorded prior to surgery.

Key findings

- Only four of the 58 units had a protocol for multidisciplinary case planning for patients undergoing intervention as a result of coronary artery disease.
- Only 21 of the 58 units held pre-operative MDT meetings.
- Most MDT meetings were attended by cardiologists (19/21 units) and cardiothoracic surgeons (17/21 units). Anaesthetists were rarely involved in MDT meetings (1/21 units).
- Documentation of participation in MDT meetings was poor and only recorded in 7/21 units.
- Only one in four patients in this study were discussed at a pre-operative MDT meeting.
- Patients who were discussed at a pre-operative MDT meeting were more likely to have a clear written operative plan.

Recommendations

Each unit undertaking coronary artery bypass grafting should hold regular pre-operative MDT meetings to discuss appropriate cases. Core membership should be agreed and a regular audit of attendance should be performed (Clinical Directors).

Each unit should have a clear policy for which cases should be discussed at pre-operative MDT meetings (Clinical Directors).

There should be a clear protocol for deciding on best treatment strategy (surgery v PCI) that involves both cardiologists and surgeons (Clinical Directors).

A clear written plan should be made pre-operatively for all patients (with the exception of salvage cases) (Clinical Directors).

Trusts and consultants should identify time within the agreed job plan to allow participation in MDT meetings (Clinical Directors).

References

1 Department of Health. (2004). *Manual for cancer services 2004.* Crown Copyright. *http://www.dh.gov.uk/en/Healthcare/NationalServiceFrameworks/Cancer/DH_4135595* last modified 29/12/2007.

8. Patient investigations

Study question

"To what extent does variation in the patient investigation process affect outcome?" The consensus process identified patient investigations as the eighth priority for study.

The advisors judged that 83.6% (684/821) of the cases had appropriate investigations, but 8.8% (72/821) did not. In over half (38/72) of those judged as not having appropriate investigations, the outcome was judged to have been adversely affected.

A written protocol for investigations was available in 78.3% (697/890). Patients were more likely to be judged to have received an overall standard of care which was good where a written protocol was used (Table 25).

The advisors identified a number of recurring themes when reviewing the casenotes and some case studies have been given to highlight the issues raised.

- **Missed abnormal blood films**

Case study 6

An elderly patient was noted to have a raised WCC at 14.2, but was believed to have a urinary tract infection. Surgery went ahead, but in the postoperative period the patient developed haematuria and the WCC had risen to 26. The patient was given IV antibiotics, but subsequently developed oliguria. The WCC was noted to have risen to 96. Only at this stage was the blood film reviewed, and a diagnosis of leukaemia reached.

Standard of care	Yes		No		Unknown	
	n=	%	n=	%	n=	%
Good practice	235	40.2	35	32.7	25	44.6
Room for improvement - clinical care	199	34.0	35	32.7	16	28.5
Room for improvement - organisational care	37	6.3	10	9.3	3	5.4
Room for improvement - clinical and organisational care	50	8.5	14	13.1	6	10.7
Less than satisfactory	29	5.0	7	6.5	3	5.4
Insufficient data	35	6.0	6	5.6	3	5.4
Total	**585**		**107**		**56**	

Table 25. Overall quality of care related to use of written investigation protocol.

- **Lack of transoesophageal echocardigraphy (TOE) availability**

- **Delays between stress test and angiogram and delays between angiogram and surgery despite ongoing angina**

Deterioration in the clinical picture, leading a poorer prognosis, may go unrecognised where there are delays between investigations and the operation.

- **Renal function not well assessed pre-operatively**

Case study 7

A middle aged insulin dependent diabetic patient had a delay of six months from a positive stress test to angiography, and a further six months delay from the positive angiogram to surgery, because of difficulties with diabetic control. The severity of disease found at operation was far greater than anticipated from the angiogram. The patient died of a postoperative myocardial infarct.

Re-assessment, with contemporaneous investigations may have led to a modification of the management plan.

Case study 8

An elderly diabetic patient had a raised pre-operative creatinine. No further investigations of renal function were undertaken. Postoperatively, the patient was returned from the ICU to the ward without a urinary catheter. The creatinine was >400 µmol/L and K+ of 5.4 mmol/L. The catheter was not replaced for nine hours. The SpR reviewing the patient on the ward gave Frusemide, which was followed by abdominal distension. The patient died of an asystolic arrest.

Abnormal pre-operative investigations, may require further follow up and senior input, in order to permit optimisation of the patient's physical status and to anticipate and prepare for likely postoperative complications.

Key findings

- Almost one in ten patients did not receive appropriate pre-operative investigations.
- In half of the patients that did not receive appropriate pre-operative investigations, the outcome was judged to have been adversely affected.
- The use of a written protocol for patient investigations was associated with a higher percentage of cases judged to have received an overall standard of care which was good.

Recommendations

There should be a written protocol available for the pre-operative investigation of all patients (Clinical Directors).

Pre-operative investigations should be contemporaneous; where delay has occurred between assessment and surgery consideration should be given to repeating investigations (Clinical Directors).

There must be a system in place to ensure that pre-operative investigations are reviewed by a senior clinician and acted upon (Clinical Directors).

9. Medical management

Study question

"To what extent does variation in medical or interventional management pre-operatively affect outcome?" The consensus exercise identified pre-operative medical or interventional management as eleventh in priority.

The anaesthetic questionnaire requested information about pre-operative medication, and whether it was stopped prior to surgery (Table 26).

Advisors were asked to assess whether the medical management of the patient prior to surgery was appropriate. Overall management was deemed appropriate in 656/816 patients (80.4%).

This study was not designed to ascertain whether particular drug therapies should be stopped prior to surgery. However, for interest we have looked at advisor opinion on the appropriateness of medical management in different groups of patients defined by whether their treatment was stopped prior to surgery. The full data, taken from the anaesthetic questionnaire and advisors' assessment form, is presented in Appendix 2.

Beta blockers

In 51 cases, this treatment was stopped before surgery; advisors judged medical management to be appropriate in 37/45 (82.2%), with insufficient data available in the remaining six. Medical management was deemed to be appropriate in 367/400 (91.8%) patients whose treatment was not stopped prior to surgery (insufficient data were available in a further 39 cases).

Drug	Before surgery	Number of patients			
	Number of patients	Not stopped	Stopped	% stopped	Not answered
Beta blockers	659	542	69	11.3	48
ACE inhibitors/ Angiotensin receptor II antagonist	643	309	297	49	37
Potassium channel blockers	286	206	63	23.4	17
Calcium antagonists	385	309	48	13.4	28
Aspirin	754	226	482	68.1	46
Clopidogrel	399	95	276	74.4	28
Warfarin	38	2	31	93.9	5
Low molecular weight heparin	191	81	90	52.6	20

Table 26. Pre-operative medication and whether stopped before surgery.

ACE inhibitors

In 234 cases, the administration of ACE inhibitors was stopped prior to surgery. Advisors judged the medical management of these patients to be appropriate in 185/214 (86.4%); there was insufficient data in a further 20 cases. In 260 cases ACE inhibitors were not stopped prior to surgery; within this group medical management was deemed to be appropriate in 219/239 (91.6%), there was insufficient data in 21 cases.

Potassium channel blockers

In 49 patients, treatment with potassium channel blockers was stopped prior to surgery. Advisors assessed the medical management of these patients to be appropriate in 40/45 (88.9%); there was insufficient data in a further four patients. In 165 patients who continued taking potassium channel blockers, management was deemed to be appropriate in 132/154 (85.7%) cases; there was insufficient data in a further 11 cases.

Calcium antagonists

Thirty eight patients stopped taking calcium antagonists prior to surgery; advisors assessed the medical management of these to be appropriate in 30/33 (90.9%) of cases; there was insufficient data in five cases. In 258 patients calcium antagonists were not stopped prior to surgery; advisors assessed medical management of these patients to be appropriate in 213/233 (91.4%) cases; there was missing data in a further 25 cases.

Overall picture

The picture regarding pre-operative medical intervention is complex. The majority of patients on pre-operative beta blockers, potassium channel blockers or calcium antagonists continued this therapy through the peri-operative period, and were judged to have received appropriate medical management. However, with ACE inhibitors, almost equal numbers of patients continued or stopped this drug pre-operatively.

Filion et al[1] recently reviewed all randomised controlled trials (RCTs) and observational studies examining the effect of peri-operative angiotensin-converting enzyme inhibitors, angiotensin II receptor blockers, aspirin, beta blockers, and calcium channel blockers on clinical outcomes. They identified 27 studies (six RCTs, 21 observational studies), involving >700,000 patients, that examined the impact of peri-operative medical therapy on clinical outcomes after CABG. Although studies provide conflicting results, the literature suggested that peri-operative aspirin use may decrease in-hospital mortality and myocardial infarction, whereas peri-operative angiotensin-converting enzyme inhibitor use does not appear to be beneficial. Multiple studies demonstrated that pre- and postoperative beta blockers are associated with a decrease in atrial fibrillation. In addition, beta blockers may reduce in-hospital and 30-day mortality, although these results were not consistent across all studies. Calcium channel blockers do not appear to improve in-hospital or 30-day mortality. No studies examined the peri-operative use of angiotensin II receptor blockers among CABG patients. They conclude that the peri-operative use of cardiac medical therapy among CABG patients remains understudied.

Aspirin

Aspirin was stopped in 387 cases prior to operation; of these, advisors assessed medical management to be appropriate in 311/348 (89.4%) of cases, with insufficient data in 39 cases. Aspirin was not stopped prior to surgery in 191 cases; medical management was assessed to be appropriate in 158/174 (90.8%) of cases; there was insufficient data in 17 cases.

Clopidogrel

In 218 patients, clopidogrel was stopped prior to surgery. In 177/197 (89.8%) cases, management was deemed to be appropriate by advisors; there was insufficient data in 21 cases. In 80 cases clopidogrel was not stopped prior to surgery; advisors assessed medical management to be appropriate in 68/73 (93.2) cases. There was insufficient data in seven cases.

Low molecular weight (LMW) heparin

In 68 patients, LMW heparin was stopped prior to surgery. Medical management was deemed to be appropriate in 46/57 (80.7%) cases; there was insufficient data in 11 cases. In 68 cases, LMW heparin was not stopped prior to surgery; medical management was deemed to be appropriate in 55/61 (90.2%) cases; there was insufficient data in seven cases.

Warfarin

Warfarin was only taken in 28 patients pre-operatively and was stopped in all but two patients.

The data presented above were gathered from cases where casenotes were supplied and anaesthetic questionnaires returned.

Drug	Number of patients	Stopped drug	Postoperative bleeding	%	Continued drug	Postoperative bleeding	%	Not answered
Clopidogrel	358	247	33	13.4	86	20	23.3	25
LMW heparin	173	76	3	3.9	78	16	20.5	19
Warfarin	34	29	1	3.4	2	0	0	3
Aspirin	674	428	64	15.0	208	36	17.3	38

Table 27. Numbers of cases with postoperative bleeding and tamponade (T).

Postoperative bleeding

The following data are taken from the surgical and anaesthetic questionnaires and shown in Table 27. Denominator will differ from the previous section as the casenotes were not required.

Clopidogrel

There were 358 patients on clopidogrel pre-operatively. This was stopped prior to surgery in 247 cases and of these 33 (13.4%) had postoperative bleeding. Ten patients developed tamponade. In 86 cases clopidogrel was not stopped, and of these 20 (23.3%) developed postoperative bleeding with eight developing tamponade.

LMW heparin

Of the 173 patients on LMW heparin pre-operatively 76 stopped; three of these 76 patients had postoperative bleeding, with one patient developing tamponade. Of the 78 patients who did not stop LMW heparin prior to surgery, 16 (20.5%) developed postoperative bleeding, and five had a tamponade.

Aspirin

There were 674 patients on aspirin pre-operatively. This was stopped prior to surgery in 428 patients; of these 64 (15.0%) patients developed postoperative bleeding. In the 208 patients where aspirin was not stopped pre-operatively, postoperative bleeding was reported in 36 (17.3%) patients.

Warfarin

There were only 34 patients on warfarin prior to surgery. In 29 cases this was stopped pre-operatively, with one case of postoperative bleeding. Neither of the two patients who were known to continue with treatment had postoperative bleeding. In the remaining three cases it was not known whether treatment was stopped.

With the exception of patients on LMW heparin, the majority of cases had their pre-operative anticoagulant or antiplatelet therapy stopped prior to surgery. However, there were still a substantial number of patients who continued this therapy throughout the peri-operative period. Those patients continuing therapy had a higher incidence of postoperative bleeding and tamponade. It should be noted that continuance of drug therapy may be associated with urgency of the operation. In the case of clopidogrel, the risk of postoperative bleeding is well recognised. The American College of Cardiology/American Heart Association guidelines recommend that surgery should be delayed for at least five days following the withdrawal of clopidogrel[2, 3].

Key findings

- While the majority of patients continued on beta blockers, potassium channel inhibitors and calcium antagonists, a substantial number of patients stopped these drugs prior to surgery.
- The majority of patients stopped anticoagulant therapy prior to surgery with the exception of LMW heparin where equal numbers of patients stopped or continued the drug.
- Whilst the majority of patients stopped clopidogrel or anticoagulant therapy a substantial number of patients continued and these patients had a higher rate of postoperative bleeding complications including tamponade.

Recommendations

- Further studies should be undertaken to establish the risks and benefits of continuing pre-operative medication. Guidelines should be produced based upon sound evidence (Society for Cardiothoracic Surgery in Great Britain and Ireland / NICE).
- NCEPOD supports the guidance of the American College of Cardiology and the American Heart Association that clopidogrel should be stopped prior to surgery wherever practicable.

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10. Non-elective, urgent, in-hospital cases

Study question

"To what extent does the in-hospital process of reviewing unstable cases affect outcome?" The consensus process identified in-hospital unstable cases as the fourth priority for study.

For the purpose of this chapter the cases will be referred to as urgent, in-hospital cases. That is to say it excludes patients who were admitted from home to have coronary artery surgery as a planned procedure (unless they were admitted to hospital more than one day prior to surgery). It includes emergency admissions and transfers from district general hospitals of patients with symptomatic coronary artery disease.

These patients are a challenging group as optimisation of clinical status and correct timing of surgery is essential. Difficult decisions surrounding use of therapies such as intra aortic balloon pumps (IABP) and 'rescue' PCI to allow ischaemic myocardium to recover and the timing of coronary artery bypass grafting in the presence of acute myocardial infarcts require consultant supervision and regular review of an often rapidly changing clinical scenario.

There are risks of operating too early in the presence of an acute myocardial infarct but also the threat that dynamic ischaemia may progress to an infarct if surgery is delayed. Close collaboration between cardiologists and cardiothoracic surgeons is essential. Many of these patients deteriorate overnight when it is more likely that doctors in training will review them. Mechanisms for involving consultant staff are important.

Results

Table 28 shows data regarding the presence of a policy for review of urgent, in-hospital patients.

Policy for review of urgent, in-hospital patients	Number of units
Yes	14
No	41
Unknown	2
Subtotal	**57**
Not answered	1
Total	**58**

Table 28. Policy for the clinical review of urgent, in-hospital cardiothoracic patients in place.

As mentioned, these patients can be a clinical challenge. Response to changes in clinical condition, use of additional supportive therapies and timing of surgery are problematic. To achieve best treatment there must be a consistent approach. In this study only 14 out of 58 hospitals had a policy for the clinical review of urgent, in-hospital patients. Successful use of such a policy is key to recognising changes and the need to potentially modify the therapeutic plan. All cardiothoracic units need to develop a policy for these patients. The need for early detection of clinical deterioration and involvement of consultant staff has been made previously by NCEPOD[1] and has led to the publication of a NICE Guideline[2]. These publications may form a useful basis for the production of a policy for review of deteriorating cardiology/ cardiothoracic patients.

Table 29 shows the specialty that was responsible for clinical management of urgent, in-hospital cardiothoracic patients. Despite the low incidence of a policy describing the review mechanism of these patients 52 hospitals were clear about the specialty who would be responsible for managing these patients. Thirty hospitals stated that cardiology would be responsible and 13 stated that cardiothoracic surgery would be responsible. Only nine hospitals had a collaborative approach between cardiology and cardiothoracic surgery.

Specialty responsible	Number of units
Cardiology	30
Cardiology and cardiothoracic surgery	9
Cardiothoracic surgery	13
Subtotal	**52**
Not answered	6
Total	**58**

Table 29. Specialty responsible for management of urgent, in-hospital cardiothoracic patients.

Much has been written about close collaboration between cardiologists and cardiothoracic surgeons in the successful management of patients with coronary artery disease[3]. Indeed this study showed evidence of this collaboration, both within the expert and advisor groups and in casenotes where good practice was noted. It is of note therefore that very few hospitals have a collaborative approach to the review of urgent in-hospital patients (only 9/52 units). There were several examples within this study where lack of collaboration was felt to have compromised patient care.

Case study 9

An inpatient waiting for urgent coronary artery bypass grafting had experienced new chest pain in the night prior to surgery. Surgery went ahead the next day as planned and the patient subsequently died. The operating consultant surgeon stated in the surgical questionnaire that the patient had clearly deteriorated overnight and that the cardiologists did not inform him of this fact.

The advisors felt that it was the responsibility of the operating surgeon to ensure that the patient was still in an appropriate condition to undergo surgery and that a surgical review prior to operation would clearly have identified the problem in this case. However, the advisors also felt that this case highlighted a serious lack of communication between cardiology and cardiac surgery.

Table 30 shows the classification of operation taken from the surgical questionnaire.

Classification	Number of patients	%
Salvage	37	4.1
Emergency	93	10.2
Urgent	407	44.8
Elective	372	40.9
Subtotal	**909**	
Not answered	1	
Total	**910**	

Table 30. Classification of operation from surgical questionnaire.

However, analysis of the casenotes allowed identification of 304 patients who met the definition of urgent and in-hospital: 134 patients were in year 1, 100 patients in year 2 and 70 patients in year 3.

Table 31 shows data on whether the patient received appropriate reviews given their clinical condition.
It was believed that 22 patients were not reviewed with appropriate frequency.

Appropriate frequency	Number of patients	%
Yes	243	84.1
No	22	7.6
Unknown	24	8.3
Subtotal	**289**	
Not answered	15	
Total	**304**	

Table 31. Appropriate frequency of reviews.

In the cases where review frequency was not appropriate the major problem was lack of review and lack of senior involvement in patients with ongoing chest pain and ECG changes consistent with myocardial ischaemia.

Case study 10

An elderly patient was admitted to hospital with chest pain and dynamic ST segment changes on ECG. The patient settled with medical management and subsequent cardiac catheterisation revealed coronary artery disease that was thought to be best managed by CABG rather than PCI. Due to the extent of the disease and the frequency of pain the patient was listed for urgent surgery and remained as an inpatient. On the evening prior to surgery the patient had more chest pain that was slow to settle with medical therapy. The patient was reviewed by an SHO at 18:00, 21:00, 23:00 and 04:00. The nursing notes state that pain had never really settled and several ECGs revealed ST segment changes (depression initially followed by elevation in leads II, III and aVF). There was no senior involvement in the overnight period and no senior review prior to surgery. At surgery it appeared that the patient had suffered a myocardial infarction overnight. After completion of surgery it was difficult to come off bypass due to poor myocardial function and hypotension. Despite inotropic support and intra-aortic balloon pump the patient died from cardiogenic shock in the immediate postoperative period.

This case highlights the need for senior doctor input in the event of overnight deterioration. It is possible that alternative strategies may have prevented the overnight complications in this case. In addition it highlights the need for the operating surgeon to be aware of any overnight deterioration so that plans can be altered if required. Close collaboration between cardiology and cardiac surgery is needed. Surgery in the presence of an acute myocardial infarct carries a very high mortality.

The medical management of these patients was assessed as being inappropriate in 37 cases (12.2%) (Table 32).

Appropriate medical management	Number of patients	%
Yes	249	82.2
No	37	12.2
Unknown	17	5.6
Subtotal	**303**	
Not answered	1	
Total	**304**	

Table 32. Appropriate medical management of non-elective, urgent, in-hospital patients.

Case study 11

An elderly patient developed unstable angina whilst waiting for urgent inpatient coronary artery surgery. The pain did not settle and a GTN infusion was started. Unfortunately this could not be continued due to hypotension. A decision was made to perform coronary artery bypass grafting as an emergency due to the inability to settle symptoms medically. The patient was haemodynamically unstable after cardiopulmonary bypass and surgery and had a persistent low output state and hypotension despite inotropic support. The patient died 36 hours postoperatively from cardiogenic shock.

Advisors commented on the timing of surgery. Would it have been more appropriate to use an intra aortic balloon pump as adjunctive therapy to treat myocardial ischaemia and optimise the condition of the patient? Alternatively should repeat coronary angiography and stenting as an interim measure have been performed?

It was noted that there appeared to be a low use of both these strategies within this study.

Appropriate investigations performed	Number of patients	%
Yes	264	86.8
No	26	8.6
Unknown	14	4.6
Total	**304**	

Table 33. Appropriateness of investigations of urgent, in-hospital patients.

Outcome affected	Number of patients
Yes	15
No	7
Unknown	1
Subtotal	**23**
Not answered	3
Total	**26**

Table 34. Affect on outcome of appropriate investigations.

Tables 33 and 34 provide data on investigation of urgent, in-hospital cases. Despite being an urgent group of patients who were inpatients there was lack of investigations in 26 cases (8.6%). In the opinion of the advisors this affected outcome in almost two thirds of patients who experienced lack of proper investigation.

Operated on out of hours	Number of patients	%
Yes	31	10.2
No	256	84.2
Unknown	17	5.6
Total	**304**	

Table 35. Out of hours in unstable cases.

Table 35 shows whether patients underwent an operation during normal working hours or not. Only 31/304 (10.2%) were operated upon out of hours. In the 256 patients who were not operated upon out of hours it was believed that the scheduling could have affected outcome in 21 patients, did not affect outcome in 220 patients and could not be commented upon in 15 cases. It was judged that delays and deterioration contributed to poor outcomes in the 21 cases.

It is difficult to interpret the scheduling of cases for this group of urgent, in-hospital cases. On first inspection it may seem poor that only 31/304 patients (10.2%) were operated upon out of hours. However, as has been noted above, it may be in the best interest of the patient to optimise medical therapy, utilise adjuncts such as IABP and schedule the patient for the next planned list. However, Table 36 (interval between hospital admission and operation) shows that 208/300 patients (69.3%) waited for three days or more for surgery. In addition of the 256 patients who were operated on in normal working hours it was believed that surgery was delayed and contributed to poor outcome in 21 cases (8.2%). In summary these decisions are difficult and mandate the input of consultants to ensure that surgery is undertaken at the optimum time.

Case studies 12 and 13 highlight issues around the timing of surgery.

Case study 12

An elderly patient was admitted to hospital with ischaemic chest pain. Following inpatient angiography a plan was made for urgent coronary artery bypass grafting. In the twelve hours prior to surgery the patient developed severe chest pain, not relieved by diamorphine or GTN. No senior assessment (cardiology or cardiac surgery) was made and surgery proceeded, as planned, the next morning.
At operation, prior to commencement of bypass, the heart was noted to be severely hypokinetic. The patient could not be weaned from bypass after the coronary artery grafts had been performed and they died in the operating theatre.

The advisors felt that patients who develop continuous chest pain in the 12 hours prior to surgery need reviewing to determine if surgery is indicated at that time. They also believed that it is generally inappropriate to operate on patients immediately post infarct.

Case study 13

A a middle-aged patient was admitted to hospital as an emergency with unstable angina. Medical management provided symptomatic relief and resolution of ECG changes. The troponin T measured 12 hours after admission was not raised. After coronary angiography a plan was made for urgent coronary artery bypass surgery which was performed four days after initial admission to hospital. During the period prior to surgery the patient had several episodes of chest pain. As a result of a prolonged episode of chest pain a repeat troponin T assay was requested the day prior to surgery. This result was not reviewed prior to surgery. Postoperatively the patient was haemodynamically unstable and died 24 hours postoperatively of refractory shock. The troponin T assay performed on the day prior to surgery was markedly elevated.

The advisors commented that it was not clear when the patient had suffered an acute myocardial infarct but that the lack of review of the troponin T assay was a missed opportunity to recognise this problem. This was another case where the timing of surgery with respect to an acute myocardial infarction was inappropriate.

Days in hospital prior to operation	Number of patients	%
0	12	4
1	40	13.3
2	40	13.3
3 or more days	208	69.4
Subtotal	**300**	
Missing or incorrect date	4	
Total	**304**	

Table 36. Interval between hospital admission and operation.

The majority (208/300 – 69.4%) of patients were inpatients for three or more days prior to surgery for coronary artery bypass grafting.

Figure 29 shows the number of reviews for patients in hospital three or more days prior to surgery, a majority were reviewed on five to six occasions. However, within this group there were also a large number of patients in hospital for three or more days only reviewed on one to two occasions.

Figure 30 shows how the overall assessment of care was divided for this group. It can be seen that this was no different to the group taken as a whole.

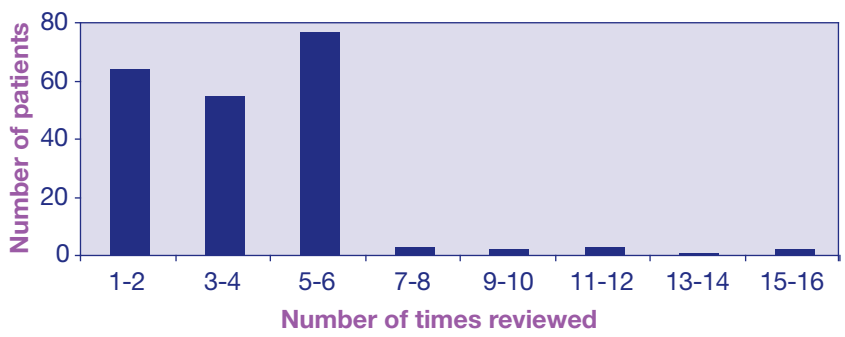

Figure 29. Number of times unstable patients, in hospital for three or more days prior to surgery, were reviewed in the three days prior to procedure.

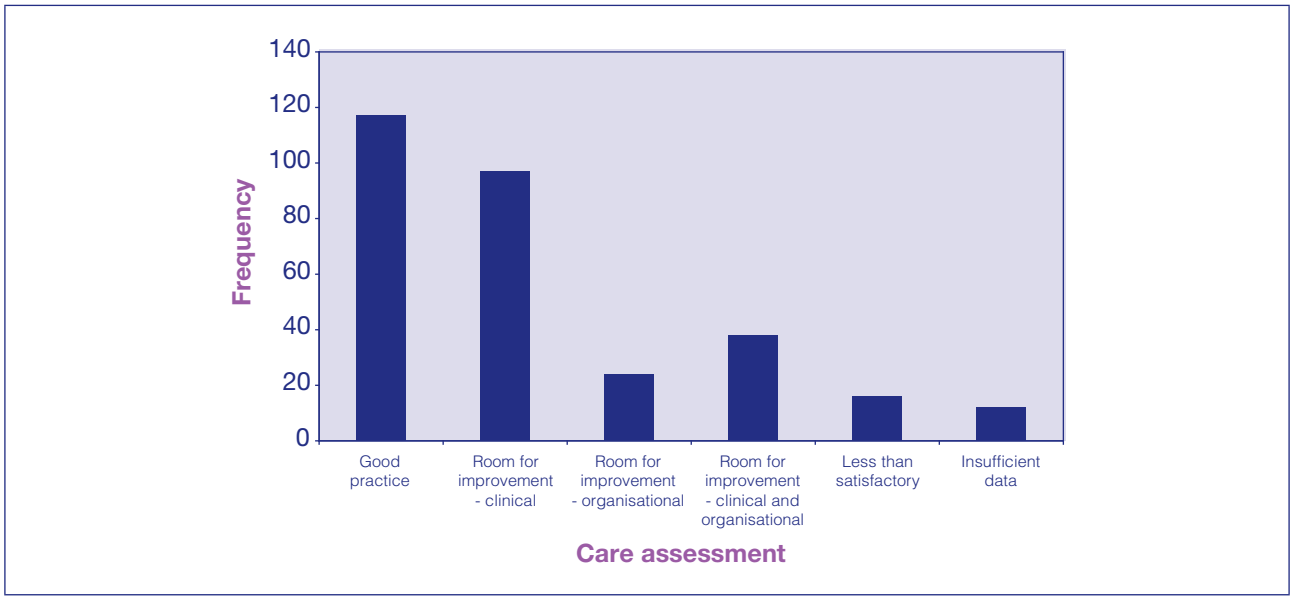

Figure 30. Overall assessment of care in unstable patients.

Key findings

- 304 patients were defined as urgent, in-hospital.
- Only 39% of these patients received a standard of care defined as good practice.
- 208/300 patients (69%) were inpatients for three or more days prior to surgery.
- Three out of four hospitals did not have a policy to ensure timely and appropriate review of these urgent, in-hospital patients.
- Medical management of these patients was inappropriate in 37 cases (12%).
- Investigations were not appropriate in 26 cases (9%) and it was felt that outcome was affected by this deficit in appropriate investigations in 15 cases.
- Peer review identified cases where surgery was inappropriately performed in the presence of an acute myocardial infarct and also inappropriately not performed when patients were clearly unstable despite medical therapy.

Recommendations

- There should be a protocol to ensure timely and appropriate review of unstable cases that involves both cardiologists and cardiac surgeons (Clinical Directors).
- The senior surgeon needs to be aware of any change in clinical status in the pre-operative period to ensure that surgery is still appropriate (Consultant Cardiothoracic Surgeons).
- Given the high mortality when operating soon after an acute infarct more use should be made of strategies to optimise clinical condition, provide symptom relief and allow surgery to be performed at a later date (IABP and PCI) (Clinical Directors).
- A “track and trigger” system should be used to provide early recognition of clinical deterioration and early involvement of consultant staff (Clinical Directors).

References

1 National Confidential Enquiry into Patient Outcome and Death. (2005). *An Acute Problem?*. NCEPOD

2 National Institute for Health and Clinical Excellence. (2007). Acutely ill patients in hospital. *Recognition of and response to acute illness in adults in hospital.* NIHCE.

3 Department of Health (2000) *Coronary Heart Disease national service framework*. Chapter 5 Revascularisation. Crown copyright.

11. Comorbidities

Study question

"Are there identifiable changes in the care processes that could reduce the influence of comorbidities on outcome?" The consensus exercise identified comorbidities as the thirteenth area for study.

Body mass index (BMI)

Table 37 shows the distribution of body mass indices for the cases in this study. Half of the patients receiving a first time coronary artery bypass graft (CABG) were either overweight (25 – 30) or obese (>30).

BMI	Number of patients	%
Underweight (<20)	21	2.6
Normal (20 - 25)	188	22.9
Overweight (25 - 30)	255	31
Obese (>30)	163	19.9
Unknown	194	23.6
Total	**821**	

Table 37. Body mass index extracted from records.

Figure 31 demonstrates the relationship between the overall care and BMI. Neither height and weight, nor BMI, were recorded in almost a quarter of cases. Care was judged to be less than satisfactory more often in those patients who were obese, but there was little apparent difference between patients who were normal or overweight. No patients who were underweight were judged as having received a level of care less than satisfactory.

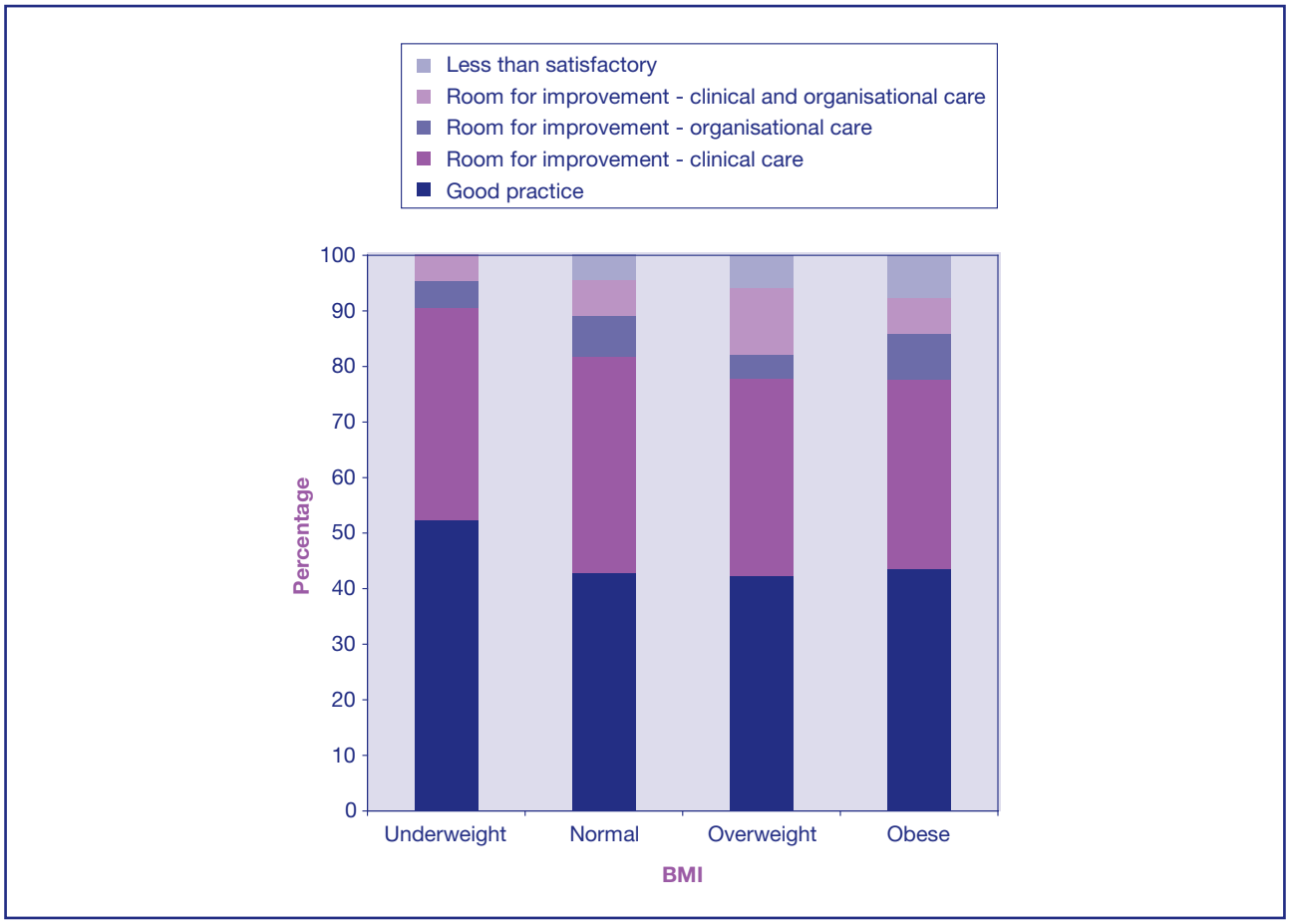

Figure 31. BMI and overall care assessment.

It is now a requirement that height and weight is recorded for all patients admitted to hospitals. It is therefore of specific note that in this study almost a quarter of patients had no evidence of height and/or weight and/or the BMI having been recorded. Where the BMI had not been calculated, but height and weight were available, the BMI was calculated by NCEPOD staff.

Medical comorbidities

Surgeons and anaesthetists were both asked to give details about the comorbidities and their management in five specified areas (which are required to complete the EuroSCORE matrix) namely: diabetes, hypertension, renal disease, ejection fraction value and respiratory disease. They were also permitted to enter free text details of other comorbidities.

Responses were available from 910 surgical questionnaires and 922 anaesthetic questionnaires. However, not all questions were answered for all patients and some were answered as "unknown". For each question, therefore, only the number of known answers given was used as the denominator to calculate the percentage for each question.

The number of reported comorbidities was very similar for both surgeons and anaesthetists. Both surgeons and anaesthetists indicated that hypertension was well managed. However, it

Comorbidity	Surgeon						Anaesthetist					
	Number of patients	Reasonably managed		Not reasonably managed		Unknown /Not answered	Number of patients	Reasonably managed		Not reasonably managed		Unknown /Not answered
		n=	%	n=	%	n=		n=	%	n=	%	n=
Diabetes	301	214	90.7	22	9.3	65	310	250	93.6	17	6.4	43
Hypertension	643	473	96.7	16	3.3	154	662	543	96.8	18	3.2	101
Renal disease	102	40	83.3	8	16.7	54	93	58	93.5	4	6.5	31
Respiratory disease	226	102	87.9	14	12.1	110	231	108	92.3	9	7.7	114

Table 38. Comorbidities and whether they were managed reasonably as reported by surgeons and anaesthetists.

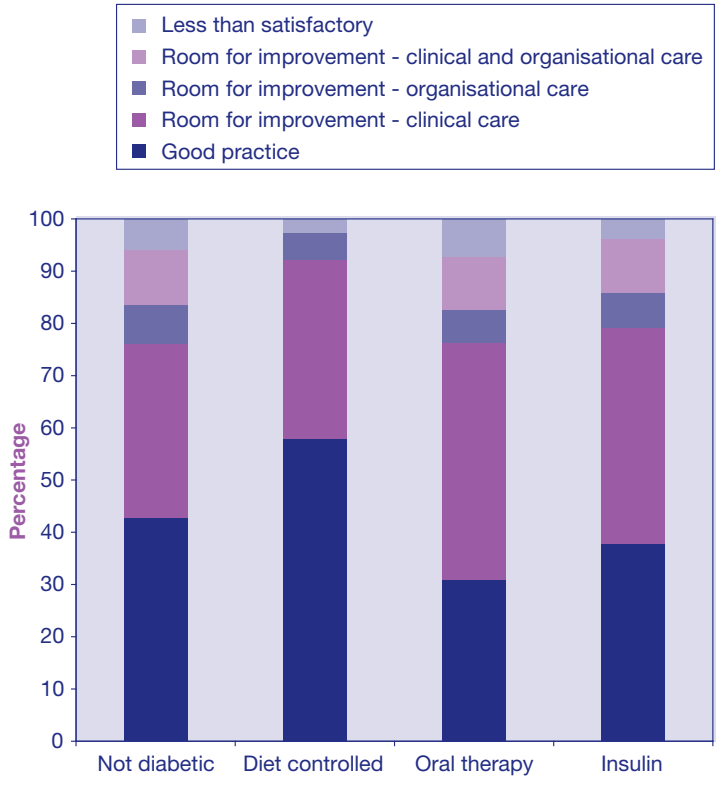

Figure 32. Relationship between type of diabetes and overall assessment of care.

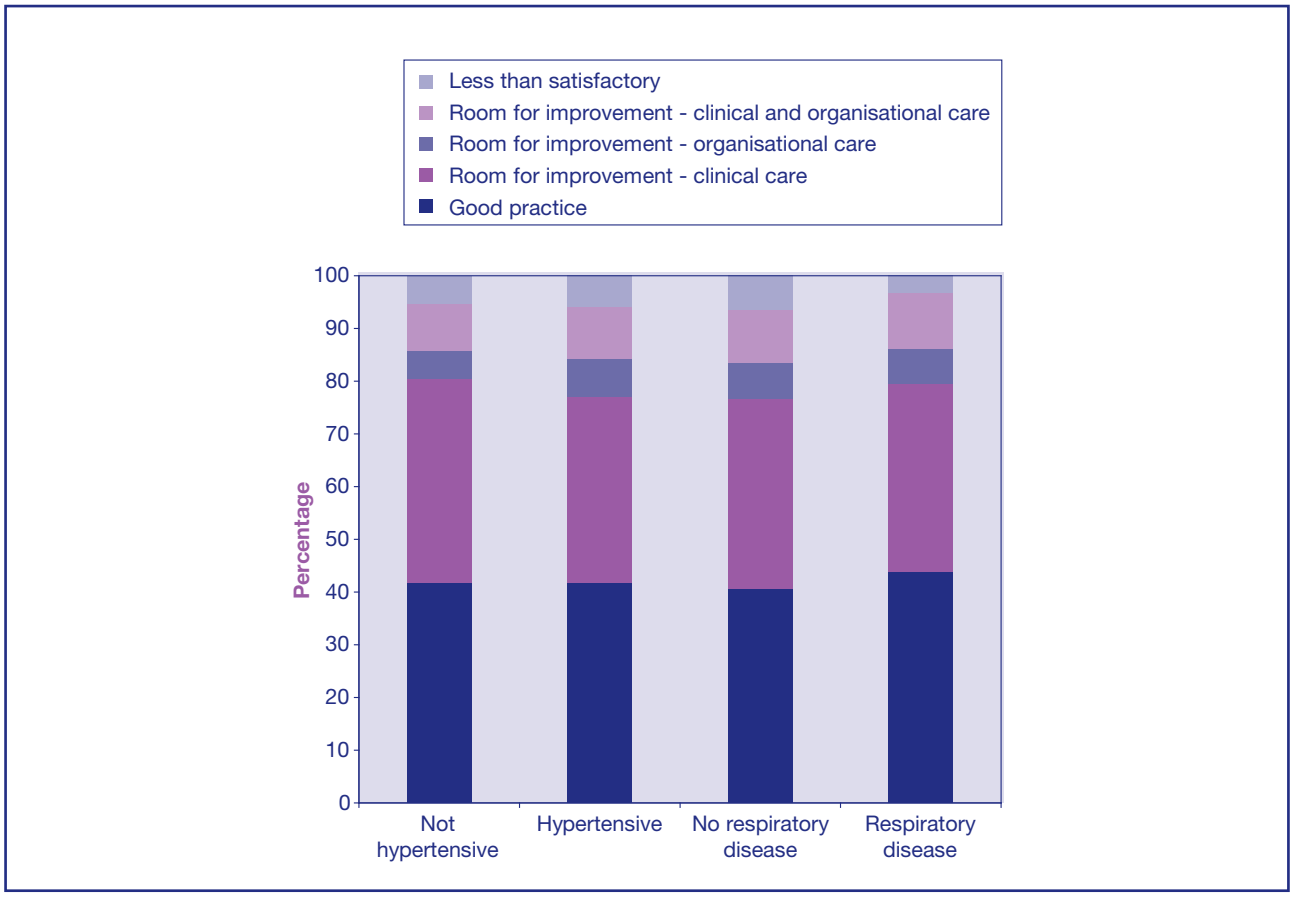

Figure 33. Overall assessment of care in patients with hypertension or respiratory disease.

should be noted that in 154 cases for the surgeons and 101 cases for anaesthetists, data were not available, and so caution should be exercised in interpretation (Table 38). Surgeons appeared to be critical in a higher proportion of cases than anaesthetists regarding the pre-operative management of diabetes, renal disease and respiratory disease. Renal disease was regarded as having been not managed reasonably in 16.7% of cases by the surgeons, but in only 6.5% of cases by anaesthetists. However, it should be noted that assessment of patients with renal disease was only possible for 48/102 (47%) patients reported by surgeons and 62/93 (67%) patients reported by anaesthetists.

An overall assessment of good practice was observed in over half those patients with diet controlled diabetes (Figure 32). Fewer patients were judged to have received good care where the diabetes was controlled with oral hypoglycaemics or insulin.

There was little observed difference in the overall assessment of care for patients with or without hypertension or respiratory disease (Figure 33).

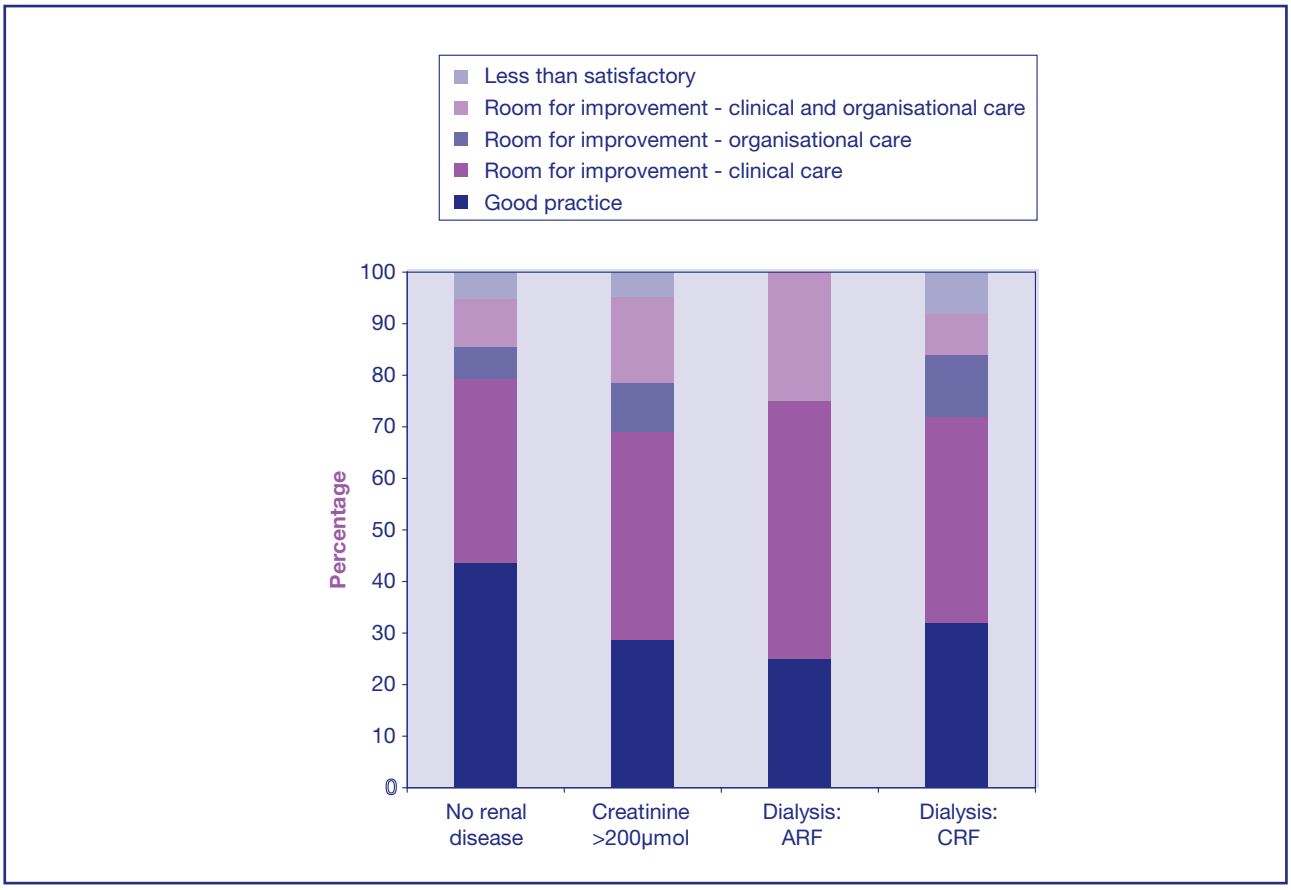

Figure 34. Overall assessment of care in patients with renal disease.

Those patients with a creatinine greater than 200µmol/l, and in particular those patients requiring dialysis for either acute (<6 weeks) or chronic (>6 weeks) renal failure, were observed to receive an overall assessment of good practice less often than those cases with no renal disease (Figure 34). However, these data should be treated with caution as there were only five patients with acute renal failure and 22 patients with chronic renal failure who had sufficient data for assessment. That having been said there was some consistency with the finding that a substantial percentage of patients with renal failure were believed by surgeons not to have received reasonable management of their renal disease.

Case study 14

A middle-aged patient with chronic renal failure underwent a surgically uneventful three vessel coronary artery bypass. Despite recognising the likelihood that postoperative filtration would be required, no arrangements were put in place. The patient was discharged from ICU to an area that could not provide renal support. The patient was admitted back to ICU two days afterwards for ventilation and haemofiltration due to fluid overload, but died 24 hours later.

		Anaesthetist			
		Good	Fair	Poor	Not answered
Surgeon	Good	241	48	4	7
	Fair	94	177	35	6
	Poor	8	43	141	5
	Not answered	8	3	2	3

Table 39. Comparison of LV function grades assigned by surgeons and anaesthetists.

This group of patients has a high incidence of comorbidity. In general, most comorbidities were judged to have been reasonably managed. However, while only a very few patients with hypertension were judged not to have received reasonable management, substantial numbers of patients with diabetes, respiratory disease, and in particular renal disease were judged not to have received reasonable management for these conditions.

Left ventricular function

The difficulties associated with the determination of left ventricular function, and the importance of this factor within the overall EuroSCORE risk stratification system have been reported in the NCEPOD Year 2 Interim Report[1].

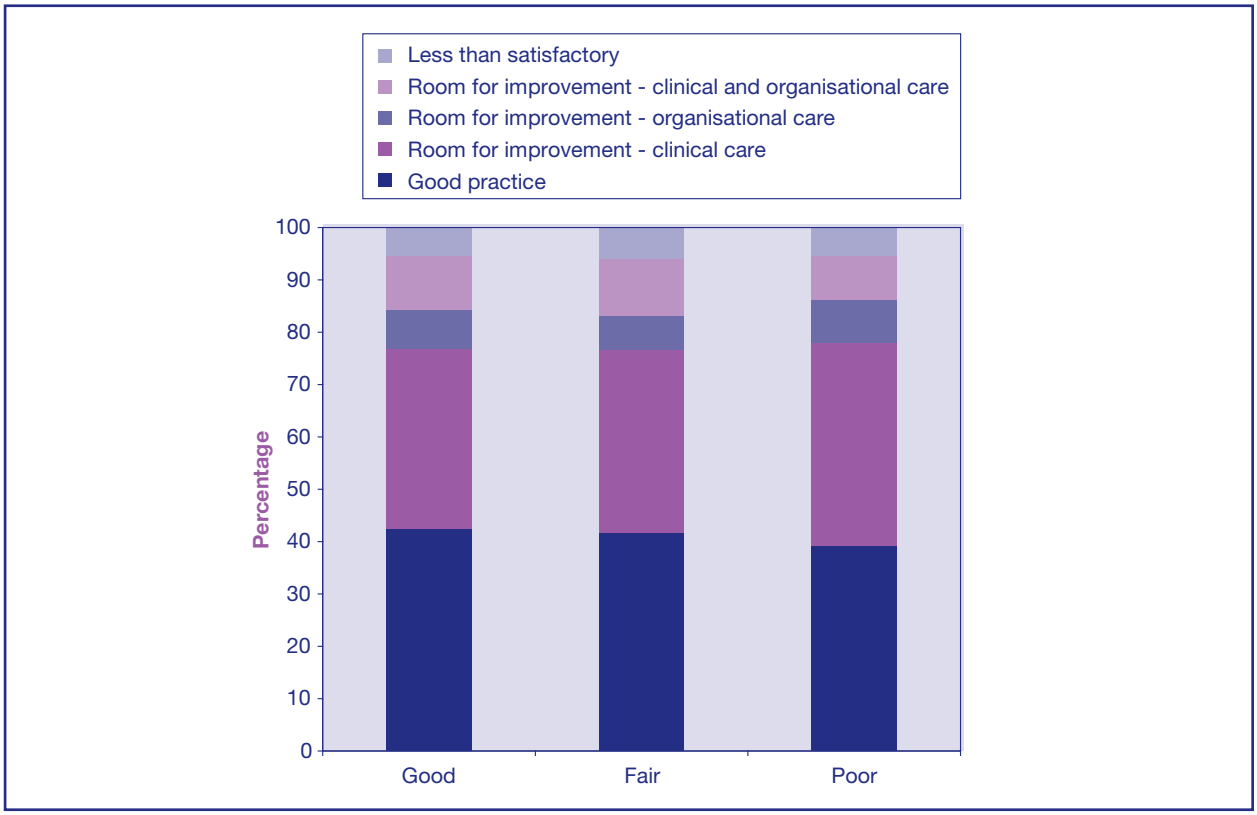

Figure 35. Grades of LV function assigned by surgeons and overall assessment of care.

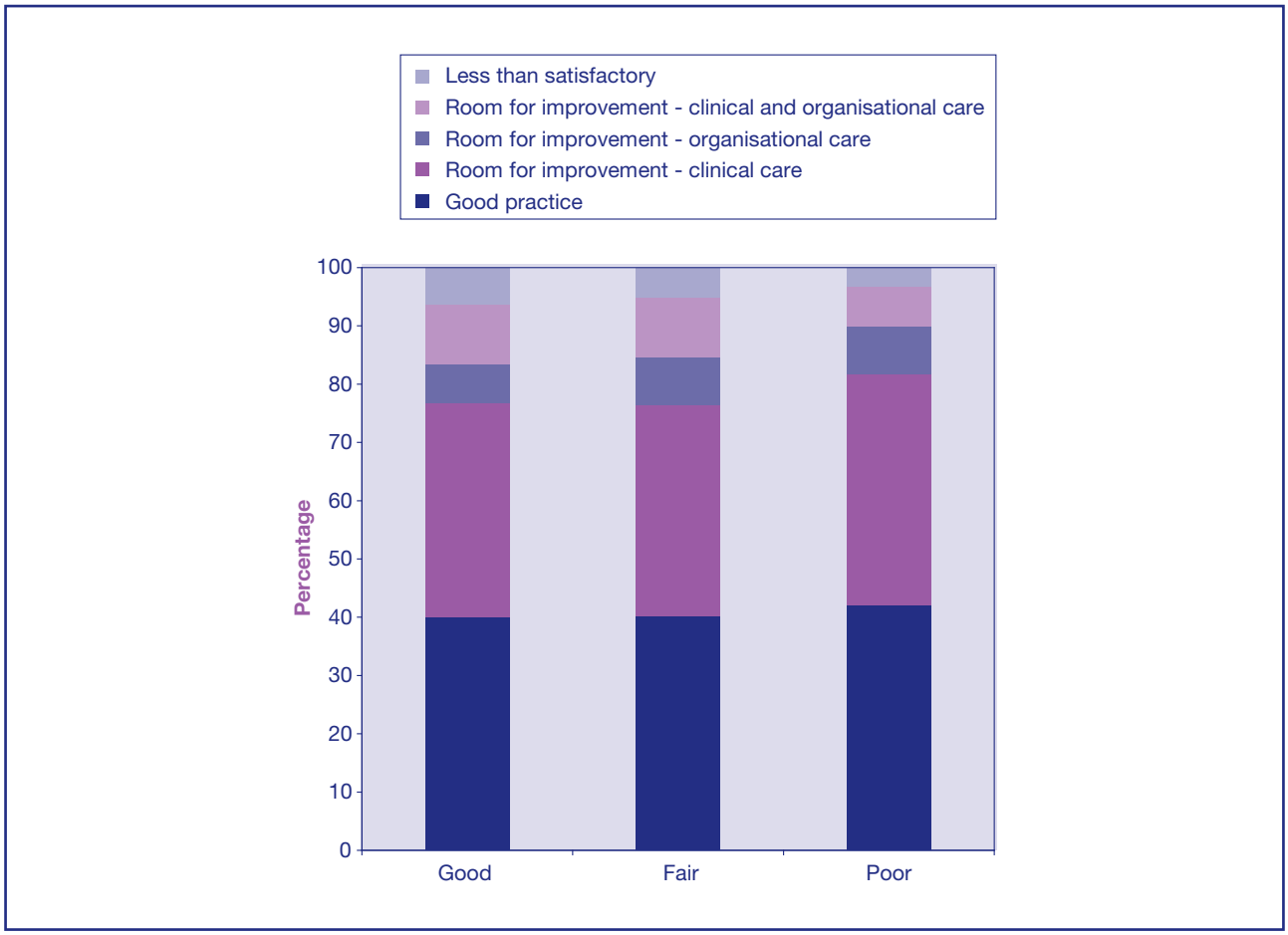

Figure 36. Grades of LV function assigned by anaesthetists and overall assessment of care.

When comparing the assessment of left ventricular function from the surgical and anaesthetic questionnaires for the cases, it can be seen that there was considerable disagreement between the grades assigned by the surgeons and anaesthetists (Table 39). Although overall anaesthetists gave more optimistic grades, there were also a substantial number of cases which were given better grades by the surgeon than by the anaesthetist.

When the grade of LV function assigned by surgeons was compared with the overall assessment of care, little difference was identified (Figure 35).

The picture was similar when the grades of LV function assigned by anaesthetists was compared with the overall assessment of care (Figure 36).

There were still a substantial number of patients in whom there was a discrepancy between the grading of left ventricular function, by anaesthetists and surgeons. To some extent this may be accounted for by deterioration between the time of the investigation and the time of surgery. It may also be the case that the surgeon finds a worse or better situation than anticipated at the time of surgery, and so adjusts the assessment on this basis. However, there does remain the underlying issue, that this is a highly weighted element of the EuroSCORE, which is being used to compare risk adjusted outcomes between surgeons and units, which is potentially amenable to manipulation.

Key findings

- Neither height and/or weight nor body mass index (BMI) were recorded in almost a quarter of cases.
- More than half of the patients were overweight or obese.
- There was a high level of comorbidity in this group of patients. The majority had their comorbidity managed reasonably, but in a number of cases there was room for improvement particularly in the management of renal disease.
- There were discrepancies between surgeons and anaesthetists in the grading of LV function.

Recommendations

- All patients should have height, weight and a BMI recorded on admission, unless their clinical condition precludes this (Medical Directors).
- Where pre-operative comorbidity exists, there should be a clear written management plan which is followed in order to optimise the physical status of the patient prior to surgery, and identify the need for specific postoperative support to be available (Clinical Directors).
- There should be clear guidance about how to estimate LV function, and at what point in the patient journey this should be ascertained and recorded. Units should audit discrepancies in recorded LV function from surgeons and anaesthetists and where there are significant differences ensure that systems are in place to address this (Clinical Directors and Audit Leads).

References

1 National Confidential Enquiry into Patient Outcome and Death. (2007). *Death following a first time isolated coronary artery bypass graft; Interim Report – Data year 2005/2006.* NCEPOD.

12. Anaesthetic process

Study question

"To what extent does variation in the anaesthetic process affect outcome?" Anaesthetic process was identified by the consensus exercise as an important area of study and was ranked sixth in the consensus exercise.

Anaesthesia for cardiac surgery is a major subspecialty within the practice of anaesthesia requiring an in-depth knowledge of cardiovascular physiology and pharmacology. Due to the complexities of cardiac surgery and the considerable patient comorbidities, cardiac anaesthesia is considered to be a consultant based service. Cardiac anaesthetists are increasingly responsible for pre-operative assessment and postoperative cardiac intensive care as well as pre-operative management. NCEPOD investigated the extent to which the anaesthetic process influenced care.

Inpatient pre-operative assessment

The anaesthetist completing the anaesthetic questionnaire was asked if the patient was seen by an anaesthetist prior to surgery. Of the 922 anaesthetic questionnaires returned 900 (97.6%) patients had been assessed by an anaesthetist before surgery. Of the remaining 22 patients, in five it was not possible to determine if they had been assessed and 13 were salvage cases.

The grade of the anaesthetist who undertook the pre-operative assessment is shown in Table 40.

Grade of anaesthetist	Number of patients	%
Consultant	706	78.8
SpR	179	20.0
Staff Grade/Associate specialist	9	1.0
Unknown	2	0.2
Subtotal	**896**	
Not answered	4	
Total	**900**	

Table 40. Grade of the anaesthetist undertaking pre-operative assessment.

Of those patients not assessed by a consultant, regardless of the category of surgery or the patient's EuroSCORE, the proportions of patients were similar to those assessed by consultants.

Case study 15

An elderly patient presented as an emergency with acute coronary syndrome for CABG. The patient was seen by an anaesthetic SpR an hour prior to surgery. The assessment was clearly documented in the patient's notes and included a comprehensive history and examination. The proposed anaesthetic was explained to the patient along with the associated risks. The entry was dated, timed and signed with a designation. In contrast the consent for surgery was taken by a surgical SHO with limited documentation of the risks of surgery.

The advisors were impressed by the clarity of the documented anaesthetic assessment.

These findings would indicate that patients were having anaesthetic assessment at an appropriate level of seniority in the majority of instances in the pre-operative period.

Induction of anaesthesia

It was the view of the expert group that one of the most critical times during the anaesthetic process was induction of anaesthesia. At and following induction of anaesthesia there can be major changes in cardiovascular status including increases and decreases in arterial blood pressure and heart rate. This can affect cardiac output and coronary perfusion pressure causing cardiac muscle ischemia which may affect cardiac function adversely. Consequently the seniority and experience of the anaesthetist who conducts induction of anaesthesia may impact on patient care.

Using the anaesthetic questionnaire, information was gathered on the grade and experience of the anaesthetist. In 898/922 (97.4%) of cases a consultant was the most senior anaesthetist present at induction. This figure compares favourably with previous NCEPOD studies where 60% of elective patients were anaesthetised by consultants[1].

However, there were some examples where untoward events occurred during induction of anaesthesia when this was conducted by anaesthetists in training. Case study 16 is an example of this.

Case study 16

A SpR 4 anaesthetist induced anaesthesia in a middle-aged patient while the supervising consultant was taking the previous patient on the operating list to the cardiac intensive care unit. Some 30 minutes following induction, on return of the consultant, the consultant noticed that the patient's ECG showed marked ST depression. The consultant immediately commenced a nitrate infusion. Before the patient commenced on bypass the ST segments had returned to normal. The patient died postoperatively from unrelated events.

The advisors commented that although the cause of death was not related to the myocardial ischaemic event following anaesthesia, this patient received suboptimal care. The advisors were of the opinion that the SpR was left without supervision for an undue period of time and that if the consultant had be present at an earlier stage the ST segment depression might have been avoided, or at least noticed earlier and treated more rapidly.

For those patients where the most senior anaesthetist was a consultant, the number of years in post is shown in Figure 37. The median number of years was 10.

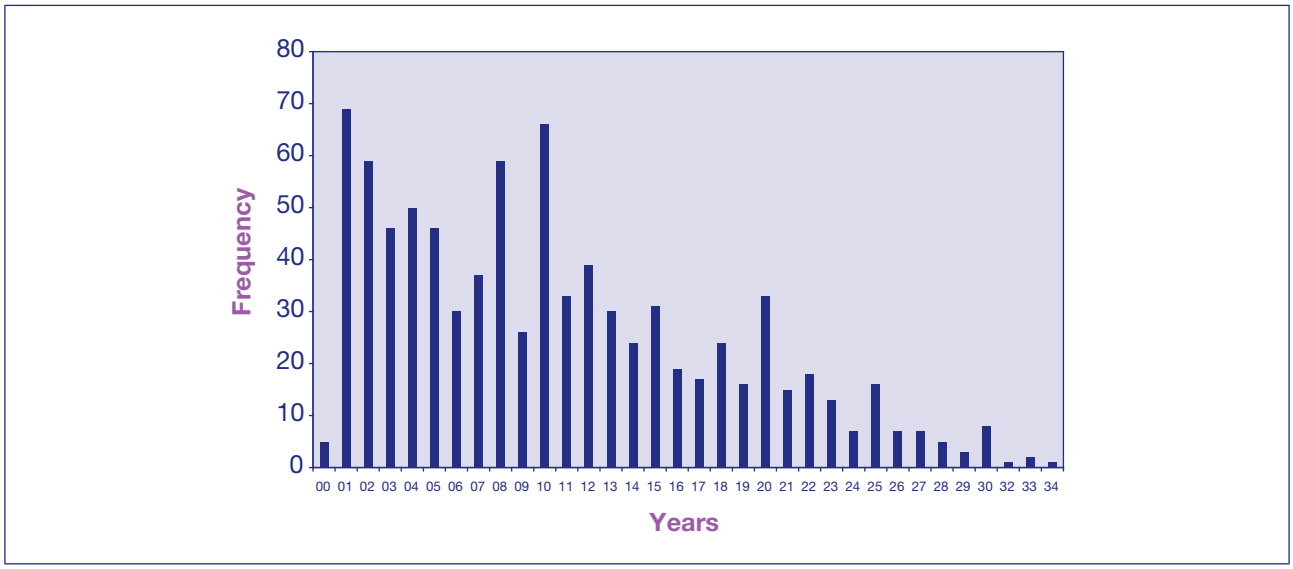

Figure 37. Number of years in a consultant post.

Furthermore, for the patients included in the study, the number of clinical programmed activities (PAs) the consultant spent in cardiac anaesthesia per week was also determined, (Figure 38). The median number of PAs was six. While there are no recommendations on the number of PAs that should be undertaken in cardiac anaesthesia the advisors were of the opinion that it might be difficult for those anaesthetists who had less than three PAs, equivalent to at least one whole day operating list a week, to maintain their expertise. Of the study sample, 6% were anaesthetised by consultants who had less than three PAs devoted to cardiac anaesthesia.

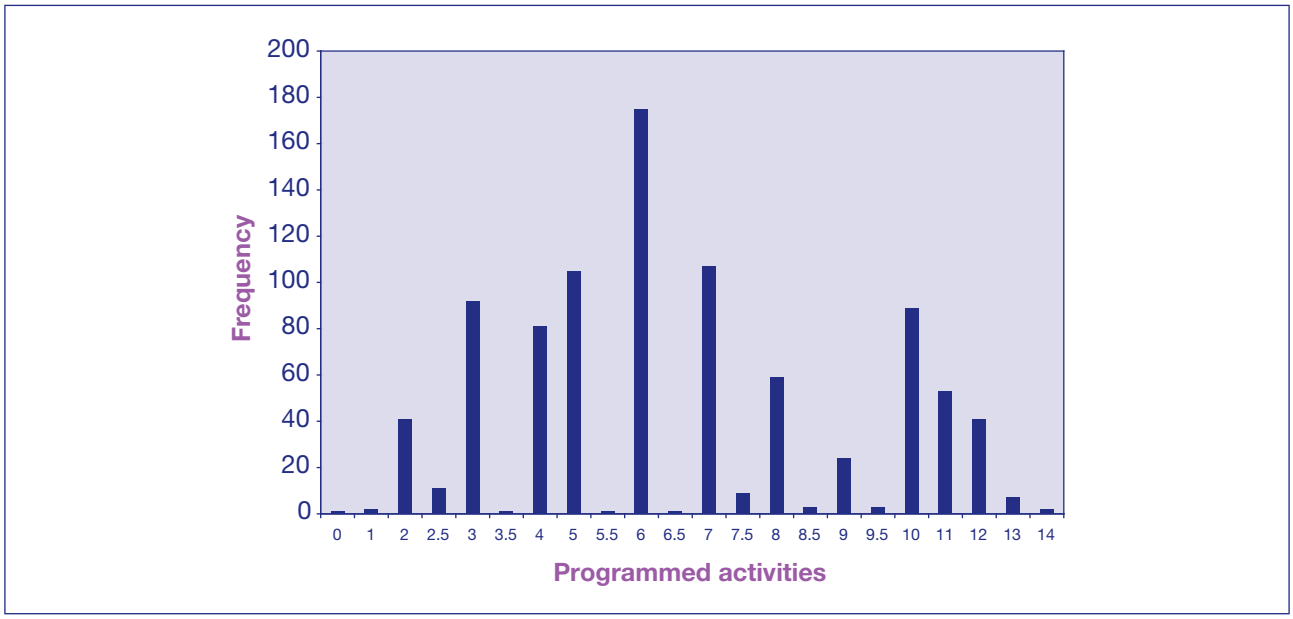

Figure 38. Number of programmed activities (PAs) per week allocated to cardiac anaesthesia.

In 85.6% of patients the consultant anaesthetist responsible for the case was a member of the Association of Cardiothoracic Anaesthetists (ACTA). Membership of such a professional body is not a prerequisite to participate in cardiac anaesthesia and is not a guarantee of competency, but it might be regarded as a marker of continuing professional development and a willingness to participate in comparative audit.

The advisors commented that the overwhelming majority of cases were anaesthetised by consultants and that the quality of anaesthetic charts was generally good. However, there were occasional tensions between consultant anaesthetists and surgeons particularly in relation to the appropriateness of trainee surgeons who were undertaking complex cases with poor supervision by consultant surgeons. There were also examples of disagreements in post bypass cardiovascular stability between consultant anaesthetists and consultant surgeons. Case study 17 is such an example.

Case study 17

An elderly patient underwent uneventful CABG surgery. A locum consultant anaesthetist was responsible for the anaesthetic care. After coming off bypass the anaesthetist considered that the patient was not sufficiently stable to be transferred to the ICU. However, the consultant cardiothoracic surgeon was of a contrary view. The patient was transferred to the ICU against the advice of the anaesthetist. Shortly after arriving on the ICU the patient's clinical condition rapidly deteriorated and had re-grafting of the coronaries with bypass on the ICU. The patient subsequently died. The anaesthetist stated that one of the reasons for the surgeon's decision was pressure to proceed with the next case due to time constraints of the operating list.

The advisors were of the opinion that there was poor in-theatre team working and that the views of the anaesthetist should have been considered more carefully. Furthermore the pressure to proceed with the next case indicated poor theatre time management.

Key findings

- 901/923 (98%) patients were assessed by an anaesthetist prior to surgery, 79% of the anaesthetists were consultants.
- In 899/923 (97%) cases a consultant was the most senior anaesthetist at induction.

References

1 National Confidential Enquiry into Peri-operative deaths. (2003). *Who operates when? II.* NCEPOD.

13. Peri-operative management and postoperative care

Study questions

"To what extent does the identification and management of peri-operative complications affect outcome?" Peri-operative management, particularly in relation to the management of complications and critical incidents, was identified by the consensus exercise and ranked ninth.

"To what extent does the appropriateness of postoperative facilities and support affect outcome?" The appropriateness of postoperative facilities was also identified by the consensus exercise as an important area of study and was ranked tenth in the consensus exercise.

Coronary artery bypass grafting is relatively low risk surgery and the vast majority of patients have an uncomplicated and well-described postoperative pathway. Indeed many cardiothoracic units use integrated care pathways for these patients, such is the predictable nature of recovery. Most patients spend a short time (24 hours or less) in a recovery area or critical care area where they are initially sedated and ventilated until physiological homeostasis is recovered and the absence of immediate postoperative complications ensured. De-escalation of intensity of observations and level of care required rapidly occurs and the patient can normally be returned to a cardiothoracic ward 24-48 hours postoperatively.

However, there are a small number of patients who, due to severity of myocardial dysfunction, intra-operative complications or other comorbidities, do not recover according to the care pathway described above. These patients often require prolonged periods of critical care and provide a challenge both in clinical care and resource utilisation.

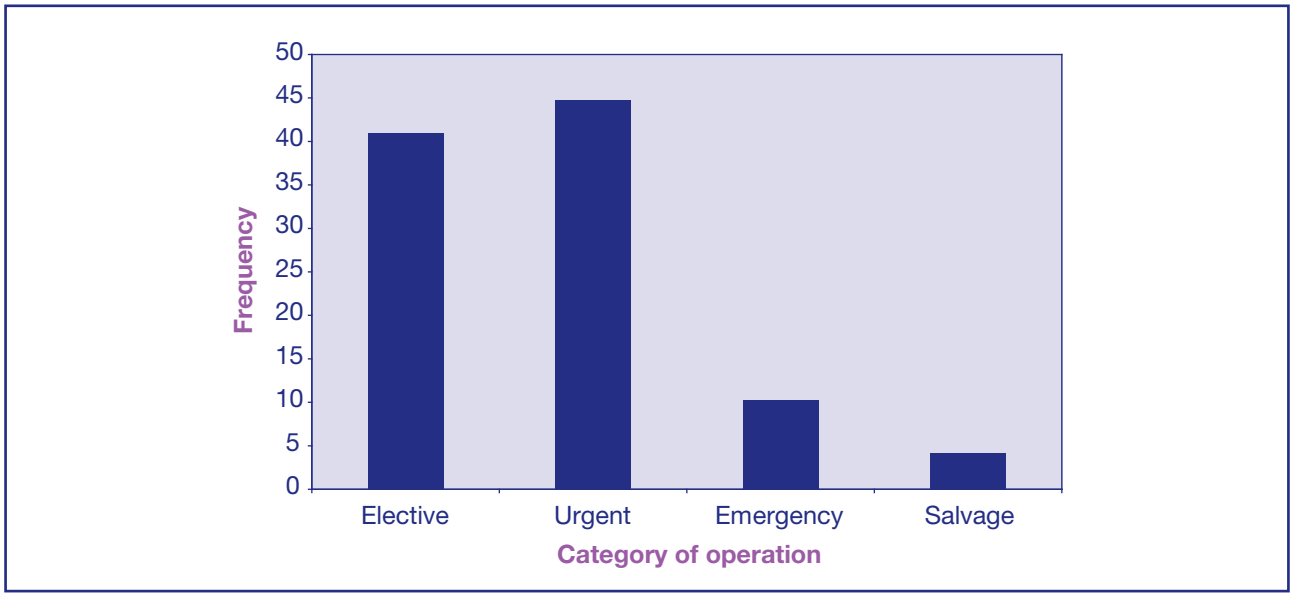

Figure 39. Category of operation.

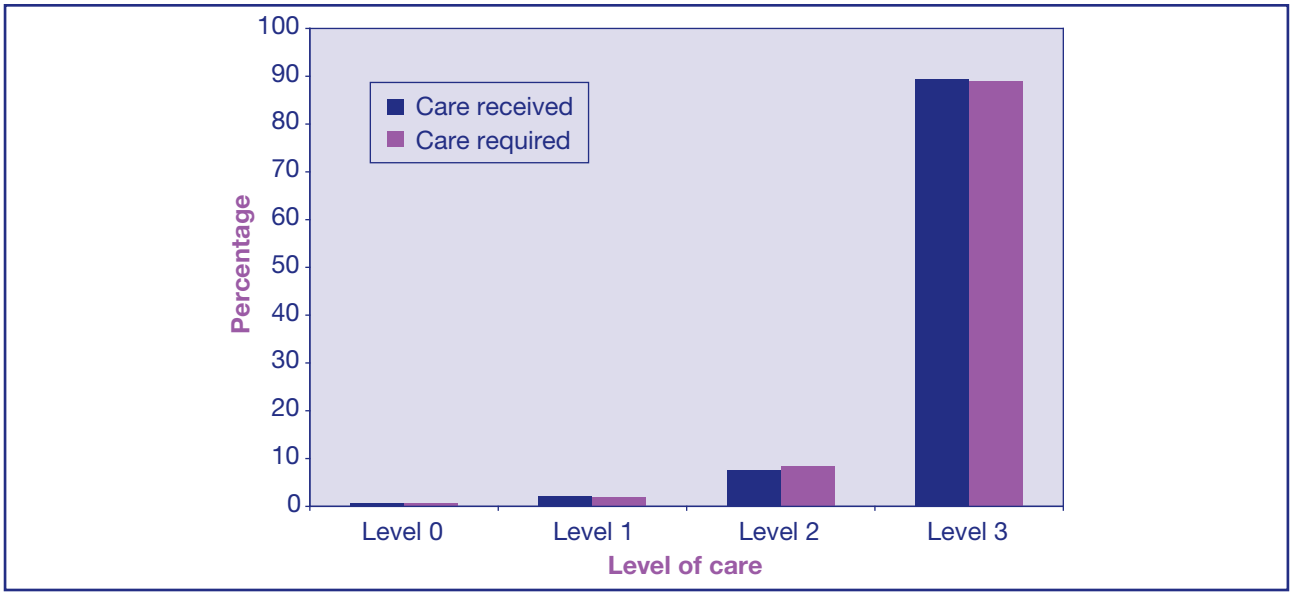

Figure 40. Level of postoperative care received/required.

Category of operation

From the surgical questionnaire, it was ascertained that there were 372/910 elective cases, 407/910 urgent cases, 93/910 emergency cases and 37/910 salvage cases (Figure 39). There was only one case where it was not possible to determine the category of urgency of the operation. The category of operation is defined in Figure 8.

Level of postoperative care

The level of postoperative care received and the level of care required are shown in Figure 40.

774 (89.5%) patients received level 3 care and 66 (7.6%) patients received level 2 care. The small number of cases described as level 1 or 0 care were surprising. However, when

analysed, these cases were all intra-operative deaths and had been classified as level 1 or 0 by the clinician completing the form as no field existed to indicate that no level of care was required (due to intra-operative death).

Patients received an appropriate level of care (level 3 or level 2) in the immediate postoperative period and there were no cases where the level of care was less than that which was considered appropriate by the responding clinician. However, it must be remembered that most of these cases were taken to theatre in the knowledge that an appropriate postoperative bed would be available as part of the package of care required. This study does not quantify the number of patients who had their procedure delayed until an appropriate bed was available. Delays and cancellations are the result of level 2 or 3 bed shortages rather than inappropriate placement of patients postoperatively. Salvage cases are probably the only exceptions to this.

Step down of care

Table 41 shows data on the timing of stepping down care and appropriateness of this.

Stepped down care	Number of patients	%
Yes	10	1.2
No	855	98.5
Unknown	3	0.3
Subtotal	**868**	
Not answered	42	
Grand Total	**910**	

Table 41. Transfer of the patient to a lower level care earlier than they should have been.

The other way in which shortages of level 3 or 2 beds can be managed is by pushing patients through the system to free up resources. This may be detrimental to patient care. This study identified that 10 (1.2%) patients were stepped down to a lower level of care sooner than was desirable from their clinical condition. It was not possible to quantify the contribution of this early and inappropriate de-escalation of care to the eventual death of these patients.

Case study 18

An elderly patient underwent uneventful coronary artery bypass grafting. The patient had longstanding diabetes and extensive small vessel disease as a result. A baseline creatinine of 167µmol/l was recorded. The patient was extubated a few hours after the completion of surgery and discharged from critical care back to a cardiac surgery ward the next day. During the short stay in critical care it was noted by the anaesthetic registrar and cardiac surgical registrar that the patient was persistently oliguric. Several fluid challenges were given but with no improvement in urine output. Serum creatinine on the day after surgery was 215 µmol/l. It appeared that the patient was discharged to the ward without due consideration to the deteriorating renal function or a plan to manage this.

Over the next 48 hours oliguria persisted. Fluid balance was approximately 6 litres positive. It did not appear that the patient was reviewed by any consultant and was only seen three times by junior doctors (as a result of nursing staff request). There was no further record of biochemistry results in the notes. The patient had a cardiac arrest and died as a result. Probable causes were fluid overload and hyperkalaemia as a result of renal failure.

Clearly this patient was at high risk of renal failure and in the opinion of the advisors was discharged from critical care too quickly. It is not clear from the notes whether this was due to pressure on beds or for other reasons.

Medical supervision in the immediate postoperative period

Tables 42, 43 and 44 show organisational data regarding the level of medical supervision in the immediate postoperative period for individual units.

Sole clinical responsibility	Number of units
Yes	53
No	4
Unknown	1
Total	**58**

Table 42. Sole clinical responsibility in the care of postoperative cardiac surgical patients for the first 24 hours postoperatively.

Specialty of clinician	Number of units
Cardiothoracic surgeon	18
Cardiothoracic surgeon and intensivist	24
Intensivist and anaesthetist	10
Subtotal	**52**
Not answered	1
Total	**53**

Table 43. Specialty of clinician whose sole responsibility is postoperative care.

Grade of clinician	Number of units
Consultant	24
Consultant and SpR	12
Consultant, SpR and Staff Grade	3
Staff Grade	3
SpR	9
Subtotal	**51**
Not answered	2
Total	**53**

Table 44. Grade of clinician whose sole responsibility is postoperative care.

From the data returned to NCEPOD it appeared that most units had a clinician whose sole responsibility was postoperative care and that this was largely a consultant cardiothoracic surgeon alone or in conjunction with anaesthetist/intensivist. All nine units where it was stated that an SpR would be the most senior clinician responsible were NHS units.

The data on medical supervision in the immediate postoperative period were hard to interpret. It may well be that respondents to the questionnaire did not understand that the question was designed to find out if clinicians were immediately available to look after postoperative cardiac surgical patients and had no other competing duties (i.e. busy in theatre operating or anaesthetising subsequent cases). Certainly the advisors' opinion was that it would be unusual to have a consultant cardiothoracic surgeon whose only clinical responsibility was to the care of postoperative level 3 and level 2 patients. It would be more likely that an anaesthetist would be available but in the opinion of the advisors these anaesthetists may well have competing commitments during the day and almost certainly would do so at night (joint responsibility to anaesthesia and covering cardiac ICU).

Postoperative complications

The majority of cases 847/900 (94.1%) were reported by surgeons as having had a postoperative complication, (Table 45 and Figure 41). This high rate of complications is not surprising, as the cases all died. By way of comparison the reported rate of overall complications in the group of matched control patients who survived was 199/537 (37.1%).

In those cases where it was possible for the advisors to make an assessment (722/821) the majority (595/722) of patients were judged to have had their complications managed appropriately. Where the complication was not managed appropriately (127;17.6%) the outcome was judged to have been adversely affected in 95/126 (75.4%); this question was not answered in one case. In 43/814 (5.3%) cases surgeons reported a delay in detecting the complication but anaesthetists only reported a delay in 28/849 (3.3%).

Postoperative complications	Number of patients	%
Yes	847	94.1
No	51	5.7
Unknown	2	0.2
Subtotal	**900**	
Not answered	10	
Total	**910**	

Table 45. Postoperative complications.

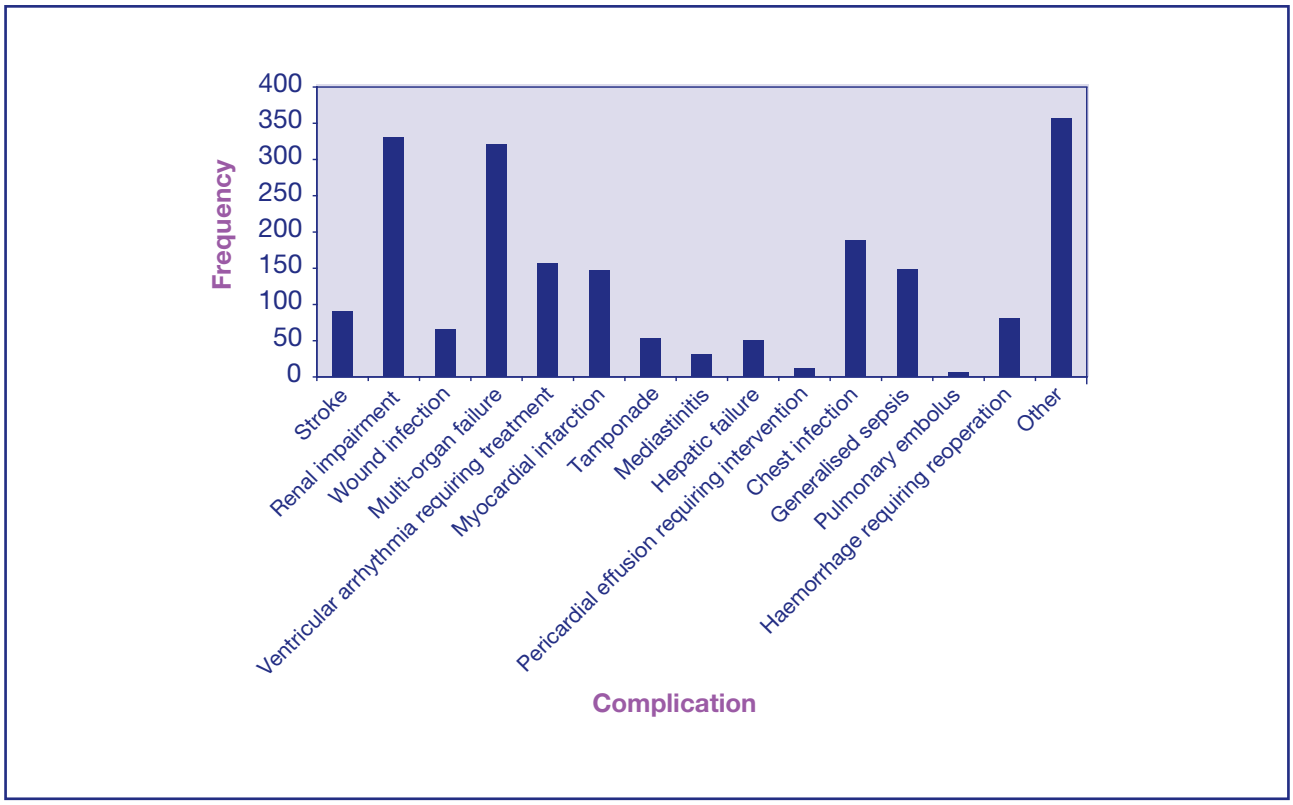

Figure 41. Category and frequency of postoperative complications.

As can be seen, renal impairment and multiple organ failure were the two most common postoperative complications.

Case study 19

An elderly diabetic patient developed ST elevation three hours postoperatively on the cardiac recovery unit. This was not recognised by the team at this stage. The patient suffered a myocardial infarction and subsequently died. A consultant was not involved in the postoperative care.

The recognition and management of intra-abdominal catastrophes (in particular ischaemic bowel) was commented on very frequently by both the advisor and expert groups.

Ischaemic bowel

Within the study there were 54 cases of ischaemic bowel. These are not detailed separately in Figure 41 as this was not a category on the surgical questionnaire (from which Figure 41 is produced). These cases were identified from free text entries and peer review comments of the advisors. Despite being a frequent complication there was concern that the management of patients with suspected or actual ischaemic bowel was poor. Almost every advisor peer review meeting had at least one case where management was commented upon. Case study 20 is an illustrative example of the concerns raised.

Tamponade

There were 53 cases of cardiac tamponade in the study. Again there was frequent advisor comment about the delayed recognition and management of this not infrequent complication after coronary artery bypass surgery. Hypotension and low cardiac output state was often ascribed to poor LV function rather than considering easily reversible problems such as tamponade. The use of echocardiography in the immediate postoperative period, which would allow rapid identification of this problem, was low.

Arrythmias

Not surprisingly there was a high incidence of ventricular arrythmias requiring treatment – 156 cases within the study. Most of these cases were bradyarrythmias requiring the use of pacing wires placed at the time of surgery. There were however a few cases where patients had suffered VT/VF in the postoperative period and were subsequently discharged from critical care to unmonitored beds – despite the recent VT/VF episode and a plan to insert an implantable defibrillator. There was at least one death due to cardiac arrest on the ward in an unmonitored patient in whom a plan was made to insert an implantable defibrillator. This was considered to be an avoidable death in the opinion of the advisors.

Case study 20

An elderly patient underwent elective CABG for multiple vessel coronary artery disease. Pre-operative comorbidities were longstanding diabetes, hyperlipidaemia and hypertension. Left ventricular function was categorised as poor. Surgery appeared uneventful but there were difficulties with poor ventricular function and hypotension immediately after cardiopulmonary bypass. The patient returned to cardiac ICU on several inotropes and with an intra-aortic balloon pump in situ.

The immediate postoperative course was very stormy with persistent hypotension, metabolic acidosis and acute renal failure. Over the next 48 hours abdominal distension and high nasogastric aspirates worsened. Despite the institution of CVVH there was a persistent metabolic acidosis and the lactate rose dramatically. Serum amylase was slightly higher than the upper end of reference range.

A surgical SpR reviewed the patient on the second day and felt that a 'watch and wait' policy was best. A second SpR in surgery reviewed the patient the next day and noted that the abdomen was 'distended but soft and non-tender' – the patient was deeply sedated. Due to continued worsening of haemodynamics and lactic acidosis a further surgical review took place the next day – the surgical consultant felt that the diagnosis was almost certainly ischaemic bowel but that due to the very poor condition of the patient no surgery was indicated and that death was very likely.

The patient continued to deteriorate with worsening multiple organ failure. Supportive care continued over the next 36 hours until the patient had an asystolic cardiac arrest and died.

Post mortem examination confirmed the diagnosis of ischaemic bowel with extensive infarction involving most of the small bowel.

This case highlighted many of the issues when patients develop complications after cardiac surgery:

1. *The management of these patients appears to be lead predominantly by junior staff.*
2. *Referrals to other services are made at junior staff level and reviews tend to be provided by junior staff.*
3. *Where patients are critically ill over many days, the care often appears fragmented with no continuity or clear leadership.*
4. *The recognition of ischaemic bowel is often very delayed. Whilst it is often quoted as a differential diagnosis there does not appear to be a robust plan to confirm or refute the diagnosis and manage the complication early.*
5. *Where patients are clearly dying there appears to be a reluctance to change from supportive care to palliative care and the dying process is often greatly prolonged.*

Tables 46 and 47 show data about detection of complications and adequacy of management.

Delay in recognising complication	Number of patients	%
Yes	43	5.3
No	757	93.0
Unknown	14	1.7
Subtotal	**814**	
Not answered	33	
Total	**847**	

Table 46. Delay in recognising a complication.

In 43 cases (5.3%) it was believed that there was a delay in recognising and managing postoperative complications.

Adequate management	Number of patients	%
Yes	518	87.4
No	66	11.1
Unknown	9	1.5
Subtotal	**593**	
Not answered	254	
Total	**847**	

Table 47. Adequate management of postoperative complications.

In 66 cases (11.1%) it was judged that complications were not managed adequately.

Case study 21

A 65 year old patient underwent elective, first time coronary artery bypass grafting, and made an uncomplicated initial recovery. On the fourth postoperative day they developed abdominal pain and a plain x-ray of the abdomen revealed free air under the diaphragm. The cardiac surgical registrar who had reviewed the patient referred the patient to the general surgeon on call who made arrangements to take the patient to theatre for a laparotomy. The general surgeon reviewing the patient and performing the surgery was a registrar as was the anaesthetist for the case. It appeared that there was no consultant involvement from cardiac surgery, general surgery or anaesthesia.

At laparotomy it was found that the patient had perforated diverticular disease of the sigmoid colon and extensive faecal peritonitis. Following surgery the patient was transferred to the cardiac ICU for postoperative care. The patient developed septic shock and multi-organ failure and died after 18 days in cardiac ICU. During this prolonged period of critical care there did not appear to be continuity of care at consultant level, there were obvious disagreements about day to day management issues between anaesthetic and cardiac surgical staff and it appeared that ward rounds were conducted once per day at most (and less frequently at weekends).

The standard of care was commented on by advisors and found to be 'very fragmented' and 'well below the standard expected'. In addition it was felt that the role of cardiac ICU was to provide a recovery area for the vast majority of patients who make rapid and uncomplicated postoperative progress and it was not set up to provide the higher level of care that a critically ill patient with multi-organ failure required.

It appeared that the cardiac ICU was not sufficient to meet the needs of such a critically ill patient.

It was difficult to ascribe some complications to pre-operative or postoperative phases due to the nature of the event. Table 48 shows data on whether any pre- or postoperative complications were managed adequately as judged by the advisors.

Adequate management	Number of patients	%
Yes	595	73.4
No	127	15.6
Unknown	89	11.0
Subtotal	**811**	
Not answered	10	
Total	**821**	

Table 48. Adequate management of pre-operative or postoperative complications.

It was believed that 127 patients did not have adequate management of complications. Of these 127 patients it was judged that inadequate management may have contributed to an adverse outcome in 95 cases.

The vast majority of patients who undergo coronary artery bypass grafting do well. They have a short stay in a recovery facility/critical care area and are rapidly extubated and follow a care pathway that sees them returned to a cardiothoracic ward shortly after. The pathway of care for these uncomplicated patients is well understood and functions well. However, a small minority of patients develop complications and become much more challenging. This small group of patients consume considerable resources (in terms of bed days) within cardiac critical care units. Furthermore, these units are primarily focused on the vast majority of patients who recover in a predictable fashion. Within this study it has been found that there were problems in managing complications in a timely fashion. There were also comments about the interface between general critical care units and cardiac critical care units. The role of general and cardiac critical care units must be considered.

Critical incidents

A critical incident was defined for the purpose of this study as: "Any incident or event which has caused or could have caused an adverse outcome for the patient"[1]. Surgeons reported 249/895 (27.8%) cases having suffered a critical incident, whereas anaesthetists reported 230/910 (25.3%) of cases as having suffered a critical incident. As noted previously anaesthetists were more likely to report critical incidents as having occurred where the case was undertaken out of hours, but overall there was little difference between the reporting of critical incident between surgeons and anaesthetists.

Whilst there was no difference in the rate of critical incidents for different categories of operation reported by surgeons, anaesthetists indicated a much higher percentage of salvage cases suffered from critical incidents, when compared with elective cases (Figure 42).

Critical incidents were more likely to occur where there was no clear operative plan, and although reported overall more frequently by anaesthetists, there was also a small increase in the number of incidents reported by surgeons when no operative plan was available (Figure 43).

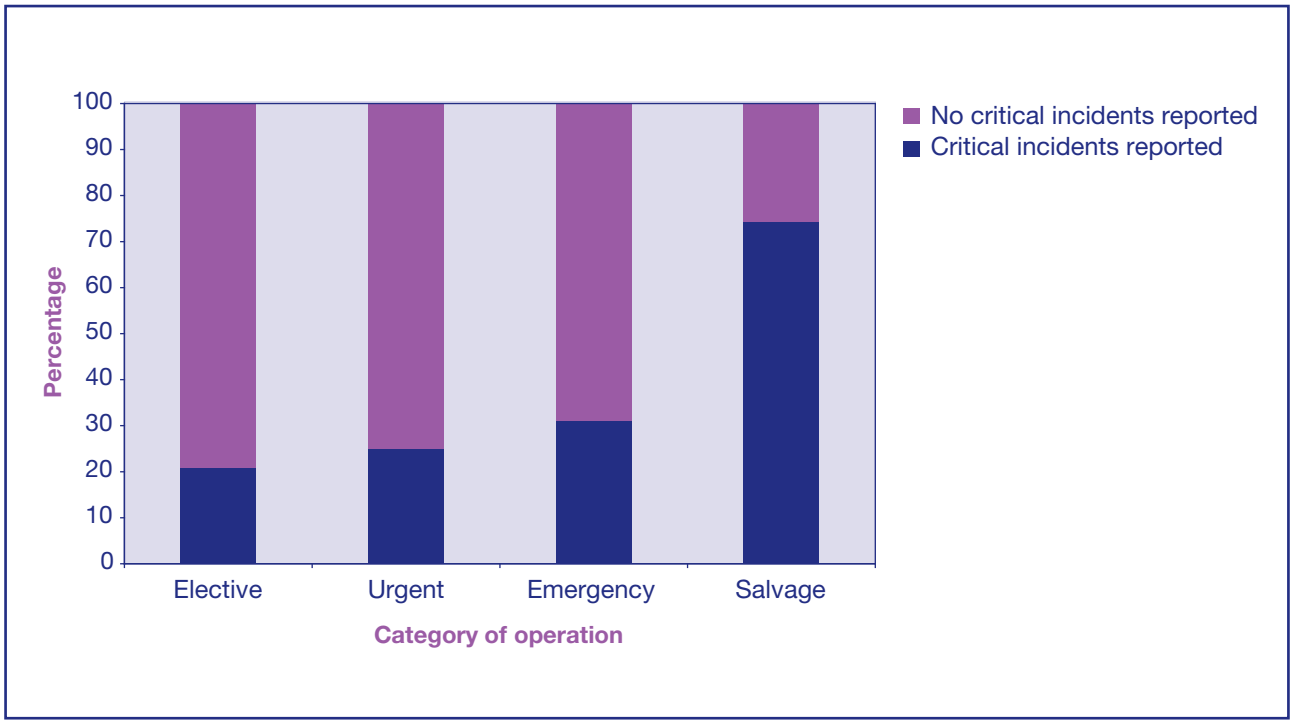

Figure 42. Critical incidents reported by anaesthetists compared to category of operation.

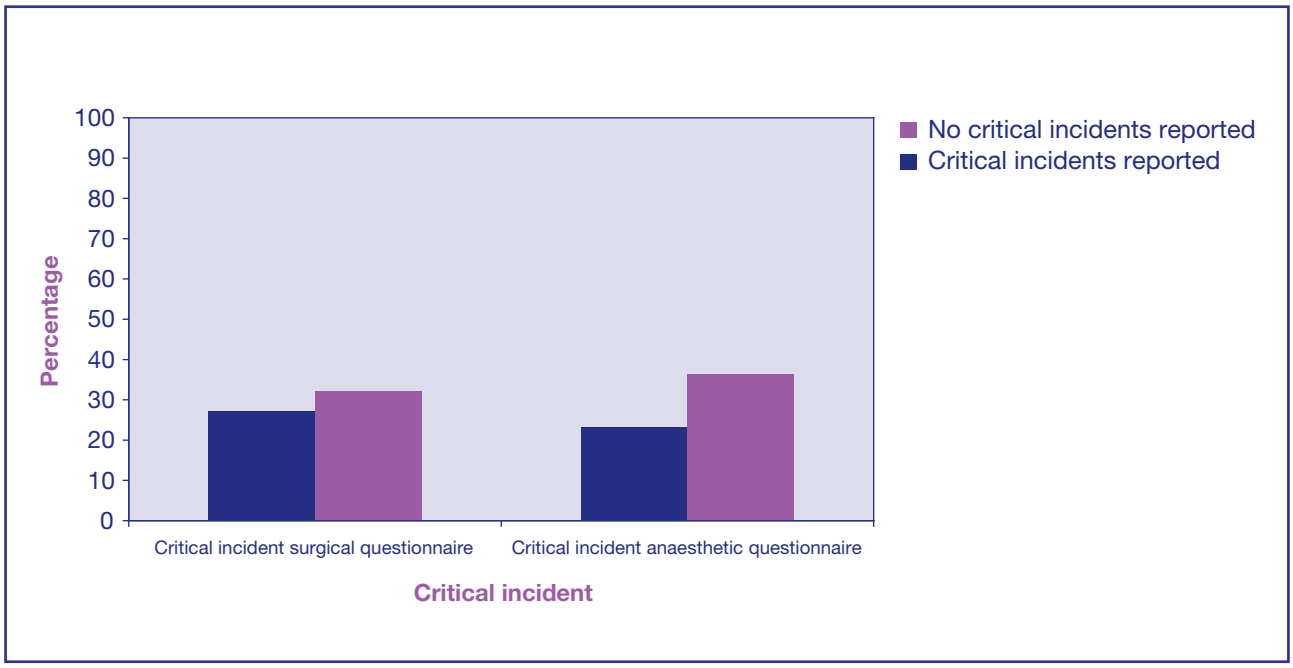

Figure 43. Critical incidents reported in the surgical and anaesthetic questionnaire and the availability of an operative plan.

Key findings

- The majority of patients underwent elective or urgent operations.
- All patients received an appropriate level of care immediately postoperatively.
- A small number of patients were transferred to a lower level of care sooner than their clinical condition dictated (10 cases).
- There was a high incidence of postoperative complications (94%).
- There was delay in detecting complications in 5% of cases.
- Pre- and postoperative complications were felt to be inadequately managed in 127/811 cases.
- Of these 127 cases it was felt that inadequate management of the complications may have led to death in 95 patients.
- Advisors raised concern over the role of cardiac ICU and general ICU in the management of patients with a complicated postoperative course.
- Critical incidents were more frequently observed in the absence of a clear written operative plan.

Recommendations

Patients who have a more complicated postoperative period are difficult to manage. Any interaction between different medical specialities about patient management should be at consultant-to-consultant level, in particular for patients with suspected intra-abdominal pathology (Consultants).

Cardiac recovery areas/critical care units are best suited to managing the majority of patients who recover uneventfully. Patients who are developing critical illness and additional organ failure should be managed in an environment with sufficient throughput of such patients to have the resources and experience to provide optimum outcomes (General Critical Care Units).

Cardiac critical care units should have the facility to provide renal replacement therapy (Cardiac Critical Care Units).

Senior clinicians should be readily available throughout the peri-operative period in order to ensure that complications (which occur commonly) are recognised without delay and managed appropriately (Clinical Directors and Consultants).

References

1 CRIME-base. (2008) *Critical incident management in emergency medicine database) Brighton.* Retieved from World Wide Web 12th March 2008. *www.eee.bham.ac.uk/crime*

14. Appropriateness of surgery

Study question

"Was the operation performed appropriate for the patient and the circumstances?" The consensus process identified the appropriateness of surgery as the fifth highest priority in this study.

Results

Overall, advisors assessed the operation as having been appropriate in 687/815 (84.3%) of cases, not appropriate in 66/815 (8.1%) and could not be assessed in a further 62/815 (7.6%).

A clear written operative treatment plan was available in 759/909 (83.4%) and this plan was followed in 696/736 (94.6%) of cases; no answer was given in the remaining 23 cases as to whether the plan was followed. In those cases where records permitted the advisors to make an assessment, 529/636 (83.2%) of patients with a clear operative plan also had a written or pictorial record indicating the extent of the coronary artery disease. The availability of a record of the extent of the disease was to 75/104 (72.1%), in those cases without a written operative plan.

As previously mentioned, critical incidents were observed more frequently when a clear written operative plan was not available.

Seniority of clinicians

It was rare (<3%) for a consultant anaesthetist not to be present at the start of the operation, whether the operation was performed in or out of hours, or whether the list was scheduled or not.

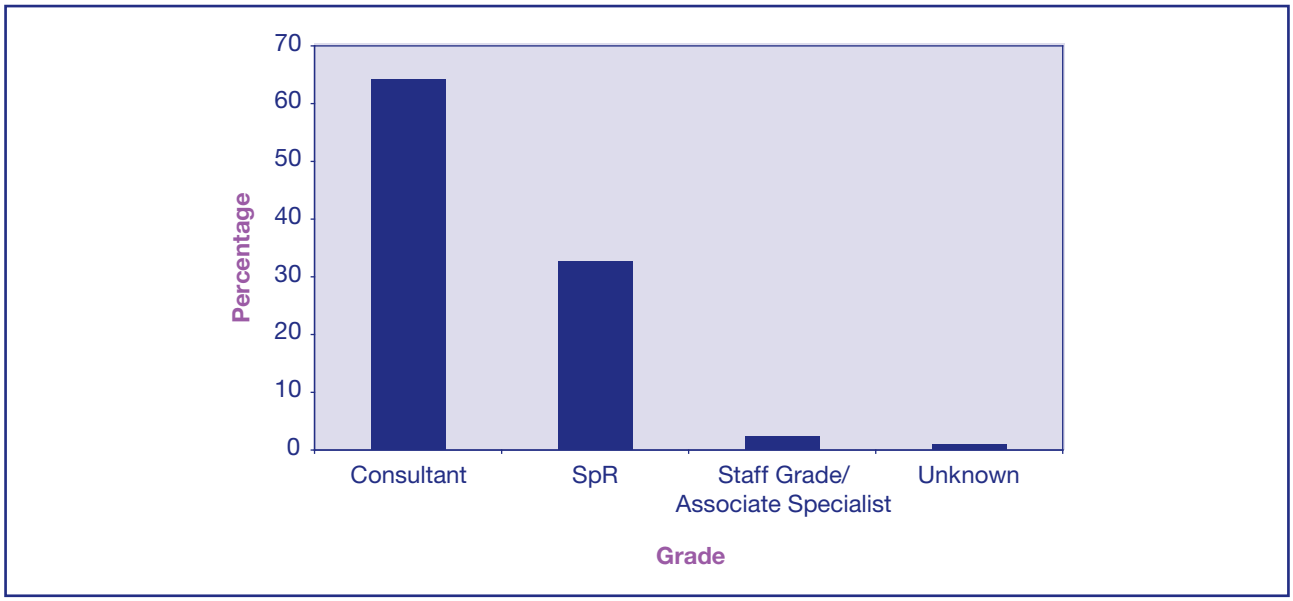

Figure 44. Grade of most senior surgeon present at start of procedure.

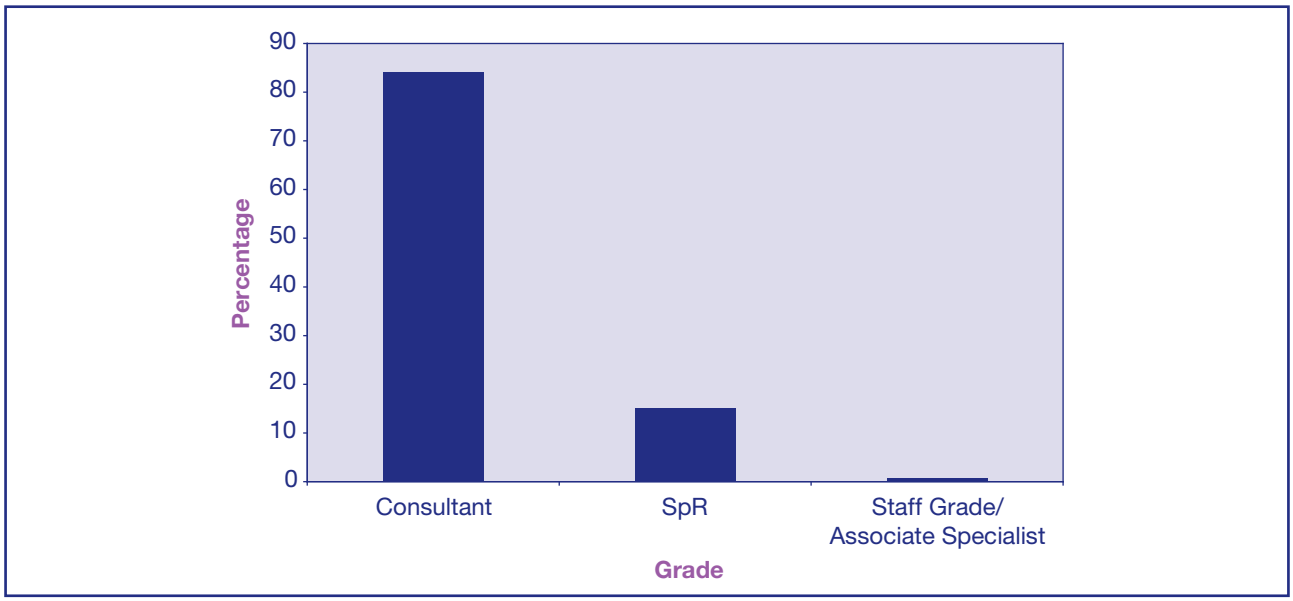

Figure 45. Grade of surgeon performing the anastomoses.

Overall consultant surgeons were present at the commencement of surgery in 581/905 (64.2%) of cases, and SpRs were the most senior surgeons present in 295/905 (32.6%) (Figure 44).

However consultant surgeons were more likely to perform the anastomoses, 759/901 (84.2%), with 135 (15%) being performed by SpRs (Figure 45).

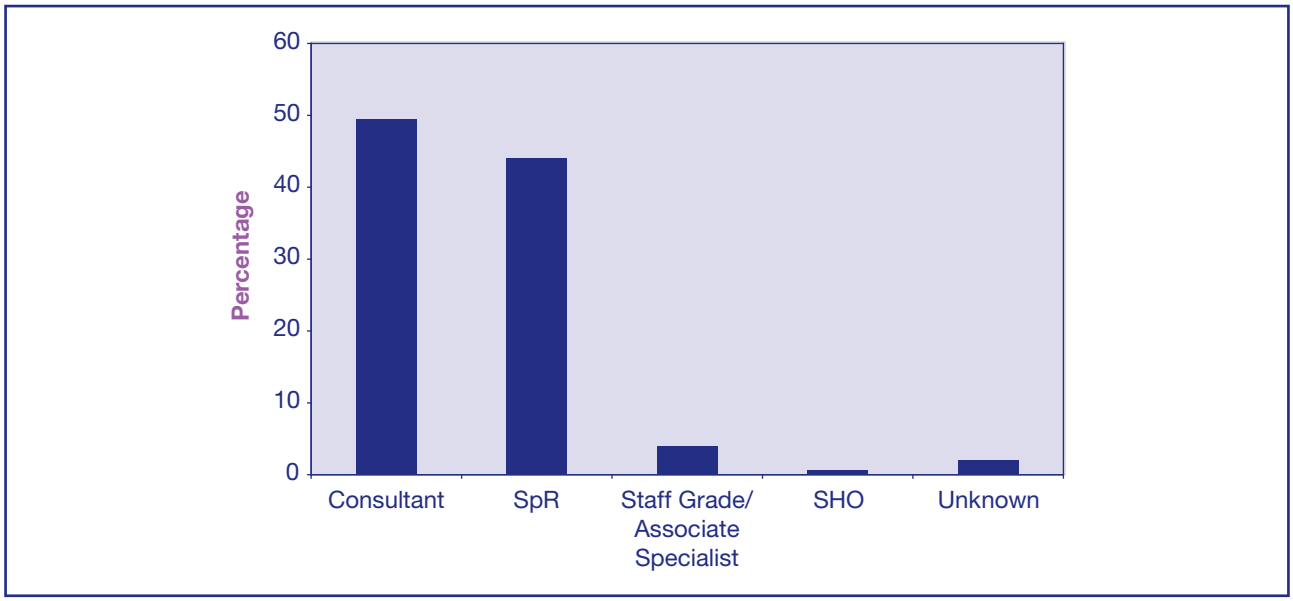

Figure 46. Grade of surgeon closing the chest

When performed out of hours, whether scheduled or not, a consultant nearly always performed the operation.

Specialist registrars were much more likely to close the chest than perform the anastomosis (395/897 (44%)) (Figure 46).

Recurring themes identified by advisors

The following themes were identified by advisors when reviewing the operative records:

- **Failure to adapt technique to pre-operative or intra-operative findings, for example off-pump cases not converted to on-pump in the face of deterioration**
- **Advisors were of the opinion that surgeons were, in a small number of cases, avoiding undertaking high risk procedures because of fears about the effect of their position in league tables**
- **Elderly patients receiving multiple arterial revascularisations rather than venous grafting**
- **Failure to accept need for palliation rather than "heroic" surgery.**

Case study 22

An elderly patient with IHD and poor LV function underwent off-pump CABG. It proved not possible to revascularise all the diseased coronary arteries at operation. The patient died in the immediate postoperative period of a VF arrest. This patient had incomplete revascularisation which may have increased their risk of a postoperative cardiac event.

Should this patient have been converted to "on-pump" before the coronary arteries were deemed to be "ungraftable"?

Case study 23

A middle-aged patient was operated upon by an unsupervised SpR 2. Whilst taking down the internal mammary artery the patient arrested. There was a delay in getting the patient on bypass because the pericardium had not been opened. The patient developed persistent vegetative state until ultimately dying.

Should an SpR 2 be operating without supervision from an immediately available consultant?

Key findings

- Overall 84% of cases received an appropriate operation.
- A clear written operative plan was available in 83% of cases.
- Consultant anaesthetists were involved in most (97%) cases.
- When operating out of hours nearly all procedures were performed by a consultant surgeon.

Recommendations

A clear written operative plan should be available. This should include contingency arrangements where the findings at surgery dictate an alternative approach (back planning) (Clinical Directors and Consultant Cardiothoracic Surgeons).

Where unexpected events occur during surgery, surgeons should have an adaptable approach, and modify the operation to suit the circumstances of the case (Cardiothoracic Surgeons).

A clear description of the extent of the disease should be recorded (Cardiothoracic Surgeons).

Where an operation performed deviates from the operation planned, the reason for this should be clearly documented (Cardiothoracic Surgeons).

15. Communication, continuity of care and consent

Study question

"Is continuity of care and communication a factor that affects outcome?" Communication and continuity of care were ranked twelfth of thirteen by the expert group.

Modern day management of hospital inpatients involves many more doctors, nurses and allied health professions than in the past. There are many reasons for this: for example a reduction in doctors' working hours, weakening of the traditional 'medical team', increasing shift working patterns, hospital at night programmes, use of more specialist wards and consequent transfer in and out of patients and movement of inpatients due to bed capacity reasons. One major consequence of this change is the importance of communication between health care providers and accurate handover of important clinical information. Each time a new health care provider or a new clinical area is involved there is an opportunity for important information about the patient to be lost or miscommunicated. This also applies to communication between different hospital sites as the care of patients with coronary artery disease often occurs in different hospital sites within a cardiac network.

This chapter also looks at consent issues. Much is written about consent, informed consent, patient information and patient choice[1, 2]. Provision of accurate information about proposed treatment, including any alternatives, and the risks of this treatment is essential. In reality this can only be provided by suitably experienced staff who fully comprehend the detail of the proposed treatment. Furthermore, the doctor who will perform the intervention should obtain consent. The increasing expectation from the public is that this will be a consultant and not a doctor in training.

Results

Protocols for handover between clinical teams

Change of clinical teams, due to shift changes or change of physical location of the patient, is a well-recognised opportunity for information dropout or miscommunication. This is well recognised in the Hospital at Night programme[3] which emphasises the importance of structured handover. Table 49 shows whether protocols existed in cardiothoracic units for handover between clinical teams.

Handover protocol between clinical teams	Number of units
Yes	16
No	38
Unknown	3
Subtotal	**57**
Not answered	1
Total	**58**

Table 49. Protocol for handover between clinical teams.

Only 16 units had a protocol for handover between clinical teams. There were some differences between the independent hospitals and NHS hospitals in this respect; seven out of 20 independent hospitals had such a protocol compared to nine out of 38 NHS hospitals (37% v 24% respectively). There was also some change over the three year study period with 37% of units having a protocol in year 3 (compared to 28% in year 1).

Structured handover between clinical areas

Patients undergoing coronary artery bypass grafting follow a well described clinical course. This usually involves discharge from operating theatre to a recovery or critical care unit followed by discharge from recovery/critical care area to a lower dependency ward. Each of these steps requires handover of a significant amount of complex information. Tables 50 and 51 show whether standard documentation existed to ensure good communication during these periods of transfer.

Theatre to recovery handover document	Number of units
Yes	38
No	18
Unknown	2
Total	**58**

Table 50. Availability of a standard handover document from theatre to recovery/critical care.

Thirty eight out of 58 units had standard documentation to make handover from theatre to recovery/critical care as robust as possible. There were differences between the independent sector and NHS units; 15 out of 20 independent hospitals had standard documentation to cover this transfer compared with 23 out of 38 NHS hospitals (75% v 60.5%). There was a change between year 1 and year 3 of the study with standard handover documentation existing in 83% of units in year 3 compared to 65.5% in year 1.

Recovery to ward handover document	Number of units
Yes	45
No	13
Total	**58**

Table 51. Availability of a standard handover document from recovery/critical care to ward.

Forty five out of 58 units had standard documentation to make handover from recovery/critical care to the ward as robust as possible. There was little difference between the independent sector and NHS units; 16 out of 20 independent hospitals had standard documentation to cover this transfer compared to 29 out of 38 NHS hospitals (80% v 76%). There was a change between year 1 and year 3 of the study with an increase in handover documentation (87.2% of units in year 3 compared to 77.6% in year 1).

Structured handover documentation can reduce information loss and it is disappointing to see that this is not universally used (Tables 50 and 51). It is not clear why the independent sector appears to utilise this to a greater extent than the NHS.

Structured information for patients

Information sheets designed to provide standard information for patients about aspects of coronary artery bypass grafting are useful to start the process of informed consent. Retention of verbal information is known to be poor and the use of a written document allows the patient to refer back to this information. It does not replace the need for a full discussion with the individual patient by a senior cardiothoracic surgeon[4], Table 52 shows data on the use of patient information sheets.

Written information sheet available	Number of units
Yes	50
No	7
Subtotal	**57**
Not answered	1
Total	**58**

Table 52. Availability of a written information sheet about coronary artery bypass grafting for patients.

Fifty out of 58 units provided written information sheets describing coronary artery bypass grafting to patients. Eighteen out of 20 independent hospitals used written information sheets compared to 32 out of 38 NHS hospitals (90% v 86.5%). The use of patient information sheets remained static between year 1 and year 3 (year 1 87.7% v year 3 89.4%).

It was notable that one in ten cardiothoracic units and not provide written information on a routine basis despite this being a recommendation of the Parliamentary and Health Service Ombudsman[4].

Consent

Guidance is available on the process of obtaining consent[1, 2]. This details how consent should be obtained, who should obtain consent and in conjunction with Good Medical Practice[5] provides a clear framework for doctors to follow.

Complications

Table 53 shows if potential complications were documented on the consent form that the patient signed.

Complications noted	Number of patients	%
Yes	588	91.4
No	55	8.6
Subtotal	**643**	
Form not sent	178	
Total	**821**	

Table 53. Notification of any possible complications on the consent form.

Potential complications were noted on 588 consent forms. However, 178 patients had no consent forms returned to NCEPOD. There were no potential complications recorded on 55 consent forms.

The population in this study is skewed by the fact that all patients died. Some of these deaths were unexpected and unforeseen; but many of the patients could clearly be identified as high-risk candidates. Given this fact it is poor that at least 55 cases (8.6%) had no mention of complications on the consent form. In addition, it was rare for any complications that were noted on the consent form to be accompanied by an incidence. This does not fit with the procedure of informed consent or guidance produced for consent in cardiac surgery[4].

Risk of death

Risk of death from the consent form was only available in 298 of 643 cases (46.3%).

No consent form was returned in 178 of 821 cases (21.7%). There was no risk of death documented in 345 of 643 cases (53.7%).

The medical notes were examined to look for documentation of risk of death if no consent form was returned or the consent form did not document a risk of death. Where a consent form was not sent in, or a risk of death was not given on the consent form, the notes were examined for a risk of death. Of the casenotes examined to look for documentation of risk of death, it could only be found in 139 out of 523 sets (26.6%). In total a risk of death could only be found in 437 of 821 cases (53.2%).

Grade of clinician obtaining consent

The GMC provides guidance on who should obtain consent[1]. This states that:

"If you are the doctor providing treatment or undertaking an investigation, it is your responsibility to discuss it with the patient and obtain consent, as you will have a comprehensive understanding of the procedure or treatment, how it is carried out, and the risks attached to it.

Where this is not practicable, you may delegate these tasks provided you ensure that the person to whom you delegate:

is suitably trained and qualified;

has sufficient knowledge of the proposed investigation or treatment, and understands the risks involved;

acts in accordance with the GMC guidance."

Table 54 shows data on the grade of clinician obtaining consent for coronary artery bypass surgery.

Grade of clinician	Number of patients	%
Consultant	120	18.7
NCCG	30	4.7
SpR	246	38.3
SHO	201	31.3
Other	5	<1
Unknown	41	6.4
Subtotal	**643**	
Consent form not returned	178	
Total	**821**	

Table 54. Grade of clinician obtaining consent.

One hundred and seventy eight consent forms were not returned and were therefore not available to contribute to this question. In 41 cases it was not possible to ascertain the grade of clinician as no record of grade was made. Consultants obtained consent in 120 cases (18.7%).

Grade of clinician obtaining consent and risk of death given to the patient

Table 55 shows the grade of clinician obtaining consent and whether a risk of death was documented as part of the consent process.

Grade of clinician	Risk of death stated		
	Number of patients	n=	%
Consultant	84	120	70
SpR	155	246	63
Clinical Fellow	10	18	55.6
Staff Grade	4	10	40
Associate Specialist	2	2	100
SHO	36	201	17.9
PRHO	1	2	50
Specialist Nurse	0	1	0
Other	0	2	0
Unknown	9	41	22

Table 55. Grade of clinician obtaining consent and whether a risk of death was documented.

Consultants obtained consent in 120 cases. Of these 120 cases 84 (70%) had a risk of death documented. SHOs obtained consent in 201 cases. Of these 201 cases 36 (17.9%) had a risk of death documented.

Greater than two thirds of patients were consented by SHOs and SpRs (SHOs 31.3%, SpRs 38.3%). Consultants consented less than one in five patients. This does not appear to satisfy the requirements of the GMC on the consenting process[1]. Furthermore, there is a clear association between seniority of clinician obtaining consent and a risk of death being quoted on the consent form to the patient (Table 60). Consultants provided a risk of death in 70% of cases that they consented whereas SHOs only provided a risk of death in 17.9% of cases they consented. This may be related to discomfort of junior staff discussing death with patients or may reflect the fact that they simply do not know the risks. Either way this does not comply with the consent process published by the GMC or the guidance produced by the Parliamentary and Health Service Ombudsman. Urgent attention is required in the area of information sharing, description of risks, estimation of risk of death and consultant involvement in the consent process for patients undergoing coronary artery surgery.

Team working and stability

A qualitative assessment of team working and function was obtained by asking the cardiothoracic surgeon and anaesthetist who filled in the questionnaires the following:

1. Did you feel there was stability within the theatre team for this case?

2. Did you feel at ease with the theatre team for this case?

Tables 56 and 57 give the surgical and anaesthetic responses to question 1 above. Tables 58 and 59 give the surgical and anaesthetic responses to question 2 above.

Was there stability within the theatre team for this case?

Was there stability?	Number of patients	%
Yes	878	96.9
No	8	0.9
Unknown	20	2.2
Subtotal	**906**	
Not answered	4	
Total	**910**	

Table 56. Surgical response.

Was there stability?	Number of patients	%
Yes	891	97.3
No	14	1.5
Unknown	11	1.2
Subtotal	**916**	
Not answered	6	
Total	**922**	

Table 57. Anaesthetic response.

Did you feel at ease within the theatre team for this case?

Ease within the theatre team	Number of patients	%
Yes	865	96.2
No	13	1.4
Unknown	21	2.3
Subtotal	**899**	
Not answered	11	
Total	**910**	

Table 58. Surgical response.

Ease within the theatre team	Number of patients	%
Yes	876	95.5
No	28	3.1
Unknown	13	1.4
Subtotal	**917**	
Not answered	5	
Total	**922**	

Table 59. Anaesthetic response.

The vast majority of anaesthetists and surgeons who completed this question believed that team working and function was acceptable.

Key findings

- Only 16 out of 58 cardiothoracic units had a protocol for handover between clinical teams.
- 18 out of 58 cardiothoracic units had no standard handover documentation from theatre to recovery/ critical care.
- 13 out of 58 cardiothoracic units had no standard handover documentation from recover/critical care to the ward.
- Independent sector hospitals had more protocols for handover between clinical teams and standard handover documents from theatre to recovery/critical care and from recovery/critical care to the ward than NHS hospitals.
- 7 out of 57 units did not provide written information sheets about coronary artery bypass grafting to patients.
- The consenting process for patients undergoing coronary artery bypass grafting is poor. Consultant involvement in the consent process was low, almost one third of patients were consented by SHOs and no risk of death could be found in 384 cases (47%).

Recommendations

Protocols must exist for handover between clinical teams and patient locations to ensure effective communication and continuity of care (Clinical Directors).

All patients should receive an information sheet describing the proposed operation (Consultant Cardiothoracic Surgeons).

A consultant should obtain consent for coronary artery bypass grafting (Consultant Cardiothoracic Surgeons).

Potential complications must be recorded on the consent form. This should detail the likely complications and the incidence of these complications based on local data (Clinical Directors and Consultant Cardiothoracic Surgeons).

An accurate risk of death must be quoted on the consent form. This should take into account the proposed procedure and clinical status of the patient (Clinical Directors and Consultant Cardiothoracic Surgeons).

References

1 General Medical Council. (1998). *Seeking Patients' consent: the ethical considerations.* GMC, London.

2 Department of Health. (2001). *Reference guide to consent for examination or treatement.* Crown Copyright.

3 NHS Healthcare Workforce. *Working Time Directive 2009; Hospital at night.* Retrieved from World Wide Web 12th March 2008. *http://www.healthcareworkforce.nhs.uk/wtdcasestudies.html*

4 The Society for Cardiothoracic Surgery in Great Britain and Ireland & the Parliamentary and Health Service Ombudsman. (2005). *Consent in Cardiac Surgery. A good practice guide to agreeing and recording consent.* Parliamentary and Health Service Ombudsmen.

5 General Medical Council (2006). *Good Medical practice.* General Medical Council.

16. Multidisciplinary review and audit

Study question

"To what extent do institutional approaches to retrospective multidisciplinary case review and audit vary?" Multidisciplinary review and audit was identified by the consensus exercise as an important area of study and was ranked second in the consensus exercise.

All healthcare professionals are expected to participate in a clinical governance process which includes clinical audit. Clinical audit has been defined as the systematic assessment and improvement of the quality of care. Participation in clinical audit is recognised by the General Medical Council and other professional bodies as an integral part of good practice[1].

The collection of clinical data on patients in whom coronary artery bypass graft surgery has been performed and central pooling of these data has been discussed in the first year of this NCEPOD study[2]. In this final year report, attention was directed to multidisciplinary review through morbidity and mortality audit meetings. Furthermore, information was collected on how findings from these meeting are disseminated through the rest of the organisation to improve patient care as part of the hospital's clinical governance system.

Specific questions were asked in the organisational and surgical questionnaires regarding the arrangements in place for morbidity and mortality multidisciplinary review for each cardiothoracic unit and for the patients included in the study. In reviewing these data one should be reminded of the select nature of the patient sample.

Morbidity and mortality meetings

NCEPOD has recommended over many years the adoption of multidisciplinary morbidity and mortality meetings as part of standard practice in the NHS. "It is a professional responsibility to examine one's practice and seek ways to improve surgical and anaesthetic management. Clinicians must strive to achieve an audit record for all deaths if professional education, credibility and public support are to be maintained"[3].

Of the 58 cardiothoracic units 43 stated that they held regular morbidity and mortality meetings. The percentage of units that held these meetings was the same in the first and third years of the study. The reason why units did not hold regular meetings was further explored. These included:

- **Insufficient time in week**
- **No audit lead**
- **Numbers too small**
- **Hospital in provisional liquidation**

Of units who did not hold morbidity/mortality meetings on a regular basis, 14 were independent and one NHS.

Thirty eight of the 43 units held meetings at least monthly with two units holding these meetings quarterly while two units did not answer this question. The majority of morbidity and mortality meetings were reported to be multidisciplinary, with only three units reporting either single or dual speciality involvement.

Most cardiothoracic units held regular morbidity and mortality audit meetings. However, those units that do not hold such meetings because of the small numbers of coronary artery bypass grafting operations performed should re-examine their procedures to ensure that these cases can be reviewed in an appropriate multidisciplinary arena within their hospital.

From the organisational questionnaire NCEPOD enquired as to whether cardiothoracic units graded the quality of care for each patient. Only 7/43 units undertook this exercise. There was no change in this percentage between year 1 and year 3 of the study. Of the units that did grade the quality of care the methods used included:

- **Peer review with risk stratification using the Parsonnet grading system[4]**
- **Expected, unexpected or avoidable deaths**
- **Modified Bristol scale:**
  - 4, reasonable care
  - 3, different management would have made no difference to outcome
  - 2, different management would have probably not have led to a different outcome
  - 1, different care might have reasonably have led to a different outcome
- **General discussion only**

Grading of quality of care of patients is a valuable exercise that not only encourages reflection by healthcare professionals on individual cases but can provide a useful yardstick of care of patients within service units and hospitals. Using peer review amongst healthcare professionals at multidisciplinary morbidity and mortality audit meetings provides the ideal environment to undertake this grading. Thus it is notable that relatively few units employed these methods. NCEPOD uses a standard scale to grade quality of care (Figure 47) and would encourage Trusts to adopt this scale along with the NCEPOD category of surgery (Figure 48).

Good practice – a standard that you would accept for yourself, your trainees and your institution.

Room for improvement – aspects of **clinical** care that could have been better.

Room for improvement – aspects of **organisational** care that could have been better.

Room for improvement – aspects of both **clinical and organisational** care that could have been better.

Less than satisfactory – several aspects of **clinical and/or organisational** care that were well below satisfactory.

Insufficient information submitted to assess the quality of care.

Figure 47. Assessment of care.

IMMEDIATE – Immediate life, limb or organ-saving intervention – resuscitation simultaneous with intervention. Normally within minutes of decision to operate.
A) Life-saving
B) Other e.g. limb or organ saving.

URGENT – Intervention for acute onset or clinical deterioration of potentially life-threatening conditions, for those conditions that may threaten the survival of limb or organ, for fixation of many fractures and for relief of pain or other distressing symptoms. Normally within hours of decision to operate.

EXPEDITED – Patient requiring early treatment where the condition is not an immediate threat to life, limb or organ survival. Normally within days of decision to operate.

ELECTIVE – Intervention planned or booked in advance of routine admission to hospital. Timing to suit patient, hospital and staff.

http://www.ncepod.org.uk/pdf/NCEPODClassification.pdf (2004)

Figure 48. NCEPOD category of surgery.

NCEPOD also gathered information on the method used by cardiothoracic units for feeding back information from audit morbidity and mortality meetings (Table 60).

Methods used to feedback audit information	Number of units
No formal mechanism	5
Discussion at Morbidity & Mortality meeting only	11
Written / e mail report to all relevant staff	14
Reports sent to Clinical Governance Committee / Director	5
Other	6
Unknown	2
Total	**43**

Table 60. Methods used to feedback information from audit morbidity and mortality meetings.

These data indicated that 25 units had some form of feedback mechanism to inform staff of findings from audit meetings. However, most units did not appear to have a formal mechanism in place to disseminate beyond those attending these meetings. All cardiothoracic units should keep written records of audit meetings with action points which can be used to aid the communication of lessons learnt.

The mechanism used by hospitals to report and manage critical incidents needs to be robust and follow standard procedures. NCEPOD requested information on the methods that were used to report and manage critical incidents. All but one unit described the methods used, examples included:

- **Written reporting systems**
- **Computerised systems**
- **Review by risk management team**
- **Use of root cause analysis**
- **Regular reports sent to relevant team members**
- **Feedback reviewed at audit meetings**

Most cardiothoracic units had appropriate systems in place to report and manage critical incidents.

From the surgical questionnaire the number of patients that were reviewed in morbidity and mortality audit meetings was determined. Of the 907 patients who died following first time CABG surgery 822 (90.6%) were reviewed at such meetings; in 3 cases this question was not answered. Of the remaining 70 that were not reviewed surgeons completing the questionnaire reported that a further 35 would be reviewed in a morbidity and mortality audit meeting in the future. It was unknown in 16 cases whether the patient was reviewed.

Somewhat incongruously, 60 patients who were reviewed in a morbidity and mortality audit meeting came from cardiothoracic units where according to the organisational questionnaire regular audit meetings were not held. The reason for this discrepancy is unclear. NCEPOD investigated whether, in these patients, the cardiothoracic units had instigated morbidity and mortality audit meeting in the third year of the study but found that this was not to be the case. An alternative hypothesis is that these meetings are only held when a patient dies. However, there was lack of clarity between surgeons who completed the clinical questionnaires and those individuals who completed the organisational questionnaires many of whom were the cardiothoracic audit leads.

From the anaesthetic questionnaire, NCEPOD found that in 396/910 (43.5%) of patients the anaesthetists for these cases were involved in multidisciplinary team audit review following surgery. As anaesthetists are involved with most aspects of peri-operative care including intensive care, the anaesthetic contribution to these meetings could be of considerable value.

NCEPOD requested documentation related to morbidity and mortality meetings, such as records of attendance and minutes of meetings. Of the 58 cardiothoracic units that participated in the study 16 units returned this documentation (eight records of attendance only and eight minutes). While the majority of these documents were well structured and provided a good record of the meeting a proportion were difficult to interpret and illegible. The advisors also commented that it was frequently impossible to determine from individual casenotes whether cases had been discussed in morbidity and mortality audit meetings.

Autopsies

From the surgical questionnaire, the number of autopsies performed was established; 798/910 (87.7%) of patients were referred to the coroner. Of the 910 patients where a surgical questionnaire was returned, an autopsy was performed in 369 (40.5%) cases. Of these, 314 were coronial while 55 were hospital autopsies. In 326 cases the surgeon stated that they reviewed the autopsy report. Of those that were not referred (80) 61 died within 30 days of surgery. It is unclear why these patients were not referred to the coroner. One would expect that deaths within a few days of surgery are more likely to be referred to the coroner than those that occurred more distant to surgery. In 32 cases it was unknown whether a referral had been made. Figure 49 shows the time of death following surgery. The median time to death following surgery was six days.

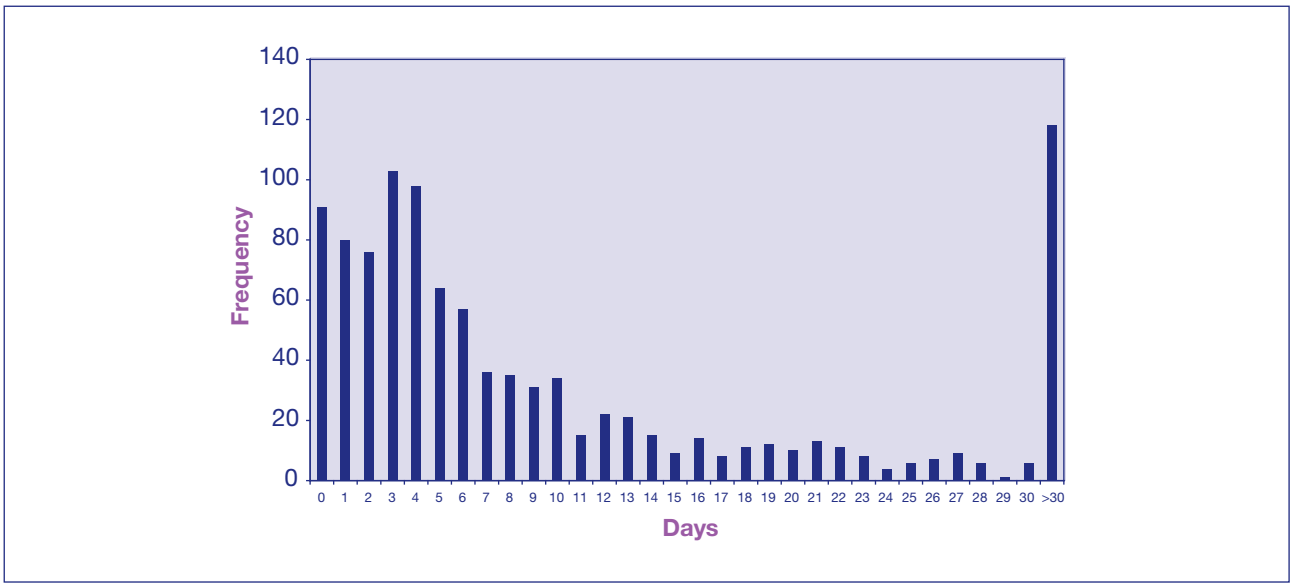

Figure 49. Time of death following surgery (days).

Year*	Referred to coroner	Referred to coroner		Not referred to coroner	Total number of autopsies	Total deaths*	Percentage
		Coronial Autopsy	**Hospital Autopsy**	**Hospital Autopsy**			
1	320	141	27	4	172	373	46.1
2	250	100	7	3	110	284	38.7
3	228	73	14	0	87	253	34.4
Total	**798**	**314**	**48**	**7**	**369**	**910**	**-**

*Where surgical questionnaire returned.

Table 61. Number of cases referred to the coroner and number of autopsies performed over the three years of the study.

In year 1 of the study 2004-05, the overall autopsy rate of 46.1% was higher than that reported in the NCEPOD report[5] "Functioning as a team?" where the autopsy rate was 41% from a sample of all deaths following surgery.

However, in the subsequent years of the study these rates were below this figure. Furthermore, over the three years of the study, the number of autopsies performed in real terms and as a percentage of deaths decreased year on year (Table 61). This amounted to an 11.7% decrease in autopsy rate from year 1 to year 3 of the study.

Moreover, the number of coronial autopsies as a percentage of referral to the coroner also decreased 44%, 40% and 32% respectively for each year of the study. This is a disturbing trend. The value of autopsies in patients who have undergone surgery is that they can improve the understanding of the pathological events involved in a patient's death and also enable surgeons to assess the technical performance of surgery. The lessons learnt from autopsies should lead to improvements in health care. Furthermore, the presence of a pathologist at morbidity and mortality meetings will greatly enhance this process. The ability to achieve these objectives, in the current climate following the controversies of organ retention and the limitations of the coronial system, is becoming increasingly difficult[6].

Case study 24

A middle-aged patient with rheumatoid arthritis and impaired renal function underwent CABG. They were on high dose steroids and methotrexate. The surgery was uneventful but the patient developed bleeding postoperatively and returned to theatre for re-exploration. No specific bleeding point could be found and the chest was packed. Bleeding thereafter continued and the patient died 24 hours later. There appeared to have been no pre-operative MDT meeting or morbidity or mortality meeting and although the patient was referred to the coroner no autopsy was performed.

The advisors commented that the documentation in the casenotes was poor which made it difficult to establish the sequence of events. However, due to the complex comorbidities this patient should have been discussed at a MDT meeting and the case reviewed at an M & M meeting. An autopsy would have been valuable in this case. The advisors were concerned that little had been learnt by the multidisciplinary team in this case.

Case study 25

An elderly patient developed persistent metabolic acidosis and low cardiac output state post CABG. They returned to theatre for chest re-exploration and a laparotomy. No cause was found for the condition and the patient died from multi-organ failure. The case was referred to the coroner but an autopsy was not performed. There was no evidence of the case being reviewed by the surgical team in a morbidity and mortality meeting.

What was the cause of death in this patient? It was the advisors' view that a morbidity and mortality meeting should have been held and if an autopsy had been performed this may have made a valuable contribution in determining the cause of death. It is to difficult to see what the surgical team learnt from this case.

Key findings

- 43/58 cardiothoracic units held regular morbidity and mortality audit meetings, of which 38/43 of these held meetings monthly or more frequently.
- Only 7/43 cardiothoracic units graded quality of patient care at morbidity and mortality audit meetings.
- Procedures for providing feedback from morbidity and mortality audit meetings varied between cardiothoracic units often without clear identifiable systems being in place.
- 822/907 (91%) of cases were reviewed at a morbidity and mortality audit meeting.
- An anaesthetist attended a morbidity and mortality audit meeting for 396/910 (44%) of cases.
- 369/910 (41%) of cases were know to have had an autopsy, 85% of these were coronial.
- The total number of autopsies fell from year 1 (172, 46%) to (87, 34%) in year 3 of the study.
- 798/910 (88%) of cases were referred to the coroner, of these the proportion that had coronial autopsies was 141 (44%), 100 (40%) and 73 (32%) respectively for each year of the study.

Recommendations

- Morbidity and mortality audit meetings should be held in all cardiothoracic units. The majority of units should hold meetings at least monthly. If the numbers of cases performed in a unit are small, alternative arrangements should be made to incorporate these cases in other surgical audit meetings (Clinical Directors and Audit Leads).
- The personnel present at morbidity and mortality audit meetings should reflect the composition of the multidisciplinary cardiothoracic team (The Cadiac Team and Clinical Directors).
- A clear record should be kept of morbidity and mortality audit meeting which should comply with national guidelines (Audit Leads).
- A common system for grading of quality of care of patients should be employed for all patients discussed in morbidity and mortality audit meetings. The peer review scale used by NCEPOD provides such a system (Clinical Directors).
- There should be robust systems in place to learn from the findings of morbidity and mortality meetings. The cardiothoracic audit leads should be responsible for managing this process (Audit Leads).
- The decline in the number of autopsies performed following deaths from first time coronary artery bypass grafting needs to be reversed. To achieve an increase in the autopsy rate will require a substantial change to both the coronial system and hospital autopsy service (Chief Executives, Medical Directors and Clinical Directors).

References

1 General Medical Council (2006). *Good Medical practice.* General Medical Council.

2 National Confidential Enquiry into Patient Outcome and Death. (2006). *Death following a first time isolated coronary artery bypass graft; Interim Report – Data year 2004/2005.* NCEPOD.

3 National Confidential Enquiry into Peri-operative Deaths. (2000). *Then and Now.* NECPOD.

4 Parsonnet V, Bernstein A D, Gera M. *Clinical usefulness of risk stratified outcome analysis in cardiac surgery in New Jersey.* Annals of Thoracic Surgery 1996; 61; S8-11.

5 National Confidential Enquiry into Peri-operative Deaths. (2002). *Functioning as a team.* NCEPOD.

6 National Confidential Enquiry into Patient Outcome and Death. (2006). *The Coroner's Autopsy: Do we deserve better?* NCEPOD.

17. Organisational data

This section looks at facilities available to units within the time frame of the study using data from the organisational questionnaire.

Only data not covered elsewhere in the report are covered in this section.

Units were asked to indicate if patients were initially cared for in theatre recovery following first time CABG and which level of care they received following this. This is shown in Table 62.

In a majority of units (n=42) this was not applicable.

Level of care	Number of units
Level 0	1
Level 1	1
Level 2	5
Level 3	8
Subtotal	**15**
Multiple answer	1
Total	**16**

Table 62. Where patients were initially cared for following surgery (Where applicable.)

NCEPOD examined access to transoesophageal echocardiography (TOE), interventional cardiology and angiography (Figure 50).

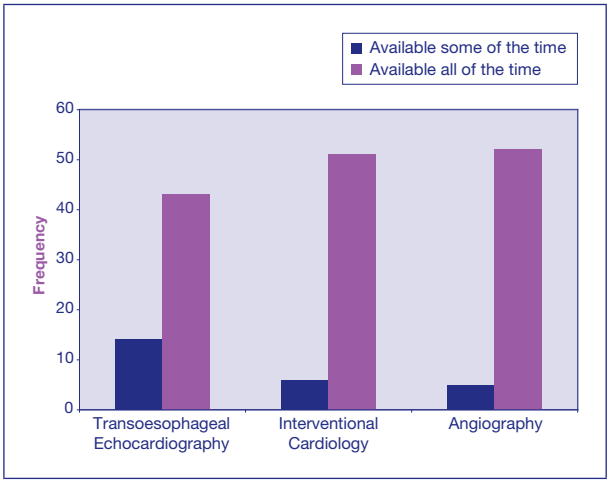

Figure 50. Facilities available to CABG patients

In most units TOE, interventional cardiology, and angiography facilities were available all of the time. In 14 units, TOE facilities were only available some of the time.

Table 63 shows the numbers of patients seen in each unit annually, numbers ranged from 12 – 1077.

Range	12 - 1077
Mean	430
Median	484
Mode	483

Table 63. Number of patients seen annually.

The number of consultants performing first time isolated bypass grafting within any one cardiothoracic unit ranged from two to 26 and this is shown in Table 64.

Range	2 - 26
Mean	7
Median	6
Mode	6

Table 64. Number of consultants performing first time CABG.

Units were also asked to indicate how many half-day sessions of cardiac surgery the unit holds in a seven day week (Table 65).

Range	0 - 55
Mean	15.5
Median	20
Mode	20

Table 65. Number of half-day cardiac sessions per week.

The number of sessions ranged between 0 – 55; with an average number of sessions of 15.5 a week.

Appendix 1 - EuroSCORE

	Definition	Score
Patient-related factors		
Age	Per five years or part thereof over 60 years.	1
Sex	Female.	1
Chronic pulmonary disease	Long term use of bronchodilators or steroids for lung disease.	1
Extracardiac arteriopathy	Any one or more of the following: claudication, carotid occlusion or >50% stenosis, previous or planned intervention on the abdominal aorta, limb arteries or carotids.	2
Neurological dysfunction	Disease severely affecting ambulation or day-to-day functioning.	2
Previous cardiac surgery	Requiring opening of the pericardium.	3
Serum creatinine	>200μmol/L pre-operatively.	2
Active endocarditis	Patient still under antibiotic treatment for endocarditis at the time of surgery.	3
Critical pre-operative state	Any one or more of the following: ventricular tachycardia or fibrillation or aborted sudden death, pre-operative cardiac massage, pre-operative ventilation before arrival in the anaesthetic room, pre-operative inotropic support, intra-aortic balloon counterpulsation or pre-operative acute renal failure (anuria or oliguria <10ml/h).	3
Cardiac-related factors		
Unstable angina	Rest angina requiring i.v. nitrates until arrival in the anaesthetic room.	2
LV dysfunction	Moderate or LVEF 30-50%.	1
	Poor or LVEF <30%.	3
Recent myocardial infarct	(<90 days).	2
Pulmonary hypertension	Systolic PA pressure >60 mmHg.	2
Operation-related factors		
Emergency	Carried out on referral before the beginning of the next working day.	2
Other than isolated CABG	Major cardiac procedure other than or in addition to CABG.	2
Surgery on thoracic aorta	For disorder of ascending, arch or descending aorta.	3
Post infarct septal rupture		4

Reference

Nashef S, Roques F, Michel P, Gauducheau E, Lemeshow S, Salamon R. (1999). *European system for cardiac operative risk evaluation (EuroSCORE)*, European Journal of Cardiothoracic Surgery, 16: 9 – 13.

Appendix 2 - Medical and interventional tables

Patients on drug and managed appropriately

Beta blockers

	Managed appropriately		
	Yes (n=439)	No (n=45)	Unknown (n=46)
Stopped drug	37	8	6
Not stopped drug	367	33	39
Not answered	35	4	1

Ace inhibitors

	Managed appropriately		
	Yes (n=429)	No (n=52)	Unknown (n=41)
Stopped drug	185	29	20
Not stopped drug	219	20	21
Not answered	25	3	0

Potassium channel blockers

	Managed appropriately		
	Yes (n=184)	No (n=27)	Unknown (n=16)
Stopped drug	40	5	4
Not stopped drug	132	22	11
Not answered	12	0	1

Calcium antagonists

	Managed appropriately		
	Yes (n=264)	No (n=26)	Unknown (n=30)
Stopped drug	30	3	5
Not stopped drug	213	20	25
Not answered	21	3	0

Aspirin

	Managed appropriately		
	Yes (n=499)	**No (n=58)**	**Unknown (n=57)**
Stopped drug	311	37	39
Not stopped drug	158	16	17
Not answered	30	5	1

Clopidogrel

	Managed appropriately		
	Yes (n=271)	**No (n=26)**	**Unknown (n=28)**
Stopped drug	177	20	21
Not stopped drug	68	5	7
Not answered	26	1	0

Low molecular weight heparin

	Managed appropriately		
	Yes (n=112)	**No (n=20)**	**Unknown (n=20)**
Stopped drug	46	11	11
Not stopped drug	55	6	7
Not answered	11	3	2

Appendix 3 – Glossary

ACE inhibitors	Angiotensin converting enzyme inhibitors
BMI	Body Mass Index
CABG	Coronary Artery Bypass Graft
CCAD	Central Cardiac Audit Database
CORU	Clinical Operational Research Unit
CVVH	Continuous Veno-Venous Haemofiltration
ECG	Electrocardiogram
GMC	General Medical Council
GP	General Practitioner
GTN	Glyceryl Trinitrate
IABP	Intra Aortic Balloon Pump
ICP	Integrated Care Pathway
ICU	Intensive Care Unit
IHD	Ischaemic Heart Disease
LMW heparin	Low Molecular Weight heparin
LV dysfunction	Left Ventricular dysfunction
LV function	Left Ventricular function
LVEF	Left Ventricular Ejection Fraction
MDT	Multidisciplinary Team
NCCG	Non Consultant Career Grade
NCEPOD	National Confidential Enquiry into Patient Outcome and Death
NHS	National Health Service
NICE	National Institute for Health and Clinical Excellence
NSF	National Service Framework
OPCS	Office of Population Census and Surveys
PA	Programmed Activity
PCI	Percutaneous Coronary Intervention
PRHO	Pre Registration House Officer
SCTS	Society for Cardiothoracic Surgery in Great Britain and Ireland
SHO	Senior House Officer
SpR	Specialist Registrar
TOE	Transoesophageal Echocardiography
UCL	University College London
VF	Ventricular Fibrillation
VT	Ventricular Tachycardia

Appendix 4 - Participation

Cases

Trust/Group	No. of sites	No. of cases	Surgical q. received	Anaesthetic q. received
Bart's and the London NHS Trust	2	43	21	24
Belfast Health and Social Care Trust (formerly Royal Group of Hospitals & Dental Hospitals & Maternity Hospitals (NI))	1	33	27	25
Blackpool, Flyde and Wyre Hospitals NHS Trust	1	21	21	21
BMI Healthcare	6	5	0	5
Brighton and Sussex University Hospitals NHS Trust	1	22	22	22
BUPA (formerly Cromwell Hospital)	1	3	1	3
Cardiff and Vale NHS Trust	1	12	10	10
Central Manchester & Manchester Children's University Hospital Trust	1	23	23	22
Classic Hospitals	1	1	1	1
Golden Jubilee National Hospital	1	2	0	2
Grampian University Hospitals Trust	1	23	23	21
Guy's and St Thomas' Hospital NHS Foundation Trust	1	61	57	43
HCA International	3	16	13	16
Hull and East Yorkshire Hospitals NHS Trust	1	33	27	29
Imperial College Healthcare NHS Trust (formerly Hammersmith Hospitals NHS Trust & St Mary's Hospital NHS Trust)	2	40	30	28
King Edward VII Hospital	1	2	2	2
King's College Hospital NHS Trust	1	18	18	15
Lothian University Hospitals Division	1	16	14	16
Newcastle Upon Tyne Hospitals NHS Trust	1	35	35	35
NHS Greater Glasgow and Clyde	2	60	56	43
Nottingham City Hospitals NHS Trust	1	19	18	18
Nuffield	3	0	-	-
Nuffield House	1	1	1	1
Oxford Radcliffe Hospital NHS Trust	1	38	38	38
Papworth Hospitals NHS Foundation Trust	1	45	45	45
Plymouth Hospitals NHS Trust	1	16	14	15
Ramsay Healthcare UK (formerly Capio Healthcare UK)	1	0	-	-
Royal Brompton and Harefield NHS Trust	2	45	31	44
Sheffield Teaching Hospitals NHS Foundation Trust	1	44	41	42
South Manchester University Hospitals NHS Trust	1	19	19	19
South Tees Hospitals NHS Trust	1	30	30	30
Southampton University Hospitals NHS Trust	1	28	26	27
Spire Healthcare (formerly BUPA)	5	0	-	-
St Anthony's Hospital	1	0	-	-
St George's Healthcare NHS Trust	1	26	19	21
Swansea NHS Trust	1	16	16	13
The Cardiothoracic Centre Liverpool NHS Trust	1	64	47	60
The Leeds Teaching Hospitals NHS Trust	1	23	22	19
The Royal Wolverhampton Hospitals NHS Trust	1	23	21	23
United Bristol Healthcare Trust	1	23	22	22
University Hospital Birmingham NHS Foundation Trust	1	17	17	12
University College London Hospitals NHS Foundation Trust	1	25	16	19
University Hospital of North Staffordshire NHS Trust	1	22	15	19
University Hospitals Coventry and Warwickshire NHS Trust	1	31	31	31
University Hospitals of Leicester NHS Trust	1	21	20	21

Controls

Trust/Group	No. of sites	No. of cases	Surgical q. received	Anaesthetic q. received
Bart's and the London NHS Trust	2	44	22	31
Belfast Health and Social Care Trust (formerly Royal Group of Hospitals & Dental Hospitals & Maternity Hospitals (NI))	1	13	8	9
Blackpool, Flyde and Wyre Hospitals NHS Trust	1	17	17	17
BMI Healthcare	6	1	1	1
Brighton and Sussex University Hospitals NHS Trust	1	6	6	6
BUPA (formerly Cromwell Hospital)	1	1	0	1
Cardiff and Vale NHS Trust	1	11	9	7
Central Manchester & Manchester Children's University Hospital Trust	1	17	16	14
Classic Hospitals	1	2	2	0
Golden Jubilee National Hospital	1	4	3	3
Grampian University Hospitals Trust	1	16	14	12
Guy's and St Thomas' Hospital NHS Foundation Trust	1	27	24	13
HCA International	3	16	8	9
Hull and East Yorkshire Hospitals NHS Trust	1	22	17	20
Imperial College Healthcare NHS Trust (formerly Hammersmith Hospitals NHS Trust & St Mary's Hospital NHS Trust)	2	23	18	14
King Edward VII Hospital	1	0	-	-
King's College Hospital NHS Trust	1	9	6	7
Lothian University Hospitals Division	1	16	14	16
Newcastle Upon Tyne Hospitals NHS Trust	1	12	12	12
NHS Greater Glasgow and Clyde	2	25	18	17
Nottingham City Hospitals NHS Trust	1	10	3	4
Nuffield	3	1	1	1
Nuffield House	1	0	-	-
Oxford Radcliffe Hospital NHS Trust	1	9	7	7
Papworth Hospitals NHS Foundation Trust	1	43	36	43
Plymouth Hospitals NHS Trust	1	11	8	6
Ramsay Healthcare UK (formerly Capio Healthcare UK)	1	0	-	-
Royal Brompton and Harefield NHS Trust	2	16	10	12
Sheffield Teaching Hospitals NHS Foundation Trust	1	22	21	19
South Manchester University Hospitals NHS Trust	1	22	18	18
South Tees Hospitals NHS Trust	1	31	30	31
Southampton University Hospitals NHS Trust	1	15	15	14
Spire Healthcare (formerly BUPA)	3	0	-	-
St Anthony's Hospital	1	5	0	1
St George's Healthcare NHS Trust	1	12	11	10
Swansea NHS Trust	1	18	16	16
The Cardiothoracic Centre Liverpool NHS Trust	1	23	15	16
The Leeds Teaching Hospitals NHS Trust	1	19	15	14
The Royal Wolverhampton Hospitals NHS Trust	1	16	15	15
United Bristol Healthcare Trust	1	43	42	43
University Hospital Birmingham NHS Foundation Trust	1	17	16	14
University College London Hospitals NHS Foundation Trust	1	21	13	14
University Hospital of North Staffordshire NHS Trust	1	23	11	16
University Hospitals Coventry and Warwickshire NHS Trust	1	18	18	17
University Hospitals of Leicester NHS Trust	1	6	5	6

This is an indicator of number of cases matched, not an indicator of who did or did not supply data. A unit with 0 cases may have supplied matching data, but have had no controls selected from their unit.

Two units were no longer participating when control data was collected.

Appendix 5 - Governance of NCEPOD

The National Confidential Enquiry into Patient Outcome and Death (NCEPOD) is an independent body to which a corporate commitment has been made by the Medical and Surgical Colleges, Associations and Faculties related to its area of activity. Each of these bodies nominates members on to NCEPOD's Steering Group.

Steering Group as at 4th June 2008

Dr D Whitaker
Association of Anaesthetists of Great Britain and Ireland

Mr T Bates
Association of Surgeons of Great Britain & Ireland

Mr J Wardrope
College of Emergency Medicine

Dr S Bridgman
Faculty of Public Health Medicine

Dr P Cartwright
Royal College of Anaesthetists

Dr P Nightingale
Royal College of Anaesthetists

Dr B Ellis
Royal College of General Practitioners

Ms M McElligott
Royal College of Nursing

Prof D Luesley
Royal College of Obstetricians and Gynaecologists

Mrs M Wishart
Royal College of Ophthalmologists

Dr I Doughty
Royal College of Paediatrics and Child Health

Dr R Dowdle
Royal College of Physicians

Professor T Hendra
Royal College of Physicians

Dr M Armitage
Royal College of Physicians

Dr M Clements
Royal College of Physicians

Dr A Nicholson
Royal College of Radiologists

Mr B Rees
Royal College of Surgeons of England

Mr M Parker
Royal College of Surgeons of England

Mr D Mitchell
Faculty of Dental Surgery, Royal College of Surgeons of England

Dr S Lishman
Royal College of Pathologists

Ms S Panizzo
Patient Representative

Mrs M Wang
Patient Representative

Observers

Mrs C Miles
Institute of Healthcare Management

Dr R Palmer
Coroners' Society of England and Wales

Mrs H Burton
Scottish Audit of Surgical Mortality

Dr K Cleary
National Patient Safety Agency

Professor P Littlejohns
National Institute for Health and Clinical Excellence

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NCEPOD is a company, limited by guarantee and a registered charity, managed by Trustees.

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Professor T Treasure

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Professor J H Shepherd

Mr M A M S Leigh

Dr D Justins

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Dr M Mason

Clinical Co-ordinators

The Steering Group appoint a Lead Clinical Co-ordinator for a defined tenure. In addition there are eight Clinical Co-ordinators who work on each study. All Co-ordinators are engaged in active academic/clinical practice (in the NHS) during their term of office.

Lead Clinical Co-ordinator
Mr I C Martin (Surgery)

Clinical Co-ordinators

Mr M Lansdown (Surgery)

Dr D G Mason (Anaesthesia)

Dr K Wilkinson (Anaesthesia)

Dr A Goodwin (Anaesthesia)

Dr J Stewart (Medicine)

Dr D Mort (Medicine)

Dr G Findlay (Intensive Care)

Professor S B Lucas (Pathology)

FINAL REPORT

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Disclaimer

The recommendations contained in this report represent the view of NCEPOD, which was arrived at after a careful consideration of the available evidence. Health professionals are expected to take it into account when exercising their clinical judgement. It does not, however, override their individual responsibility to make appropriate decisions in the circumstances of the individual patient, in consultation with the patient and/or guardian or carer.

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