

EXECUTIVE SUMMARY

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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)

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.



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 disease¹. It is usual to attribute the description of angina to Heberden in 1768. The historian Christopher Lawrence² 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 surgery⁵ 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*



References

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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 year¹. 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 patients³.

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 19,444⁷.



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.

References

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- 7 Society for Cardiothoracic Surgery in Great Britain and Ireland. *Sixth national adult cardiac surgical database report. 2008.* In press.

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).

EXECUTIVE SUMMARY

Method

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).

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 et al, 2007¹.

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.

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.

Questionnaires

Surgical questionnaire

A surgical questionnaire was sent to the consultant cardiothoracic surgeon involved in each patient's care.

Anaesthetic questionnaire

An anaesthetic questionnaire was sent to the consultant anaesthetist responsible for the care of each patient.

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.

Casenotes

Alongside the completed questionnaires NCEPOD also asked that copied extracts of the casenotes be returned. These included **admission notes; EuroSCORE scoring sheet; medical casenotes for the duration of the hospital stay (admission to death or discharge);** 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; 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 copies of any **written policies for clinical review of unstable, urgent, in-hospital cardiothoracic patients; records of attendance for/minutes of MDT case planning meetings; patient information sheets for cardiac surgery; records of attendance for/minutes of MDT review and audit meetings.**

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

References

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EXECUTIVE SUMMARY

Overview of data collected

Results

Hospital participation

Every site returned an organisational questionnaire for at least one year of the study.

Population

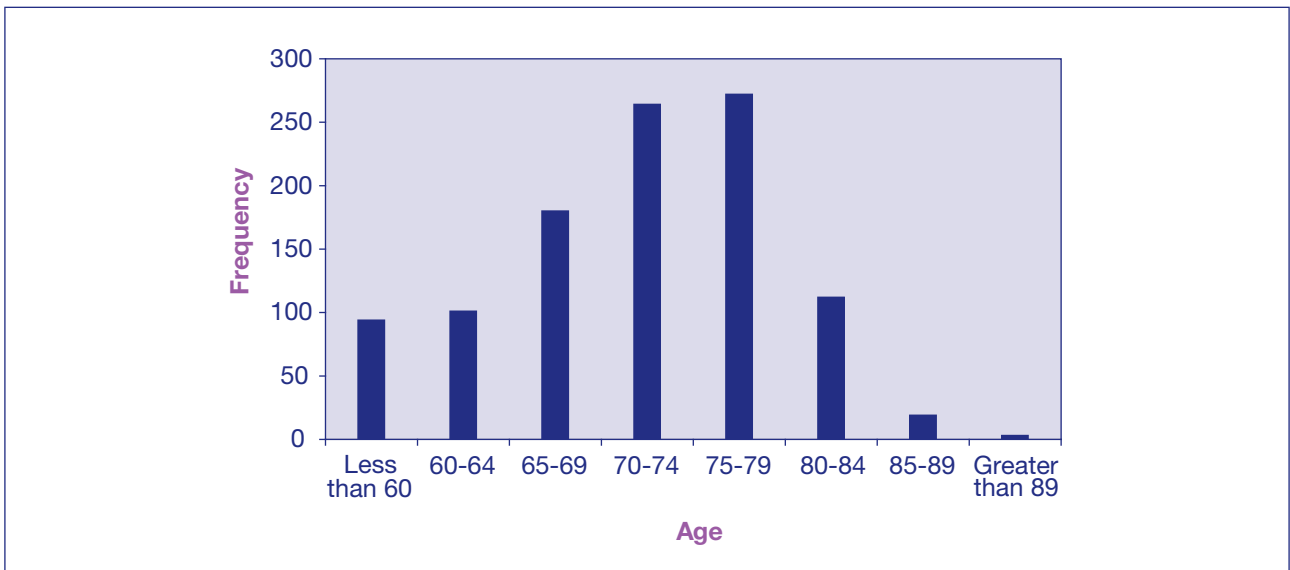


Figure 5. Age range.

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).

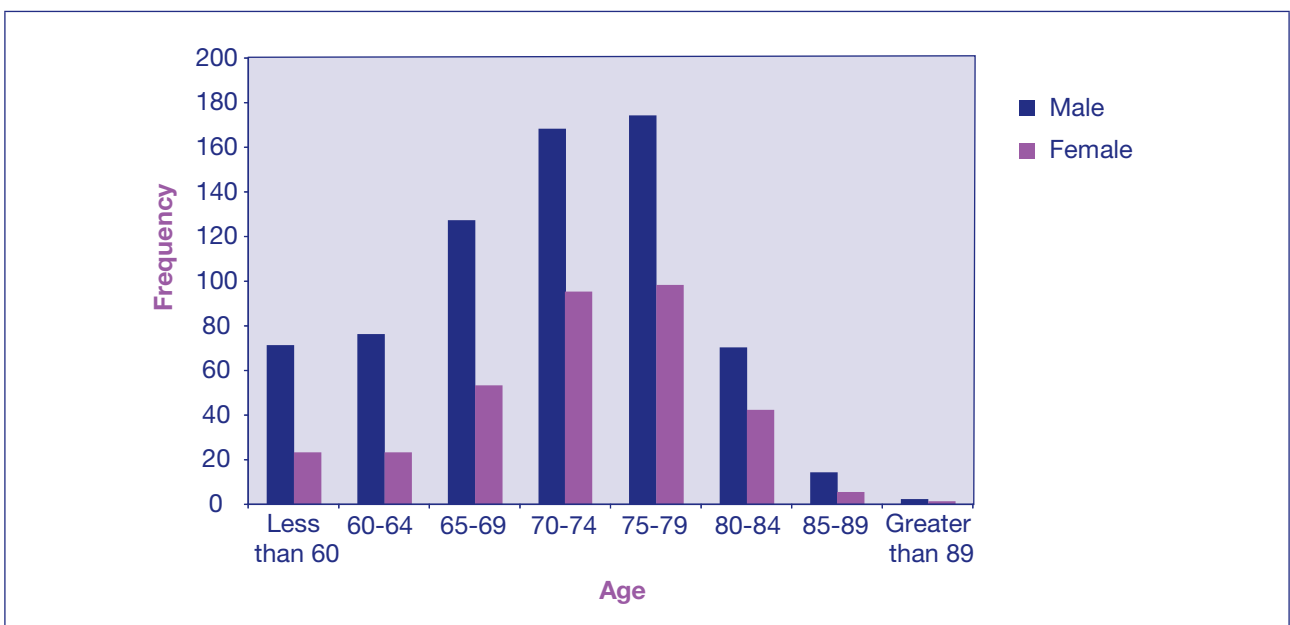


Figure 6. Age range by gender.

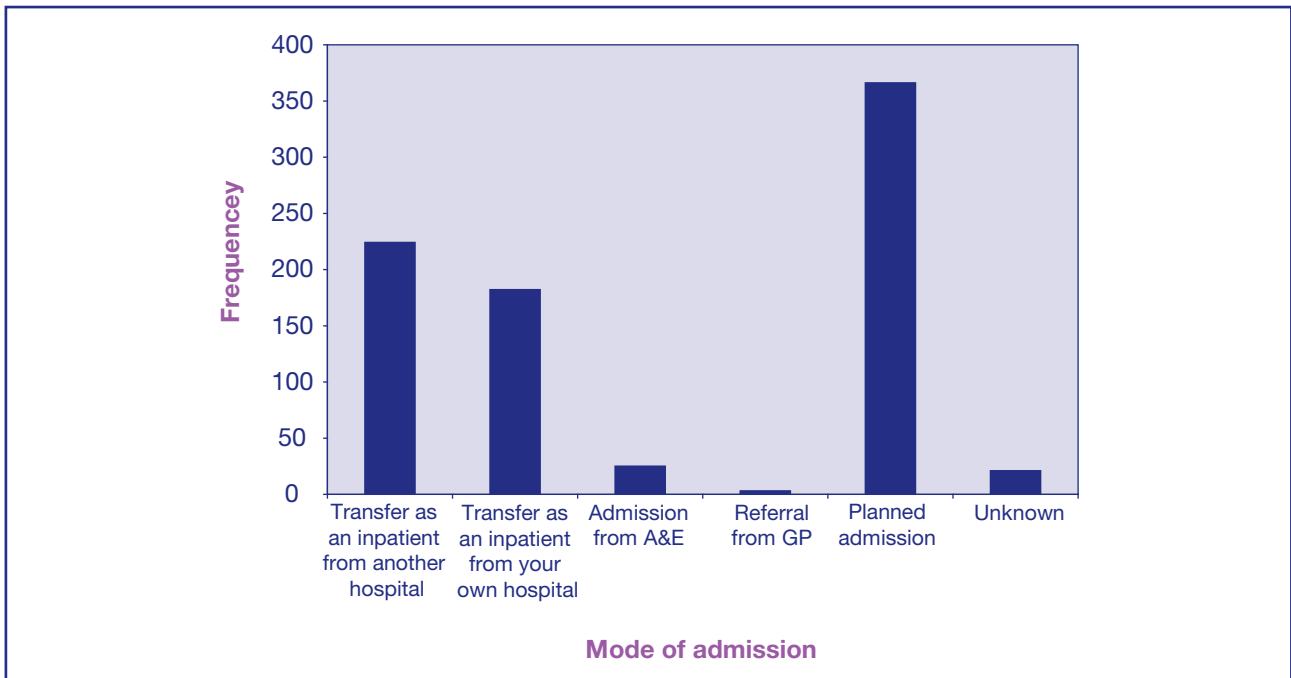


Figure 7. Mode of admission

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).

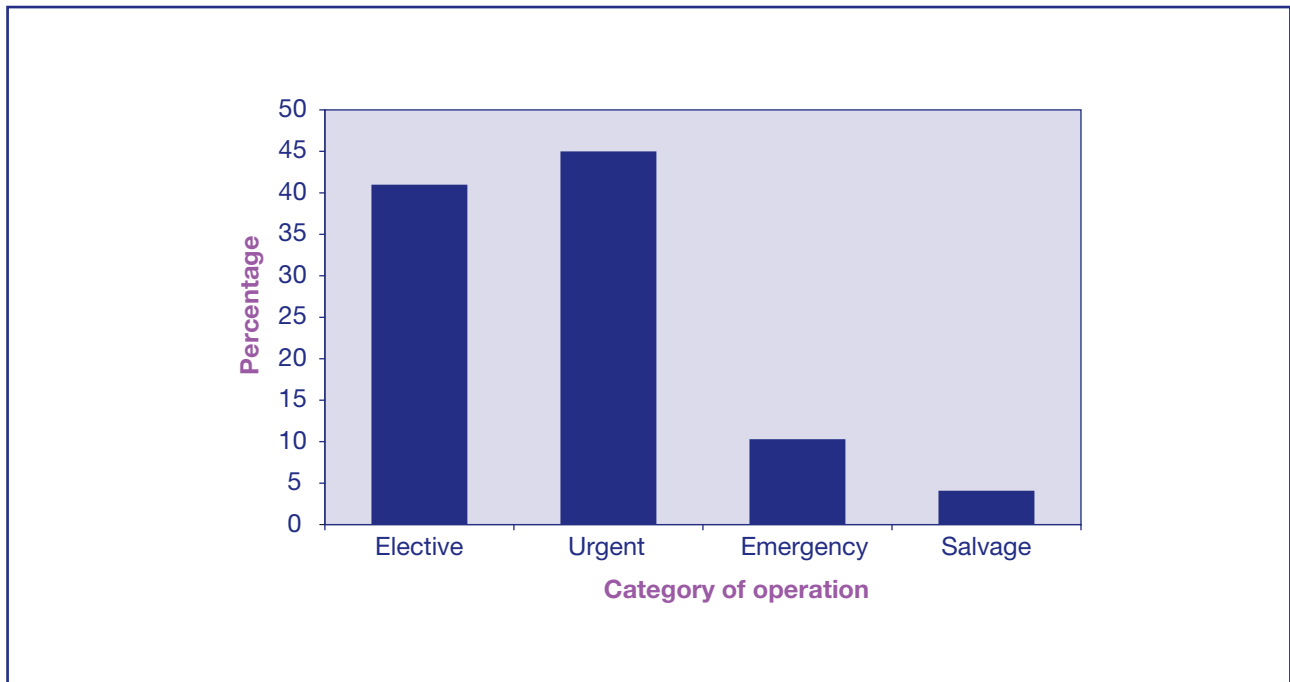


Figure 9. Category of operation.

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.

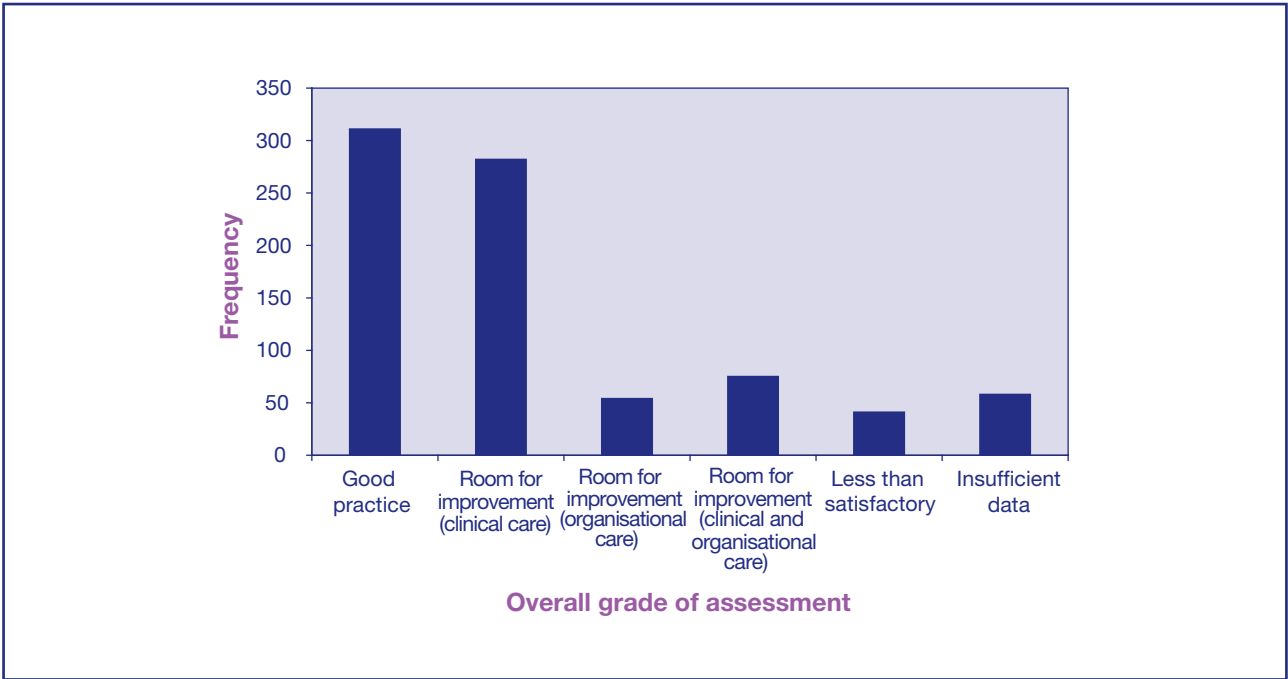


Figure 10. Overall assessment of care (cases).

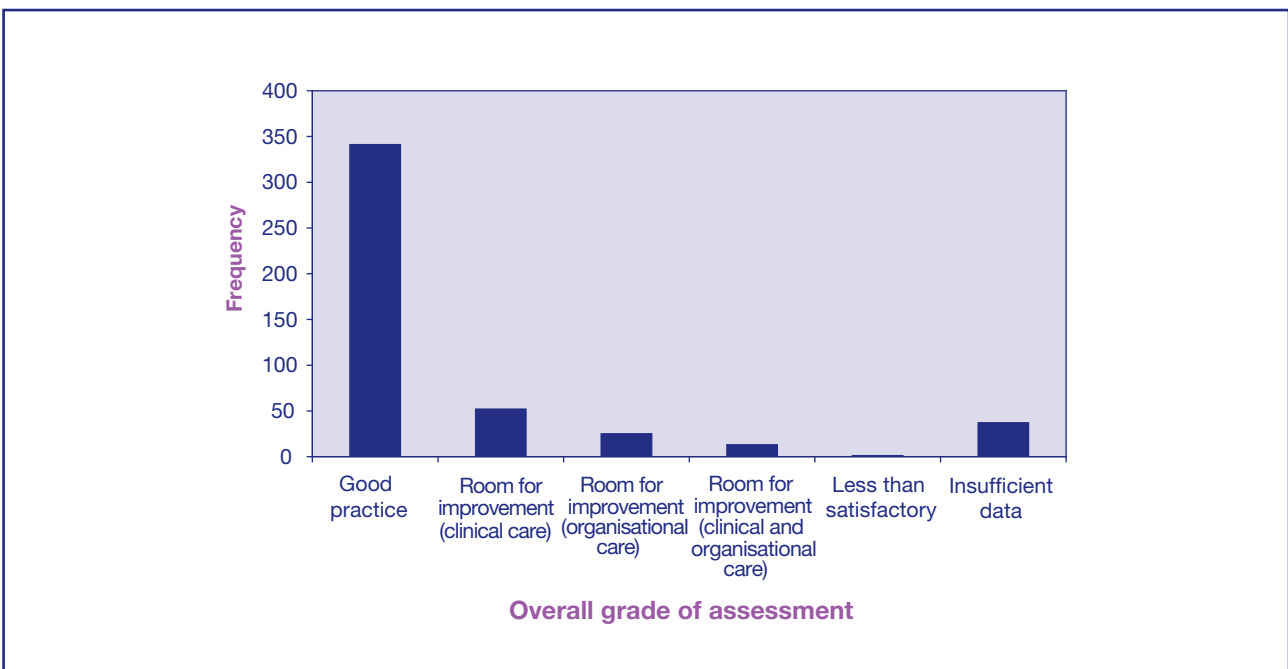


Figure 11. Overall assessment of care (controls).

Referral and admission process

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).

Scheduling of operations

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.

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.

Multidisciplinary case planning

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).

Patient investigations

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).

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.

Medical Management

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.

Non-elective, urgent, in-hospital cases

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).

Key findings and recommendations by report chapter

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.

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.

Key findings and recommendations by report chapter

Comorbidities

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).

Anaesthetic process

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.

Peri-operative management and postoperative care

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).

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.*

Appropriateness of surgery

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).

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”?

Communication, continuity of care and consent

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).

Multidisciplinary review and audit

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 known 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 Cardiac 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).

EXECUTIVE SUMMARY

Published June 2008 by the National Confidential Enquiry into Patient Outcome and Death

4-8 Maple Street, London, W1T 5HD

Tel: 020 7631 3444

Fax: 020 7631 4443

Email: info@ncepod.org.uk

Web site: www.ncepod.org.uk

A company limited by guarantee – Company number 3019382

Registered charity number 1075588

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This work was undertaken by The National Confidential Enquiry into Patient Outcome and Death who received funding from the Department of Health; the views expressed in this publication are those of the authors and not necessarily those of the Department of Health.

Designed and produced by Interface, Bristol. Telephone: 0117 923 2235

