Prince of Wales Hospital
The Chinese University of Hong Kong

Cardiac Surgery Report

2005-2006

Division of Cardiothoracic Surgery
Department of Surgery

Foreword

Hong Kong is a modern, vibrant city; a city of constant change and innovation. A proud city, whose citizens demand exacting standards in commerce, industry, technology and healthcare. The present report from the Prince of Wales Hospital builds on this noble tradition by demonstrating that, in one of the most demanding, innovative and technological branches of surgery, Hong Kong surgeons not only meet, but exceed, the highest international standards of quality.

The presentation of surgical results for public scrutiny for the first time is a courageous, but inevitable, step in a world where there is increasing public awareness and regulation of healthcare. Indeed, there is a growing international recognition that in developed healthcare economies it is no longer acceptable to practise cardiac surgery without collecting robust data to allow for risk-adjusted analysis and audit of results.

Reports of this kind not only demonstrate a responsible and professional approach to quality assurance and improvement but also provide a solid platform which enables surgical groups to help healthcare providers and purchasers to allocate appropriate resources for service development for the benefit of patients.

Effective quality assurance is further enhanced by reference to national or international standards. I would thus like to offer surgical colleagues in Hong Kong the opportunity to submit their data for inclusion in the regular United Kingdom National Adult Cardiac Surgical Database Reports compiled by the Society for Cardiothoracic Surgery in Great Britain and Ireland.

Sir Bruce Keogh

President, Society for Cardiothoracic Surgery in Great Britain and Ireland.
Secretary General, European Association for Cardio-Thoracic Surgery
Commissioner, Healthcare Commission, England

Introduction

This is the first annual report of the Division of Cardiac Surgery at The Chinese University of Hong Kong, which is based at the Prince of Wales Hospital, Shatin, New Territories, Hong Kong.

The report emphasises the capture of data which can enable risk stratification and outcome analysis. The data collected was based on the minimum dataset of the Society of Cardiothoracic Surgeons of Great Britain and Ireland (Appendix 1). Future data collection will be yet more comprehensive and meet, if not exceed, international standards. Over time, the data will yield increasingly important epidemiological information about our patient population.

The report aims to provide insight into the clinical activity in cardiac surgery, and to chart progress in measuring and reporting risk-adjusted outcomes for our patient population. Presenting this information on an annual basis will ensure that important changes in the nature of disease treatment by cardiac surgery are observed in a timely manner. We also trust that the publication of these regular reports will assure the community at large that our service quality and outcomes are being effectively monitored along international lines.

Since November 2005, the Cardiac Surgery Unit has implemented an ever-expanding quality assurance programme dedicated to providing the most positive and helpful journey for patients undergoing cardiac surgical treatment in our institution. We have collected high-quality, validated data which can be used to measure and benchmark our performance against comparable cardiac surgical facilities.

The programme has been enhanced by the introduction of multidisciplinary audit and mortality and morbidity meetings, the institution of preoperative assessment clinics and a nurse-led patient satisfaction project, all of which contribute in important ways. Most crucially, however, we now have a fully computerised database and outcome analysis system within the Division. This system has been fully integrated with the computerised medical system (Clinical Management System) of the Hospital Authority to enable automatic uploading of patient demographic data to our cardiac database. The system is supported by a dedicated research assistant who facilitates data collection and entry, and an audit trail which establishes the accuracy and validation of the data collected. The data presented in this report has been subjected to the above processes.

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Contents

List of Appendices

1. The Division of Cardiothoracic Surgery

The Division of Cardiothoracic Surgery at The Chinese University of Hong Kong (CUHK) is based at the Prince of Wales Hospital (PWH), an acute regional hospital and the medical teaching centre associated with CUHK. It is situated in the New Territories and hosts the Regional Trauma Centre as well as other acute surgical specialties. The Division of Cardiothoracic Surgery provides services within the specialty for a population of 3-4 million people, excluding paediatric cardiac surgery, cardiac transplantation and oesophageal surgery.

Within the Division of Cardiothoracic Surgery there are 30 designated beds in wards 4B, 4C and 4D (Level 4, PWH). Ward 4B provides exclusive use of 4 high-dependency beds and 12 ward beds for cardiac surgical patients. The Intensive Care Unit (ICU) provides 25 intensive care beds and is located on Level 3, adjacent to the operating suite. Two beds in the ICU are for the exclusive use of cardiac surgical patients, and patients are looked after by accredited intensivists, with surgical input as necessary. Patients transferred from the ICU to the High Dependency Unit (HDU) are looked after by the cardiac surgical team, with input from other support specialties as necessary. One operating theatre (Theatre 11) is allocated to cardiac surgery and is currently funded for use three days a week. A preoperative cardiac assessment clinic is held on alternate weeks. Multidisciplinary audit and mortality and morbidity meetings are held four times annually.

2. Outcome Reporting and International Comparisons

In the absence of a Hong Kong comparator, the outcomes presented in this report have been compared and benchmarked against the National Cardiac Surgical Database report from the United Kingdom (UK). The

populations treated may be different, but the UK publication is one of the most authoritative and comprehensive documents of national cardiac surgical practice available anywhere in the world, and is used here as the 'gold standard' for comparison (United Kingdom Cardiac Surgical Register, UKCSR) (1). For outcomes that are not detailed or accessible in the UKCSR, the annual report of the United Bristol Health Care Trust (UBHT), Bristol, UK, has been used, since this report provides 10 years of comprehensive validated data for contemporary cardiac surgical activity, and since the familiarity of the present author (MJ Underwood) with this dataset facilitates comparison(2). Data from these publications has been used with permission.

3. Overall Cardiac Surgical Activity

During the period 1 November 2005 to 31 October 2006, 310 patients had cardiac surgical operations. This performance was achieved against a target of 300 cases per annum. Figure 1 shows the relevant percentages of the operations by type. The 'other' category includes patients operated on for closure of atrial and ventricular septal defects, postinfarction ventricular septal defects and atrial myxomas. It excludes patients undergoing stenting for disease of the descending thoracic aorta, a procedure that has been performed on a regular basis by members of a multidisciplinary team who trained at St Vincent's Hospital, Melbourne, Australia. The interventions and outcomes for these patients are being monitored in a separate specific database and will form the basis of a separate report in due course.

Within this patient cohort, 45 operations were classified as emergencies (14.4%). However, during this time, standard internationally accepted classifications of patient categories (elective, urgent, emergency and salvage) were not in place and this figure groups all 'non-elective' patients together. Likewise, many of the patients designated as 'elective' cases were in fact 'urgent,' so little can be currently deduced from this percentage.

To stratify risk, a case was designated as an 'emergency' if the operation was performed before the beginning of the next working day (EuroSCORE definition Appendix 2). Classification for future reports will group patients according to internationally recognized criteria, as the degree of preoperative urgency may be an important factor in outcome.

Mortality (defined as death during the same hospital admission) for this period was 1.3% (4 patients), with one death in the isolated CABG group (0.6%). This outcome compares favourably with the non-risk adjusted crude mortality figures from the UK (UKCSR, all cases 3.5%, isolated CABG 2.3%). There was no mortality in patients who underwent elective surgery during the period under review. All cases of mortality were discussed at the multidisciplinary audit and mortality meetings (Appendix 3).

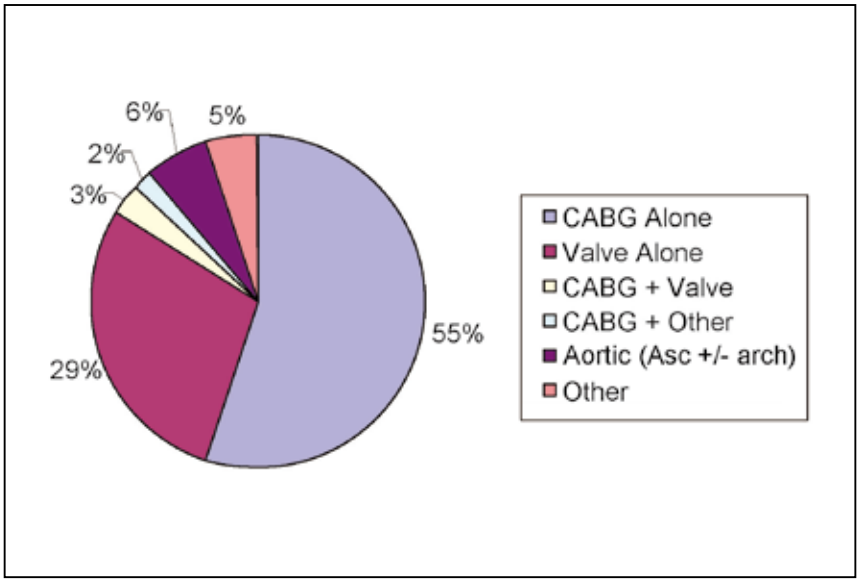


Figure 1. Overall Activity

The number of valvular cases performed was higher than that in comparable units in the UK, in which coronary artery bypass grafting still represents the majority of the workload, in the region of 68% (UKCSR) to 70% (UBHT) of cases. Only 55% of the total workload at PWH was isolated CABG. This may well reflect the higher prevalence of rheumatic valvular heart disease within the region. The number of combined valve/coronary operations was also lower than that in the UK. This could reflect the younger age of our valve population with rheumatic disease, who are unlikely to have associated coronary artery disease. It will be interesting to see if this changes as the age profile of the Hong Kong population changes.

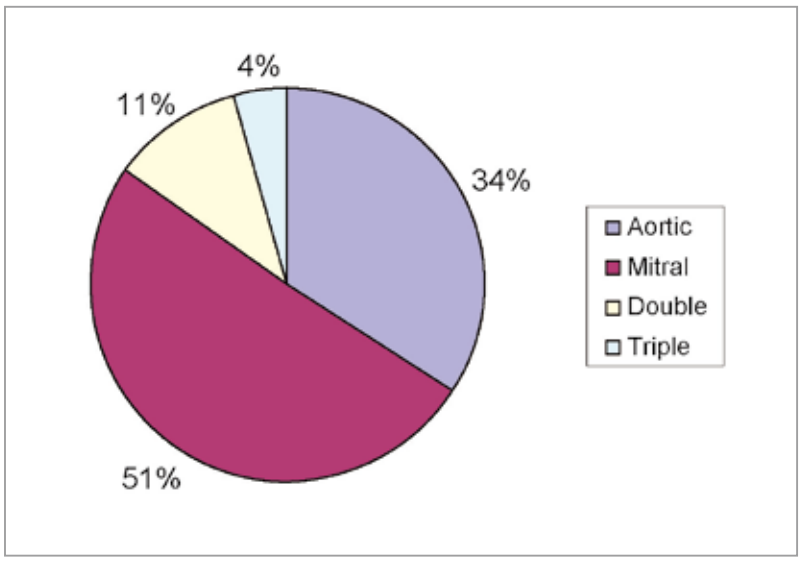


Figure 2. Isolated Valvular Cases

Two cases within the isolated aortic group were early (within 6 weeks) re-operations for early prosthetic valve endocarditis. Triple valve procedures included tricuspid valve repairs, and there were no tricuspid valve replacements in this period. Within the mitral surgery group, ten patients also underwent tricuspid valve repair. There was no mortality in our group of patients undergoing valvular surgery.

Figure 2 shows the percentage distribution of valve type for isolated valve operations and Table 1 shows the absolute number of procedures.

Aortic	31		
Mitral	46	+ Tricuspid	10
Double	10		
Triple	4		

Table 1. Number of Valve Operations

Figure 3 shows the predominance of rheumatic valvular heart disease when looking solely at the pathology of our mitral valve patient population, over 60% of whom required operation for rheumatic disease.

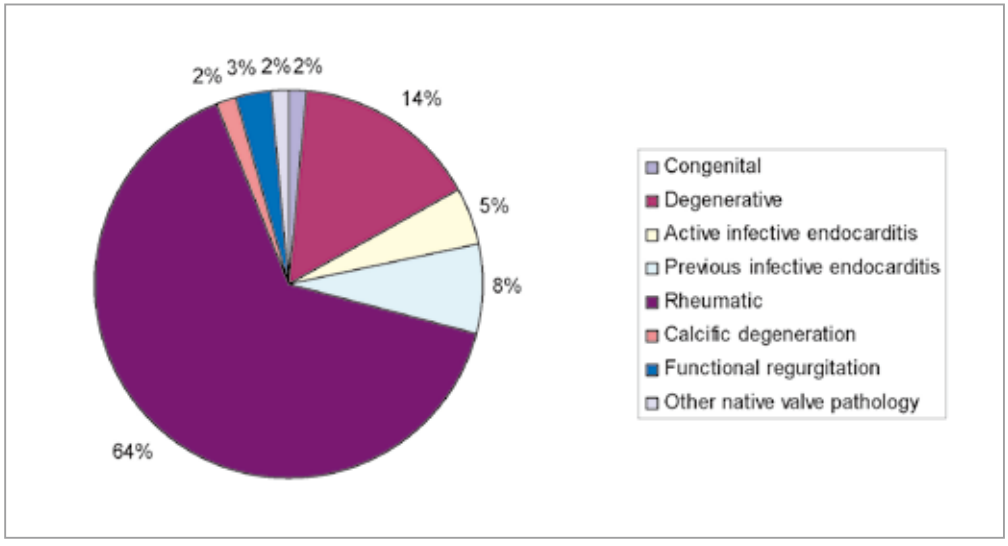


Figure 3. Mitral Valve Pathology

There has also been significant activity in surgery involving the ascending aorta +/- aortic arch. Eighteen operations were undertaken during this time period, comprising 6% of the total workload (UBHT 4%). Fourteen of these cases were emergencies for acute Type A aortic dissection, and four were elective cases for ascending aortic aneurysm. In 15 cases, circulatory arrest was used to perform reconstruction of the aortic arch +/- hemi-arch replacement. The mean circulatory arrest time was 27 minutes (range 14–42). Four patients (1 dissection, 3 aneurysms) required composite root replacement, whilst leaflet-preserving replacement of the ascending aorta was performed in the other cases. Two patients underwent concomitant coronary artery bypass grafting.

There were two deaths in this group (both emergency cases), giving a crude mortality of 11% (BRI 15.2%, UKCSR 14%). However, the numbers are too small to draw conclusions.

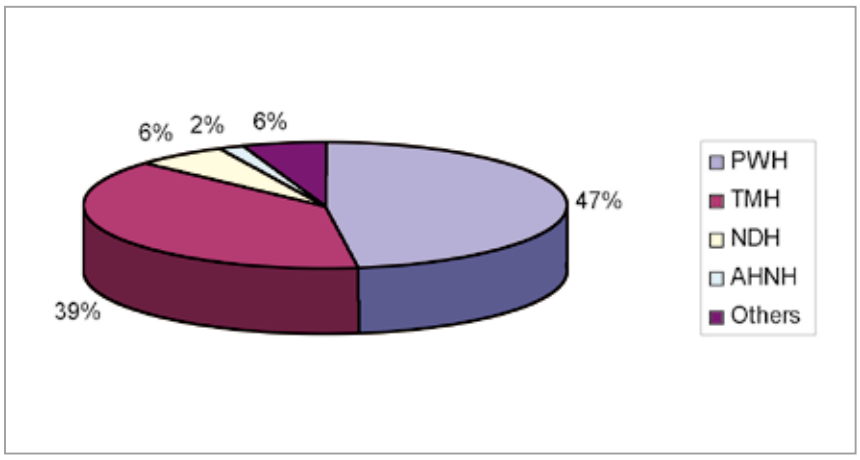
Stroke is a major adverse outcome in this group of patients, particularly if circulatory arrest is used, and we are gratified to report that within this cohort of patients there was no permanent neurological morbidity.

4. Waiting Times for Cardiac Surgery and Referral Patterns

Waiting Time		November 2005	August 2006
<3 months		67	37
3 – 12 months		128	113
>12 months		14	0

Table 2. Cardiac Surgical Waiting Times

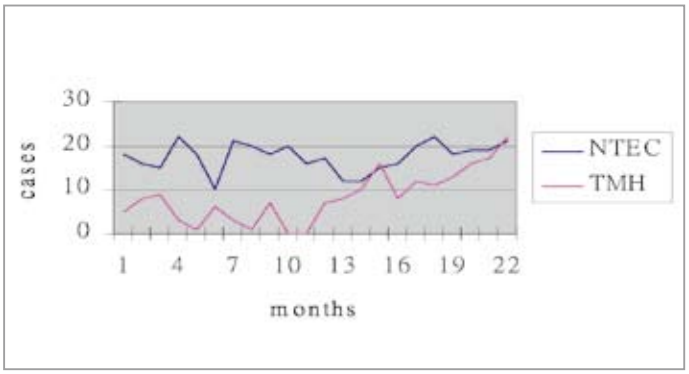
Table 2 shows the waiting times for cardiac surgery from November 2005 and August 2006. Clinical re-evaluation and priority evaluation were introduced to reach the goal of a waiting time for surgery no longer than 12 months. This goal was achieved by mid-2006. We will continue to monitor waiting times.



Abbreviations: PWH (Prince of Wales Hospital), TMH (Tuen Mun Hospital), NDH (North District Hospital), AHNH (Alice Ho Miu Ling Nethersole Hospital).

Figure 4. Referred Cases by Hospital

Figure 4 shows the hospitals for which we provide a service and the percentage of our workload per hospital. Figure 5 shows recent referral trends to our unit, documented as cases per calendar month. We continue to monitor referral numbers and surgical activity on a monthly basis, and look forward to further expansion of facilities to maintain good and timely service for referred patients and their cardiologists.



Abbreviations: NTEC (New Territories East Cluster, including the PWH, NDH and AHNH), TMH (Tuen Mun Hospital).

Figure 5. Referral Patterns Jan 2005 to Oct 2006

5. Preoperative Assessment Clinic

A new case cardiac surgery outpatient clinic was opened in February 2006 to reduce in-patient admissions for preoperative assessment and to provide a more convenient service for our local patient population. Currently this clinic operates twice monthly. This project has been primarily led by our cardiac nurses, who have audited the effect of its introduction on bed occupancy, as shown in Figure 6.

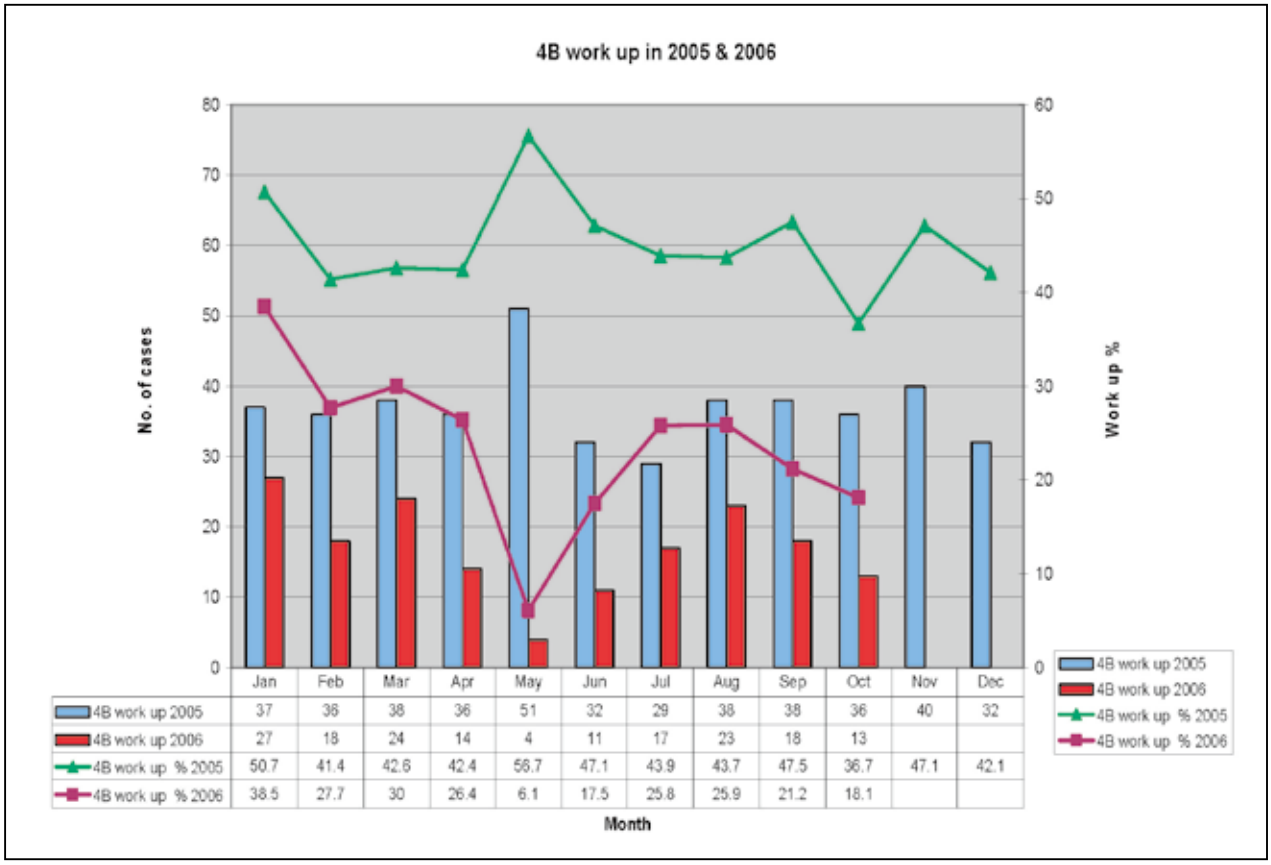


Figure 6. In-Patient Bed Occupancy Data for 2005 and 2006.

The effect of this new out-patient clinic was to reduce the number of patients admitted to hospital for pre-assessment by over 23% and it allowed, on average, an additional three beds per month to be used for postoperative patient care. We hope to expand this clinic to provide a streamlined out-patient service for all our patients and also use it as a focus for our nurse-led patient satisfaction and cardiac education project, all of which are important components of our overall quality assurance programme.

6. Patient Demographics

Sixty-seven percent (67%) of our patients were male, and 33% were female. During the year, the mean patient age was 62.3 yrs (19-84), and 24% of patients were older than 70 years. This is in keeping with the UK data, although our mean age was slightly lower (UBHT 65.2).

While we have no previous validated comparative data, the UK data and individual unit figures indicate that patients who are being referred for cardiac surgery are getting older. One important factor pertinent to the Hong Kong population, however, is that this recorded age may not reflect the true age of the patients, many of whom may be chronologically older than the age stated on their official record. This is an important consideration, as advancing age has a major influence on operative risk and is an important component of many of the published risk-stratification models.

The age mix of our patient population is shown in Figure 7.

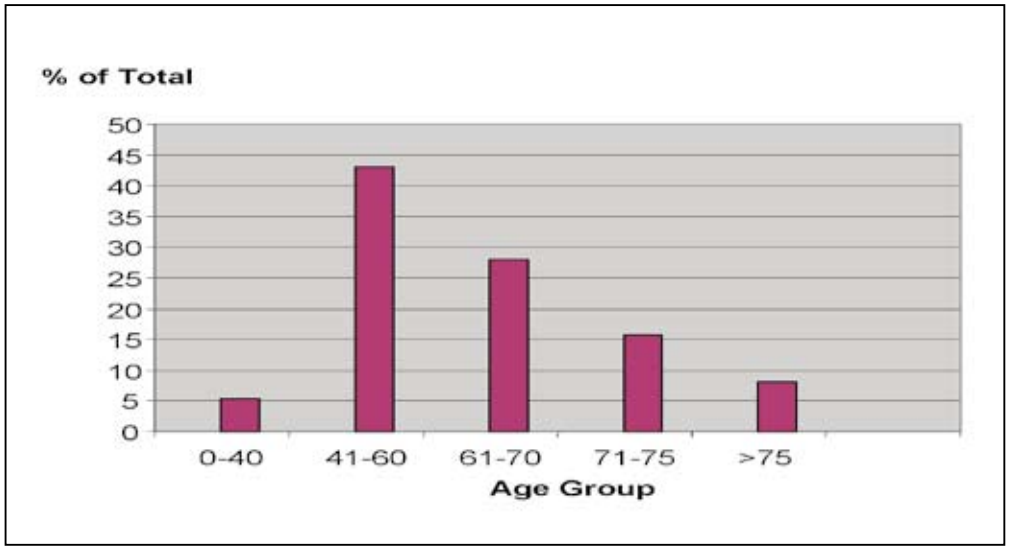


Figure 7. Patient Age

7. Risk-Stratification and Presentation of Outcomes

Introduction

The risk that any one patient will not survive surgery depends on a number of different factors, some of which can be quantified. Risk-scoring systems for patients undergoing cardiac surgery take some of these factors and turn them into a numerical risk score, which represents the probability of death or some other outcome for an individual. Over

time, a variety of risk-stratification systems have evolved, ranging from simple additive systems to highly complex statistical algorithms. These provide the basis for rational and meaningful comparisons of outcomes between groups of patients and institutions.

On the members' page of their website, the Society of Cardiothoracic Surgeons of Great Britain and Ireland has included downloadable software for data entry and plotting of non-risk adjusted data (crude mortality) in a funnel plot for comparison against and based on the national average mortality in the UK with 99.8% alert lines. The blue line is the UK National Average mortality, the green line is the lower 99.8% control limit, and the red line is the upper 99.8% control limit. This software was used to plot our data.

Figure 8 shows our outcome in terms of crude mortality for all patients (PWH data, blue dot) compared to that in the UK in the format of a funnel plot, which provides a clear visual picture of any divergent performance or variation. As informative as this graphical depiction of mortality is, however, we believe that the introduction of a level of risk adjustment is important for a more comprehensive comparison of outcomes.

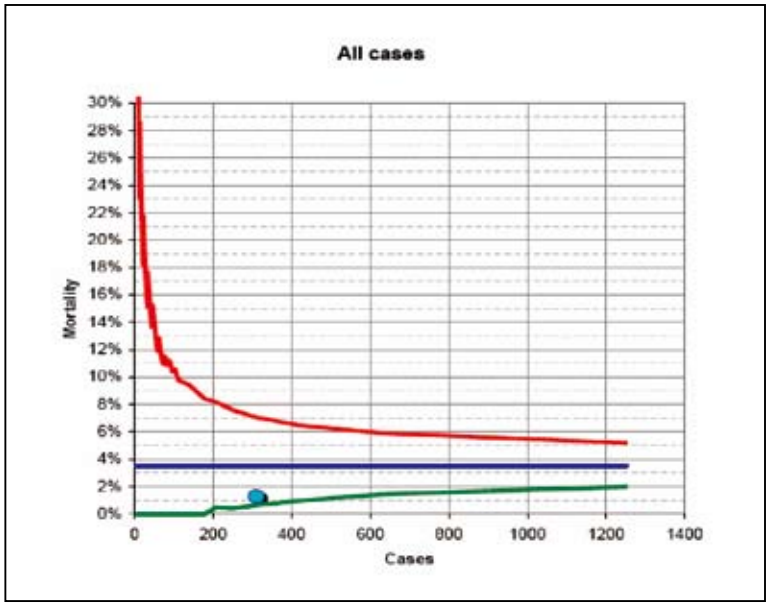


Figure 8. Funnel Plot, PWH Mortality, UK Alert Lines

Risk-Stratification: Application to PWH Data

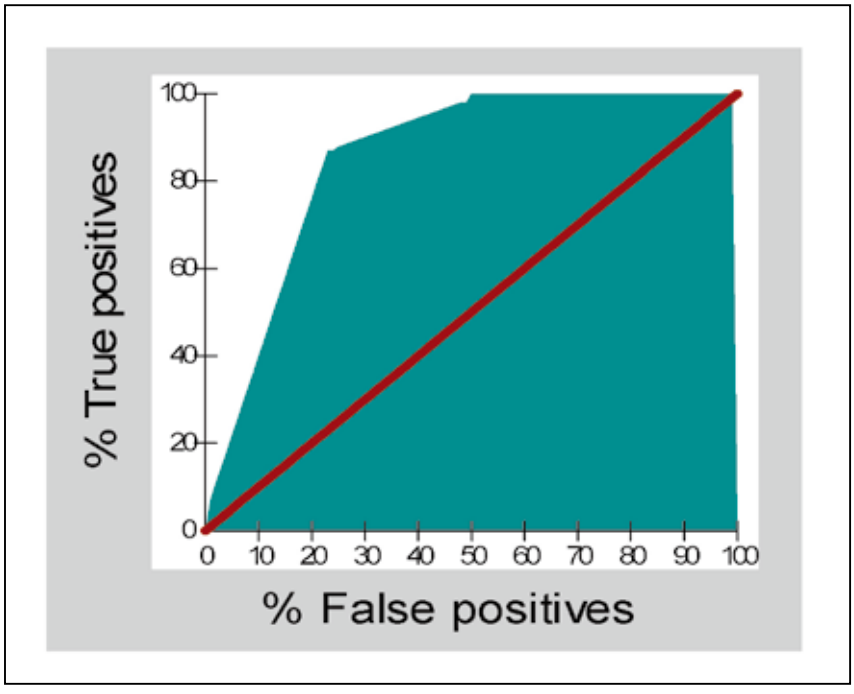
The additive EuroSCORE is a risk-scoring system for patients undergoing cardiac surgery that was developed based upon a pan-European patient population (3). This system is used in many areas of the world, but its applicability to the Hong Kong population has not been tested.

We collected data to allow calculation of the additive and logistic EuroSCORE for our patient population (Appendix 4).

It is important to establish validity in our population if we are to use the system for outcome analyses and comparisons. Statisticians have developed a number of methods to measure the predictive accuracy of such scoring systems. One method of assessing the validity of discrimination is the generation of the Receiver Operating Characteristic (ROC) curve. The area under the curve represents 'the probability that a randomly chosen diseased subject (or deceased patient) is (correctly) rated or ranked with greater suspicion than a randomly chosen non-deceased (or alive) subject (patient)'. An area of 0.5 indicates that there is no discrimination, whilst an area of 1.0 represents perfect discrimination. The closer the value is to 1.0, therefore, the more accurate the system, and an area of > 0.75 is generally accepted as providing evidence of an acceptable discrimination scoring system.

The ROC curve for our patient population is shown in Figure 9 with axes of % true positives (sensitivity) and % false positives (specificity).

Figure 9. ROC curve



The area under the curve was calculated as 0.823, indicating that use of the additive EuroSCORE for our patient population will allow confidence in its discriminatory applicability. A similar result was achieved when validating the logistic EuroSCORE. However, it is well known that risk-scoring systems can become outdated with changes in patient characteristics

and outcomes over time, and we will continue to monitor this aspect of the work closely. In this context, it should be noted that our existing analytical system already allows us to adopt a wide variety of risk-scoring systems in international use, including complex Bayesian analysis.

Presentation of Outcome: Mortality

Presentation of outcome following cardiac surgery can be achieved in a variety of ways. One mechanism is to present the data as a plot of cumulative events (death) against time (CUSUM chart). To incorporate adjustment for risk, however, the statistical analysis is complex and utilises odds ratios to produce risk-adjusted CUSUM charts (RA-CUSUM). We have chosen to present our outcomes graphically using this technique, and Figure 10 shows the RA-CUSUM for all cases reported in this document.

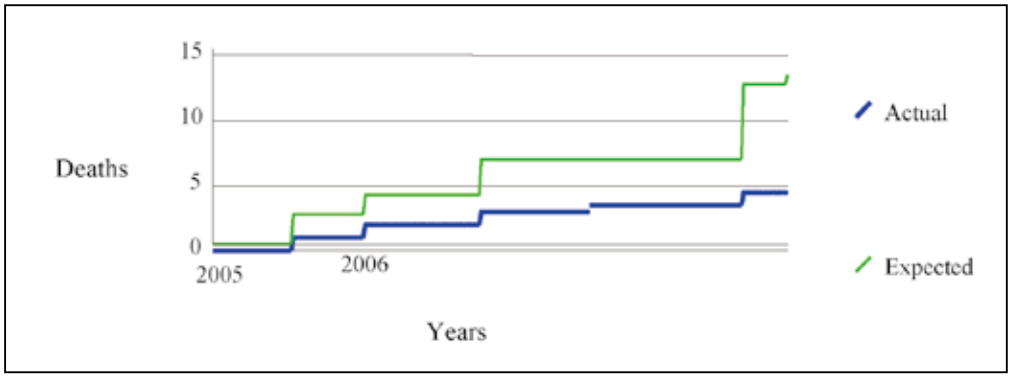


Figure 10. RA-CUSUM for All Patients (Risk Predicted by additive EuroSCORE)

With the incorporation of risk adjustment using the risk-scoring system (additive EuroSCORE) that we have shown to be valid for our patient population, we can see that actual outcomes are better than expected over time. As already stated, the applicability of risk-scoring systems can change over time, and presently it is common for most units publicly reporting their outcomes to outperform the additive EuroSCORE-predicted risk.

Figure 11 shows a comparison of the overall risk profile of our patient population, estimated using the additive EuroSCORE, with that reported

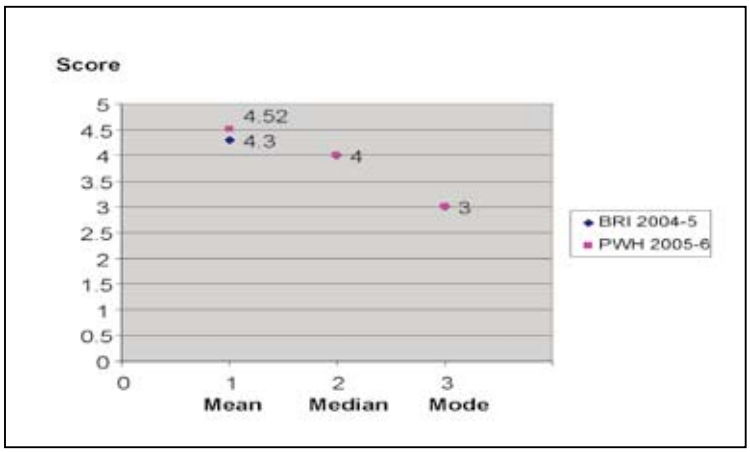


Figure 11. Risk Profiles: EuroSCORE Comparison with UBHT Data (All Cases)

by the UBHT.

From these comparisons we can see that despite case-mix differences, the overall risk profiles are very similar, with the median and mode having identical values.

Figure 12 groups our data in order to show the distribution of cases within individual risk-scoring ranges for comparison with the UBHT data. It is fascinating to observe that, as with the overall risk profiles of patients, the distribution of risk over the various groups is very similar, apart from small differences in the percentage of cases within the two highest risk groups.

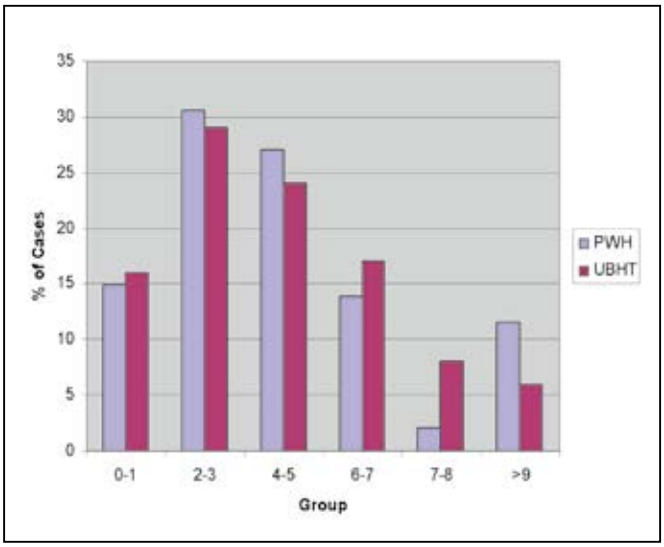


Figure 12. Case Distribution within EuroSCORE Groups (%)

Outcome Presentation: Morbidity

In addition to the presentation of outcome in the form of mortality, it is important to recognize that a poor outcome includes not only death, but also a variety of events which may lead to significant morbidity and be detrimental for the patient. We have recorded re-operation for haemorrhage or tamponade, permanent stroke, need for new dialysis postoperatively, need for postoperative intra-aortic balloon support (IABP) (CABG only), and re-operation for mediastinitis (requiring sternal rewiring) as important indicators of morbidity. The occurrence of these and comparative incidences is shown in Table 3.

The occurrence of these outcomes can also be shown in graphical form as a CUSUM chart, with the comparative indices set as a fixed value taken from international data. Figure 13 shows the CUSUM chart for re-operation for bleeding or tamponade over time, with the reported UK figure of 5% (estimated) set as the standard for comparison. This comparative index suggests that we are performing better than expected for our patient population.

		PWH	UKCSR	UBHT 2004
Re-operation		2.2%	5.5%	2.4%
Stroke		0.6%	3.5%	0.6%
Dialysis		0.6%	No Data	2.4%
Mediastinitis		0.0%	No Data	0.5%
IABP		0.6%	No Data	2.0%

Table 3. Incidence of Significant Morbidity

We have also instituted audits in other areas of postoperative outcome, particularly in the area of blood loss and postoperative transfusion of blood and blood products. We are pleased to report that by paying attention to this issue and instituting an audit process, we have been able to increase the number of patients undergoing cardiac surgery who do **NOT** receive a blood transfusion from 26% to 42% ($p < 0.002$) when analysing comparative time periods in 2005 and 2006 (see Figure 14).

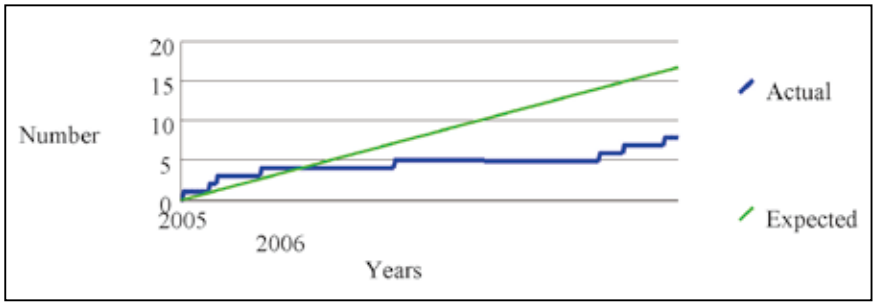


Figure 13. CUSUM for Re-operation for Bleeding/Tamponade (Actual vs Fixed 5%)

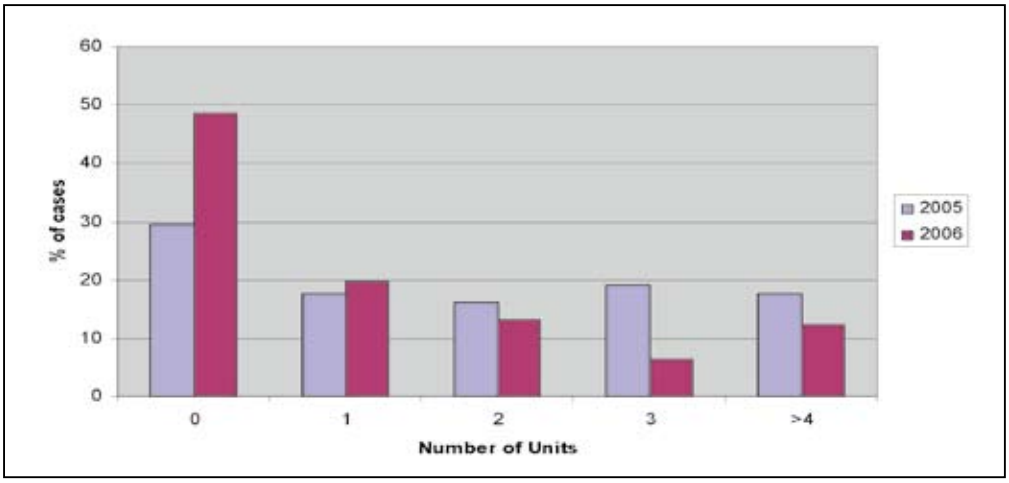


Figure 14. Blood Transfusion in 2005 and 2006 (Number of Units Transfused)

We have achieved similar results for the use of blood products (platelets and fresh-frozen plasma) (not shown) and will continue to focus on this area in subsequent audits and reports. This reduction in transfusions has been achieved even though there were no actual differences in blood loss (p = 0.456) during the same time frames, where blood loss was measured as the first 24-hour postoperative blood loss in mls (see Figure 15). This suggests that the reduction in blood and blood product use is to some degree a result of eliminating 'unnecessary' transfusion. But further work is still needed to improve in this area. Our aim is to achieve a transfusion rate of < 20% for elective cases, which is in line with the rate in other units (UBHT 2005).

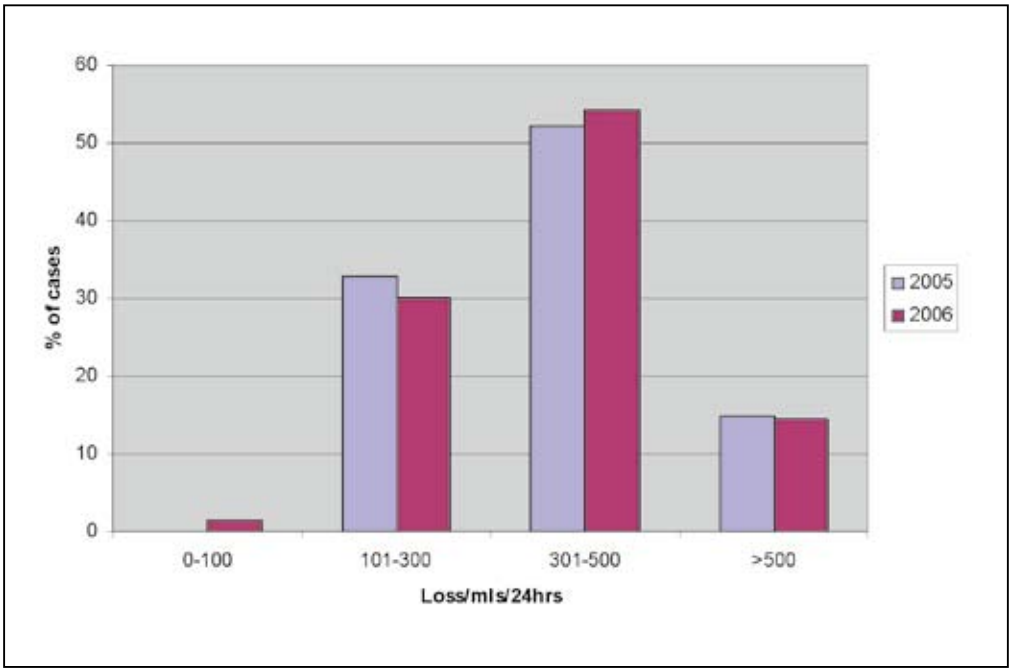


Figure 15. Mean 24-hour blood loss in 2005 and 2006.

8. Coronary Artery Bypass Grafting

The operation of coronary artery bypass grafting has been chosen by the Society of Cardiothoracic Surgeons of Great Britain and Ireland as the marker operation for outcomes as it has been analysed in depth, is commonly performed and the outcomes are reproducible and well delineated. However, it should be recognised that not all factors which can affect outcomes (such as size of coronary vessel, presence of distal

coronary artery disease) are accounted for in the currently used risk-stratification systems. We have collected data and analysed in detail the demographics and outcomes of patients undergoing coronary artery bypass grafting in our unit. This analysis excluded those patients (n = 4) who underwent associated resection and repair of left ventricular aneurysms.

Patient Demographics

Eighty percent (80%) of patients were male, which is comparable to the UK series in which women have consistently represented around 20% of the cohort group undergoing coronary artery bypass grafting (UKCSR). The age distributions shown in Figure 16 are grouped as they are in the UKCSR for easy comparison.

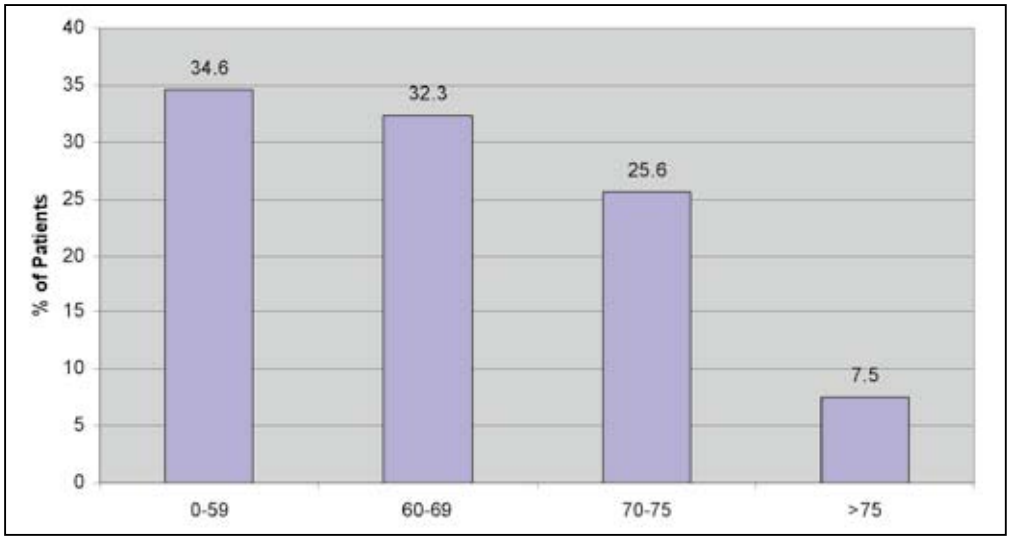


Figure 16. Age Distribution of CABG Patients

Similar to the percentage cited in the UK data, over 30% of our patient population was 70 years of age and older, with the proviso, as mentioned earlier, that this may be an underestimation in the case of the Hong Kong population.

In terms of preoperative symptoms, 28% of our patients had class III/IV angina (lower than the UK figure of approximately 50%) 31% had had a previous myocardial infarction and 5% had had two or more myocardial infarctions prior to surgery (Figure 17).

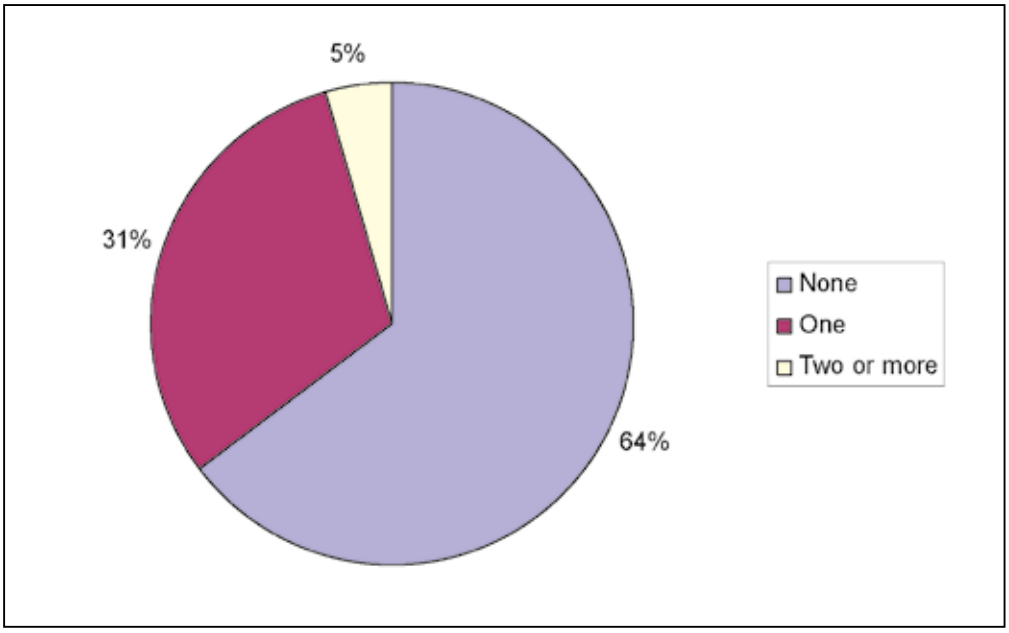
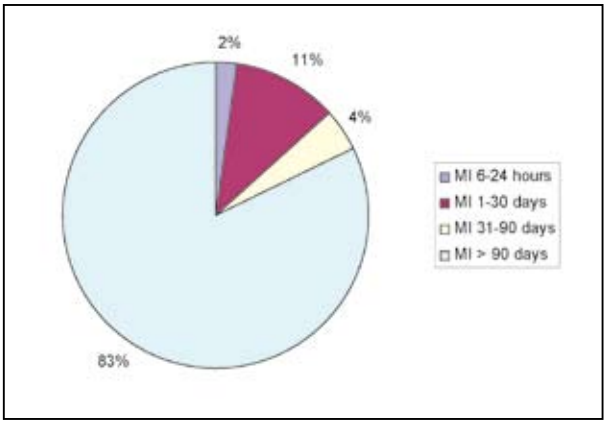


Figure 17. Incidence of Previous Myocardial Infarction

These figures are similar to those in the UK, where just over 40% of patients had had a previous myocardial infarction. Nearly 10% of our patients had previously undergone percutaneous coronary intervention (PTCA), again, a percentage similar to that in the UK.

The timing of surgery in relation to the timing of the most recent heart attack has a profound effect on outcome. Preferably, surgery is delayed to give the heart time to recover. Figure18 shows the timing of surgery in relation to the previous myocardial infarction of our patients who have suffered one or more myocardial events.

Figure 18. Timing of Surgery Following Myocardial Infarction



As in the UK, the majority of our patients were operated on 30 days or more after the most recent myocardial infarction, in keeping with standard surgical practice. There remained a small percentage of patients, however, that required earlier surgery for a variety of reasons and these patients, particularly the 2% operated within twenty-four hours, represent a high risk group.

Nearly 65% of our patient group had hypertension (defined using EuroSCORE classification) (UKCSR 62%) and the number and type of patients with diabetes is shown in Table 19.

Although the incidence of diabetes has increased by 50% over the past 7 years in the UK (UKCSR), the proportion of patients with diabetes (any type) in 2003 was approximately 23%. In our group, 48% of patients had diabetes, including 37% who were on either oral or insulin therapy.

Our population of patients undergoing CABG had a high incidence of diabetes (higher than that in the UK), which has been shown to adversely impact postoperative morbidity and potentially prolong hospital stay. It may also explain why we had a relatively high proportion of patients in the younger age group who required coronary artery bypass grafting.

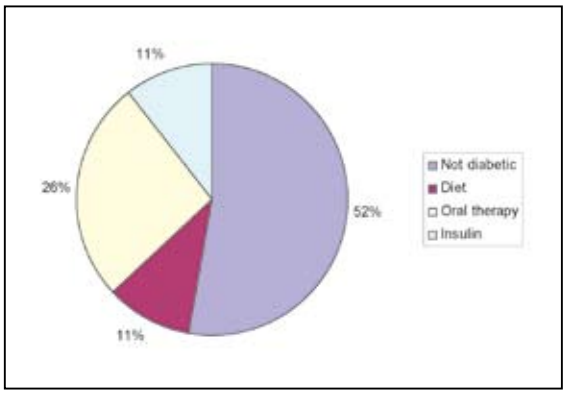
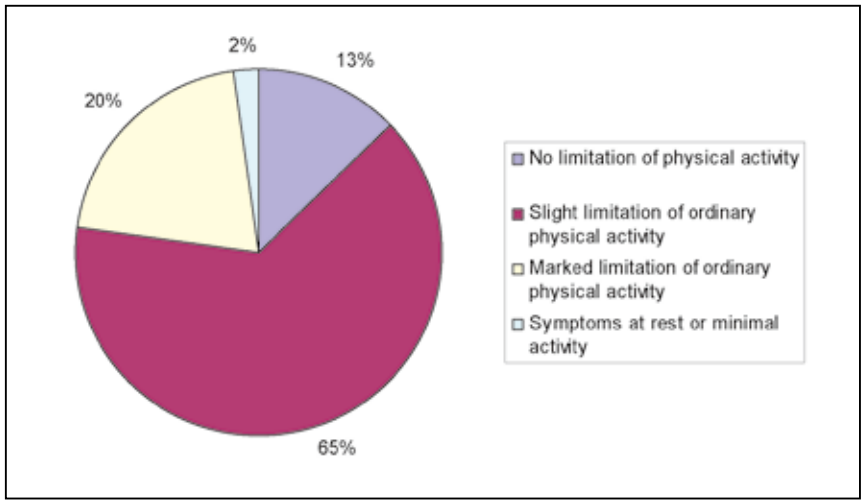


Figure 19. Incidence of Diabetes and Type of Therapy

The presence of shortness of breath (dyspnoea) in patients undergoing CABG may be associated, if significant, with a higher risk of postoperative morbidity. Figure 20 shows the incidence of dyspnoea in our patient cohort. Twenty-two per cent had marked limitation (New York Heart Association Classification NYHA3/4), which is consistent with the UK data (UKCSR).

Figure 20. Incidence of Dyspnoea in Patients Undergoing CABG



Stroke is a cause of major postoperative morbidity following CABG and the

risk is increased in patients with a history of neurological disease. In terms of preoperative neurological problems, 9% of our patients had had a previous stroke with either a full recovery (5%) or a residual neurological deficit (3%). There were no postoperative new neurological problems in this patient group.

Coronary Disease and Myocardial Function

Nearly 70% of our cohort had triple vessel coronary disease, and the incidence of left main stem (LMS) stenosis is shown in Figure 21.

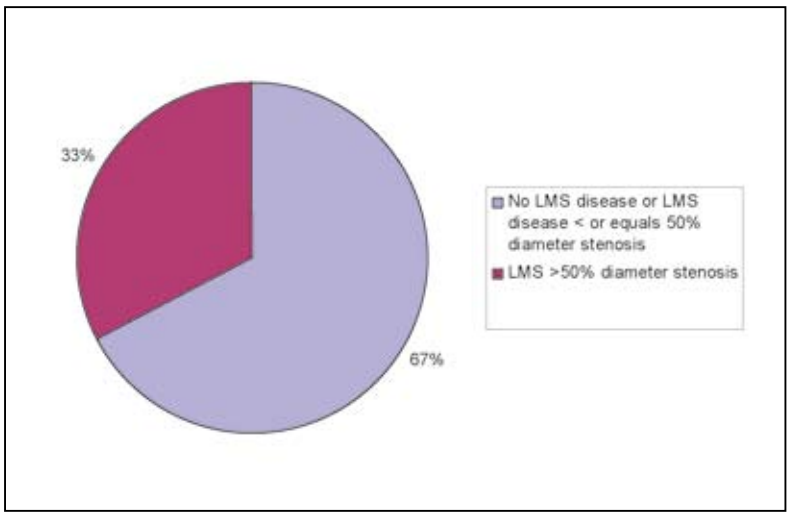


Figure 21. Incidence of Left Main Coronary Artery Disease

Left main stem disease may be associated with poorer outcomes following coronary artery surgery. In the UK, only 21% of patients undergoing CABG in 2003 had LMS disease. Our figure of 33% indicates a higher prevalence of LMS disease in our patient population, with the potential consequences relating to the outcome. Heart function (ejection fraction) remains one of the most important predictors of postoperative outcome. Thirty-four per cent of our patients undergoing CABG had moderate or poor left ventricular function. This figure is very similar to other reported figures (UKCSR 32%).

Conduits for Coronary Artery Bypass Grafting

It is well recognized in the cardiac surgical community that, in general, arterial grafts are preferable to vein grafts, particularly when revascularising the left anterior descending coronary artery. Ninety-four per cent of our patients received one or more arterial grafts, usually the left internal mammary artery to the left anterior descending artery. This is an important factor in long-term outcome and compares well with the UK national figures (UKCSR 90%; UBHT 94.3%, 2005).

9. CABG Mortality and Risk-Adjusted Outcome

The average EuroSCORE for patients undergoing coronary artery bypass grafting compared to the score published in the UKCSR for the UK population is shown in Figure 22. The difference between a score of 3.7 and 3.4 is not significant, and once again it is interesting to see how closely the two populations mirror one another in terms of overall risk profiles.

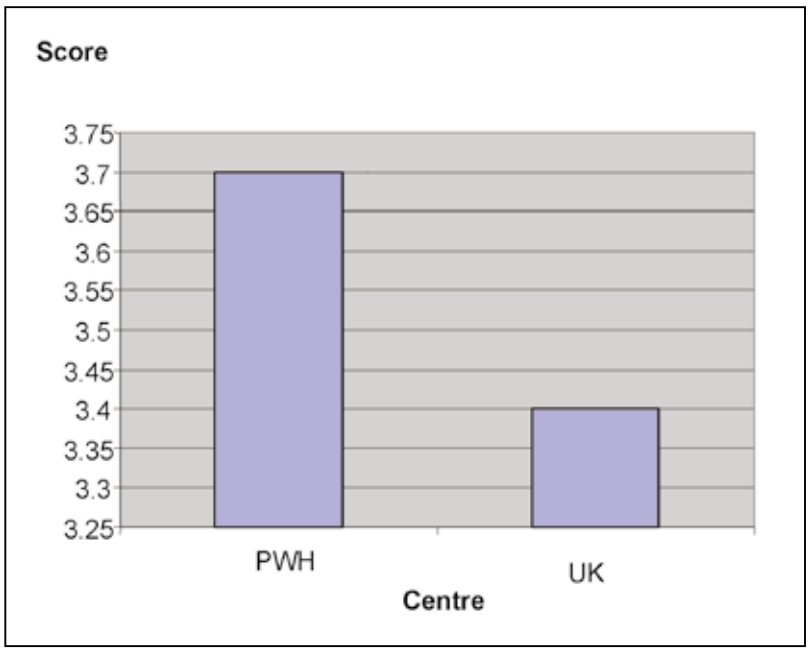


Figure 22. Additive EuroSCORE for Patients having CABG (vs UKCSR)

As stated previously, our overall crude mortality for coronary artery bypass grafting was 0.6% (one case), which is shown in comparison with UK crude data in the funnel plot in Figure 23.

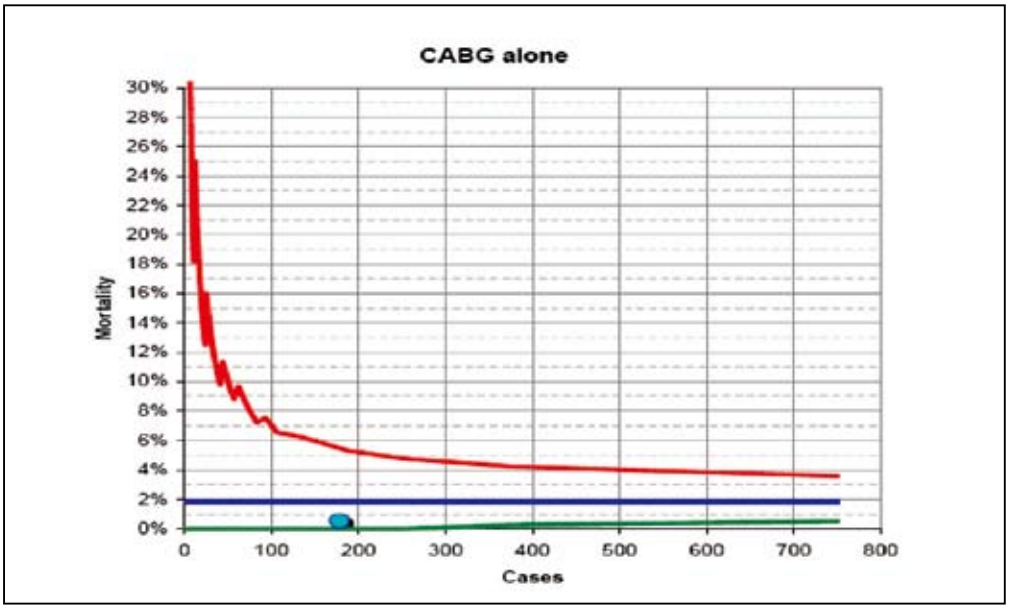


Figure 23. Funnel Plot of Crude CABG Mortality

PWH data, blue dot; UK, alert lines (see the explanatory note on p. 17).

The risk-adjusted CUSUM is shown in Figure 24, but with a small number of cases and low mortality it is difficult to draw conclusions.

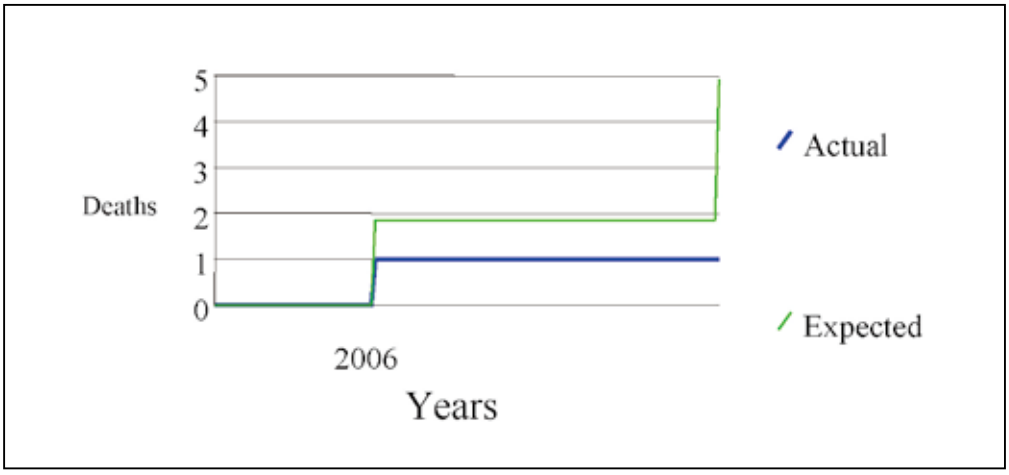


Figure 24. RA-CUSUM for CABG (Risk Predicted by Additive EuroSCORE)

Although the small numbers and low mortality mitigate against detailed risk and outcome analyses, we can be reassured that the overall performance of the cardiac unit is excellent and that the data collected will prove useful for future benchmarking and performance assessment, becoming yet more noteworthy as data accumulates over time.

Summary

1 In this first annual report we have implemented a data collection process that has allowed us to verify the accuracy of the additive and logistic EuroSCORE in predicting outcomes for our patient population.

2 When all cardiac surgical activity is analysed, the risk-adjusted outcomes indicate that we are performing better than predicted by this scoring system.

3 Outcomes additional to mortality are excellent, and we have benchmarked postoperative morbidity against international standards.

4 We have produced risk scores which suggest we are operating on patients of similar risk to that of populations in the United Kingdom Database and UBHT.

5 We have shown that in terms of overall activity we perform fewer coronary artery bypass grafting operations and more valve operations than do comparative units in the UK.

6 There are few re-operations within our cohort of patients, which is in keeping with the developing practice of a relatively new unit.

7 We have recorded detailed demographic data describing our population of patients undergoing coronary artery bypass grafting which show similarities between our population and the UK population in terms of impairment of preoperative left ventricular function, previous myocardial infarction and incidence of previous PCTA, and differences in terms of the higher incidence of diabetes and LMS disease in our cohort.

8 We have shown that the risk-adjusted outcome for the subset of patients undergoing CABG is excellent.

References

1) Keogh BE, Kinsman R. *Fifth National Adult Cardiac Surgical Database Report 2003*. London: The Society of Cardiothoracic Surgeons of Great Britain and Ireland 2003.
http://www.scts.org/documents/PDF/5thBlueBook2003.pdf

2) Bristol Royal Infirmary and University of Bristol Directorate of Cardiothoracic Services, *Adult Cardiac Surgery Audit Report 2004-2005*.
http://www.ubht.nhs.uk/mainreports/ACSAR2004-05.pdf

3) Roques F, Nashef SA, Michel P, Gauducheau E, de Vincentiis C, Baudet E, Cortina J, David M, Faichney A, Gabrielle F, Gams E, Harjula A, Jones MT, Pintor PP, Salamon R, Thulin L. Risk factors and outcome in European cardiac surgery: analysis of the EuroSCORE multinational database of 19030 patients. *Eur J Cardiothorac Surg*. 1999;15(6):816-22.
http://www.euroscore.org/calc.html

Acknowledgements

Associated Professionals

The activity and outcomes presented in this report demonstrate par excellence the benefits of teamwork. The performance of the cardiac unit would not have been possible without a wide range of associated personnel, including cardiology, anaesthetic and intensive care colleagues, junior medical colleagues, ward, intensive care and theatre nurses, perfusionists, physiotherapists, pharmacists, blood bank technicians, laboratory technicians and many other support personnel. Outcomes and service provision in this and future reports reflect the input of all these professionals.

International Advisers

We would like to thank Professor Sir B Keogh for reading, commenting on and agreeing to write the foreword for this first report as well as his site visit and advice regarding future progress. Mr AJ Bryan, Consultant Cardiac Surgeon, Lead Clinician and Cardiac Audit Lead, Bristol Royal Infirmary, Bristol, UK and Mr B Bridgewater, Consultant Cardiac Surgeon, Clinical Director of Cardiac Surgery, Trust Director of Clinical Audit, Wythenshawe Hospital, Manchester UK read and commented on the outcome analysis and we are grateful for their structured advice.

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COMMERCE, INDUSTRY AND TECHNOLOGY BUREAU THE GOVERNMENT OF THE HONG KONG SPECIAL ADMINISTRATIVE REGION.

Appendix 1

Minimum Dataset for the Society of Cardiothoracic Surgeons of Great Britain and Ireland (Page 1)

The Society of Cardiothoracic Surgeons of Great Britain and Ireland
National Adult Cardiac Surgical Database

version 3.8 page 1

This form is designed so that questions requiring a single response are identified with round radio-buttons next to the options, whereas questions where more than one response may be selected are identified by square tick-boxes next to the options

Local patient identifier		Date & time of operation	DD/MM/YYYY HH:MMM
NHS number		Birth date	DD/MM/YYYY
Patient name (Surname)		Patient gender	○ 1. Male ○ 2. Female
Patient name (Forename)		Postcode of usual address	

Admission details

Admission date	DD/MM/YYYY	Administrative category	○ 1. NHS ○ 2. Private

Cardiac history

Angina status pre-surgery	○ 0. No angina ○ 1. No limitation of physical activity ○ 2. Slight limitation of ordinary activity ○ 3. Marked limitation of ordinary physiacl activity ○ 4. Symptoms at rest or minimal activity
Dyspnoea status pre-surgery	○ 1. No limitation of physical activity ○ 2. Slight limitation of ordinary activity ○ 3. Marked limitation of ordinary physiacl activity ○ 4. Symptoms at rest or minimal activity
Number of previous MIs	○ 0. None ○ 2. Two or more ○ 1. One ○ 9. Not known
Interval between surgery and last MI	○ 0. No previous MI ○ 1. MI <6 hours ○ 4. MI 8-21 days ○ 2. MI 6-24 hours ○ 5. MI 22-90 days ○ 3. MI 1-7 days ○ 6. MI >90 days

Previous interventions

Previous PCI	○ 0. No previous PCI ○ 2. PCI >24 hours before surgery; same admission ○ 1. PCI <24 hours before surgery ○ 3. PCI >24 hours before surgery; previous admission
Date of last PCI	DD/MM/YYYY
Previous cardiac, vascular or thoracic surgical interventions	○ 0. No previous surgery ☐ 1. CABG ☐ 5. Aortic surgery - ascending or arch ☐ 2. Valve ☐ 6. Aortic surgery - descending or abdominal ☐ 3. Congenital cardiac ☐ 7. Other thoracic ☐ 4. Other cardiac ☐ 8. Carotid endarterectomy ☐ 9. Other peripheral vascular
Date of last cardiac op'n	DD/MM/YYYY

Risk factors for the acquisition of coronary disease

Diabetes management	○ 0. Not diabetic ○ 2. Oral therapy ○ 1. Diet ○ 3. Insulin
Cigarette smoking history	○ 0. Never smoked ○ 1. Ex-smoker ○ 2. Current smoker
History of hypertension	○ 0. No hypertension ○ 9. Unknown ○ 1. Treated or BP >140/90 on >1 occasion prior to admission

This dataset **became** operational on 1 April 2003; Full definitions for all data items may be found at www.scts.org; numbering for each of the questions and options within each question may be found at www.ccad.org.uk/ccadweb.nsf

Minimum Dataset for the Society of Cardiothoracic Surgeons of Great Britain and Ireland (Page 2)

The Society of Cardiothoracic Surgeons of Great Britain and Ireland
National Adult Cardiac Surgical Database

version 3.8 page 2

This form is designed so that questions requiring a single response are identified with round radio-buttons next to the options, whereas questions where more than one response may be selected are identified by square tick-boxes next to the options

Local patient identifier | Date & time of operation: DD/MM/YYYY HH:MMM

Additional medical history and risk factors

Renal disease at the time of surgery
- ○ 0. No renal disease
- ☐ 1. Functioning transplant
- ☐ 2. Creatinine >200µmol /l
- ☐ 3. Dialysis: Acute renal failure; onset within 6 weeks of cardiac surgery
- ☐ 4. Dialysis: Chronic renal failure; more than 6 weeks prior to cardiac surgery
- ☐ 9. Unknown

History of pulmonary disease
- ○ 0. No pulmonary disease
- ○ 2. COAD / Emphysema
- ○ 2. Asthma

History of neurological disease
- ○ 0. No history of neurological disease
- ☐ 1. TIA or RIND
- ☐ 2. CVA with full recovery
- ☐ 3. CVA with residual deficit

History of neurolgocial dysfunction
- ○ 0. No
- ○ 1. Yes

Carotid bruits
- ○ 0. No
- ○ 1. Yes

Extracardiac arteriopathy
- ○ 0. No
- ○ 1. Yes

Pre-operative heart rhythm
- ○ 0. Sinus rhythm
- ○ 1. Atrial fibrillation/flutter
- ○ 2. Complete heart block/pacing
- ○ 3. Ventricular fibrillation or ventricular tachycardia
- ○ 4. Other abnormal rhythm

Cardiac investigations

Left or right heart catheterisation
- ○ 0. Never
- ☐ 1. This admission
- ☐ 2. Previous admission

Date of last catheterisation: DD/MM/YYYY

Extent of coronary vessel disease
- ○ 0. No vessel with >50% diameter stenosis
- ○ 1. One vessel with >50% diameter stenosis
- ○ 2. Two vessels with >50% diameter stenosis
- ○ 3. Three vessels with >50% diameter stenosis
- ○ 9. Not investigated

Left main stem disease
- ○ 0. No LMS disease or LMS disease <=50% diameter stenosis
- ○ 1. LMS disease >50% diameter stenosis
- ○ 9. Not investigated

PA systolic: mmHg; value if known | **LVEDP**: mmHg; value if known

Aortic valve gradient: mmHg; value if known | **Mean PAWP / LA pressure**: mmHg; value if known

Ejection fraction category
- ○ 1. Good (LVEF>50%)
- ○ 2. Fair (LVEF 30-50%)
- ○ 3. Poor (LVEF <30%)
- ○ 9. Not measured

Ejection fraction value: value if known

Pre-operative status and support

Intravenous nitrates or any heparin
- ○ 0. No
- ○ 1. Until operation
- ○ 2. Within one week of operation

Cardiogenic shock (Pre-operation)
- ○ 0. No
- ○ 1. Yes

Ventilated preop
- ○ 0. No
- ○ 1. Yes

Intravenous inotropes prior to anaesthesia
- ○ 0. No
- ○ 1. Yes

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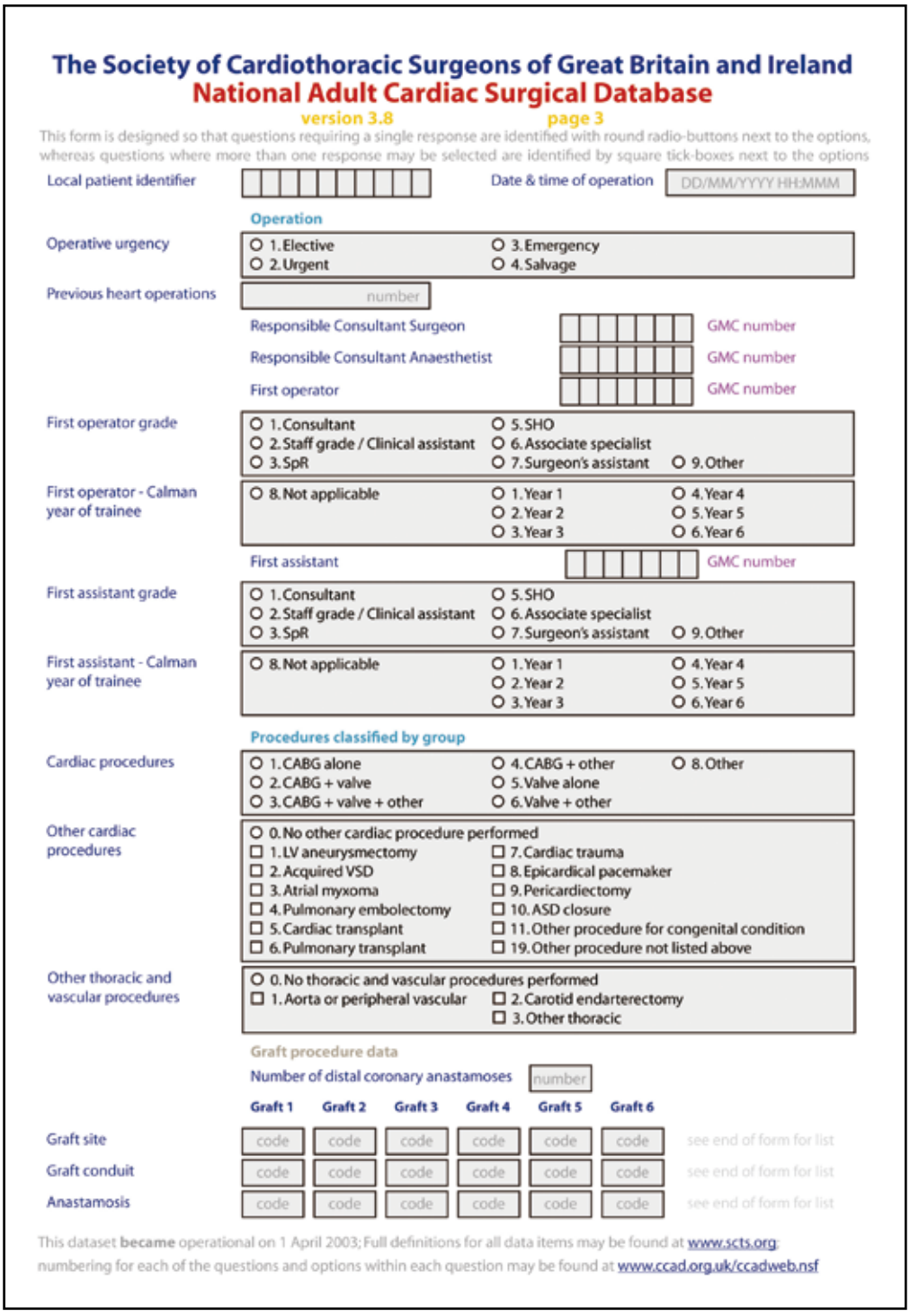
Minimum Dataset for the Society of Cardiothoracic Surgeons of Great Britain and Ireland (Page 3)



The Society of Cardiothoracic Surgeons of Great Britain and Ireland
National Adult Cardiac Surgical Database
version 3.8 page 3

This form is designed so that questions requiring a single response are identified with round radio-buttons next to the options, whereas questions where more than one response may be selected are identified by square tick-boxes next to the options

Local patient identifier

Date & time of operation DD/MM/YYYY HH:MMM

Operation

Operative urgency
- 1. Elective
- 2. Urgent
- 3. Emergency
- 4. Salvage

Previous heart operations number

Responsible Consultant Surgeon GMC number

Responsible Consultant Anaesthetist GMC number

First operator GMC number

First operator grade
- 1. Consultant
- 2. Staff grade / Clinical assistant
- 3. SpR
- 5. SHO
- 6. Associate specialist
- 7. Surgeon's assistant
- 9. Other

First operator - Calman year of trainee
- 8. Not applicable
- 1. Year 1
- 2. Year 2
- 3. Year 3
- 4. Year 4
- 5. Year 5
- 6. Year 6

First assistant GMC number

First assistant grade
- 1. Consultant
- 2. Staff grade / Clinical assistant
- 3. SpR
- 5. SHO
- 6. Associate specialist
- 7. Surgeon's assistant
- 9. Other

First assistant - Calman year of trainee
- 8. Not applicable
- 1. Year 1
- 2. Year 2
- 3. Year 3
- 4. Year 4
- 5. Year 5
- 6. Year 6

Procedures classified by group

Cardiac procedures
- 1. CABG alone
- 2. CABG + valve
- 3. CABG + valve + other
- 4. CABG + other
- 5. Valve alone
- 6. Valve + other
- 8. Other

Other cardiac procedures
- 0. No other cardiac procedure performed
- 1. LV aneurysmectomy
- 2. Acquired VSD
- 3. Atrial myxoma
- 4. Pulmonary embolectomy
- 5. Cardiac transplant
- 6. Pulmonary transplant
- 7. Cardiac trauma
- 8. Epicardical pacemaker
- 9. Pericardiectomy
- 10. ASD closure
- 11. Other procedure for congenital condition
- 19. Other procedure not listed above

Other thoracic and vascular procedures
- 0. No thoracic and vascular procedures performed
- 1. Aorta or peripheral vascular
- 2. Carotid endarterectomy
- 3. Other thoracic

Graft procedure data

Number of distal coronary anastamoses number

	Graft 1	Graft 2	Graft 3	Graft 4	Graft 5	Graft 6	
Graft site	code	code	code	code	code	code	see end of form for list
Graft conduit	code	code	code	code	code	code	see end of form for list
Anastamosis	code	code	code	code	code	code	see end of form for list

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Minimum Dataset for the Society of Cardiothoracic Surgeons of Great Britain and Ireland (Page 4)

The Society of Cardiothoracic Surgeons of Great Britain and Ireland
National Adult Cardiac Surgical Database

version 3.8 page 4

This form is designed so that questions requiring a single response are identified with round radio-buttons next to the options, whereas questions where more than one response may be selected are identified by square tick-boxes next to the options

Local patient identifier | Date & time of operation: DD/MM/YYYY HH:MM

Valve procedure data incorporating the UK Heart Valve Registry fields

Number of valves replaced/repaired: number

	Aortic valve	Mitral valve	Tricuspid valve	Pulmonary valve
Haemodynamic pathology	1. Stenosis 2. Regurgitation 3. Mixed	1. Stenosis 2. Regurgitation 3. Mixed	1. Stenosis 2. Regurgitation 3. Mixed	1. Stenosis 2. Regurgitation 3. Mixed
Explant type	1. Native valve 2. Mechanical 3. Biological 4. Homograft 5. Autograft 6. Ring	1. Native valve 2. Mechanical 3. Biological 4. Homograft 5. Autograft 6. Ring	1. Native valve 2. Mechanical 3. Biological 4. Homograft 5. Autograft 6. Ring	1. Native valve 2. Mechanical 3. Biological 4. Homograft 5. Autograft 6. Ring
Native valve pathology	code	code	code	code
Other native valve pathology	enter as text	enter as text	enter as text	enter as text
Reason for repeat valve replacment	1. Thrombosis 2. Dehiscence 3. Embolism 4. Infection 5. Intrinsic valve failure 6. Haemolysis 19. Other reason	1. Thrombosis 2. Dehiscence 3. Embolism 4. Infection 5. Intrinsic valve failure 6. Haemolysis 19. Other reason	1. Thrombosis 2. Dehiscence 3. Embolism 4. Infection 5. Intrinsic valve failure 6. Haemolysis 19. Other reason	1. Thrombosis 2. Dehiscence 3. Embolism 4. Infection 5. Intrinsic valve failure 6. Haemolysis 19. Other reason
Other reason for repeat valve replacement	enter as text	enter as text	enter as text	enter as text
Valve procedure	1. Replacement 2. Repair	1. Replacement 2. Repair	1. Replacement 2. Repair	1. Replacement 2. Repair
Implant type	2. Mechanical 3. Biological 4. Homograft 5. Autograft	2. Mechanical 3. Biological 4. Homograft 6. Annuloplasty ring	2. Mechanical 3. Biological 4. Homograft 6. Annuloplasty ring	2. Mechanical 3. Biological 4. Homograft
Implant prosthesis name	HVR prosthesis code	HVR prosthesis code	HVR prosthesis code	HVR prosthesis code
Valve prosthesis model				
Valve serial number				
Valve size	mm	mm	mm	mm

Aorta procedure data

Number of aorta segments operated on: number

	Root	Asecending	Arch	Descending	Abdominal	
Aortic pathology	code	code	code	code	code	see end of form for list
Aortic procedure	code	code	code	code	code	see end of form for list

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Minimum Dataset for the Society of Cardiothoracic Surgeons of Great Britain and Ireland (Page 5)

The Society of Cardiothoracic Surgeons of Great Britain and Ireland
National Adult Cardiac Surgical Database

version 3.8 page 5

This form is designed so that questions requiring a single response are identified with round radio-buttons next to the options, whereas questions where more than one response may be selected are identified by square tick-boxes next to the options

Local patient identifier | Date & time of operation: DD/MM/YYYY HH:MMM

Perfusion and myocardial protection

Cardiopulmonary bypass	○ 0. No	○ 1. Yes	
Predominant method of myocardial protection	○ 0. Non-cardioplegic ○ 1. Cardioplegia		
Cardioplegia - Solution	○ 8. Not applicable	○ 1. Blood	○ 2. Crystalloid
Cardioplegia - Temperature	○ 8. Not applicable	☐ 1. Cold	☐ 2. Warm
Cardioplegia - Infusion mode	○ 8. Not applicable	☐ 1. Antegrade	☐ 2. Retrograde
Cardioplegia - Timing	○ 8. Not applicable	○ 1. Intermittent	○ 2. Continuous
Non-cardioplegic myocardial protection	○ 8. Not applicable ○ 1. Aortic cross-clamping with fibrillation ○ 2. Fibrillation with perfusion ○ 3. Cross-clamp with direct coronary perfusion ○ 4. Cross-clamp and beating heart ○ 5. Beating heart without cross-clamp		
Intra-Aortic Balloon Pump used	○ 0. Not used ☐ 1. Pre-operatively	☐ 2. Intra-operatively ☐ 3. Post-operatively	
Reason for IABP use	○ 0. Not used ○ 1. Haemodynamic instability ○ 2. Unstable angina	○ 3. CPB wean ○ 4. Prophylactic	

Height	cm	Weight	kg
Cumulative bypass time	min	Cumulative cross clamp time	min
Total circulatory arrest time	min		

Post-operative course

Reoperation	○ 0. No re-operation required ☐ 1. Re-operation for bleeding or tamponade ☐ 2. Re-operation for valvular problems ☐ 3. Re-operations for graft problems ☐ 4. Re-operation for other cardiac problems ☐ 5. Sternum resuturing (sterile) ☐ 6. Surgery for deep sternal wound problem		
New post-operative stroke	○ 0. None ○ 1. Transient stroke ○ 2. Permenant stroke	New haemofiltration or dialysis post-operatively	○ 0. No ○ 1. Yes
Discharge destination from cardiothoracic ward	○ 4. Not applicable - patient deceased ○ 1. Home	○ 2. Convalescence ○ 3. Other hospital	
Patient status at discharge	○ 0. Alive	○ 1. Dead	
Date of discharge / Date of death	DD/MM/YYYY		

This dataset **became** operational on 1 April 2003; Full definitions for all data items may be found at www.scts.org; numbering for each of the questions and options within each question may be found at www.ccad.org.uk/ccadweb.nsf

Appendix 2

Definitions used in the EuroSCORE Calculation

Notes

[1] **Chronic pulmonary disease** Long term use of bronchodilators or steroids for lung disease

[2] **Extracardiac arteriopathy** One or more of claudication, carotid occlusion or >50% stenosis, previous or planned intervention on the abdominal aorta, limb arteries or carotids

[3] **Neurological dysfunction** Disease severely affecting ambulation or day-to-day functioning

[4] **Active endocarditis** Patient still on antibiotic treatment for endocarditis at time of surgery

[5] **Critical preoperative state** Ventricular tachycardia / ventricular fibrillation or aborted sudden death, preoperative cardiac massage, preoperative ventilation before anaesthetic room, preoperative inotropes or IABP, preoperative acute renal failure (anuria or oliguria <10ml/hr)

[6] **Unstable angina** Rest angina requiring i.v. nitrates until arrival in anaesthetic room

[7] **Recent MI** Myocardial infarction within 90 days

[8] **Pulmonary hypertension** Systolic pulmonary artery pressure >60mmHg

[9] **Emergency** Operation before beginning of next working day

Appendix 3

Mortality Form

CONFIDENTIAL

Cardiac Services Prince of Wales Hospital

Mortality Case Review Form

Age	yrs		Gender	Male Female
Operative priority	Elective	Urgent	Emergency	Salvage
Procedure date				
Review date				
Diagnosis & Procedure *(if inoperable please state why)*				
Pre-procedure complications *(Write 'NIL' if none)*				
Post-procedure complications *(Write 'NIL' if none)*				
Cause of death				
Post mortem?	No	Yes		
Critical Incident?	No	Yes		
Complaint made?	No	Yes		
Source of contributory procedural error *(tick all that apply)*	No procedural errors	Incorrect treatment, drug or dose	Adverse drug reaction	Equipment failure
	Observational failure	Communications failure	Intervention too late	
Course of key events				
What differing course of action may have been taken to potentially avoid this death? *(Write 'NIL' if none)*				
Recommendations for change *(Write 'NIL' if none)*				
Staff responsible for managing change				
Implementation deadline				
Completed by *(Please print name, date and sign)*				

Version 1.3

Appendix 4

EuroSCORE Calculator from the PWH-CUHK Cardiac Database Showing Valid Fields

EuroSCORE

Factors	Response	Score	Logistic score
Age	105	10	3.132
Gender	Male	0	0
Chronic pulmonary disease	No Source Data	No Source Data	No Source Data
Extra-cardiac arteriopathy	No Source Data	No Source Data	No Source Data
Neurological dysfunction	No Source Data	No Source Data	No Source Data
Previous cardiac surgery	No Source Data	No Source Data	No Source Data
Serum creatinine >200 µmol/l	No Source Data	No Source Data	No Source Data
Active endocarditis	No	0	0
Critical preoperative state	No Source Data	No Source Data	No Source Data
Unstable angina	No Source Data	No Source Data	No Source Data
LV dysfunction	No Source Data	No Source Data	No Source Data
Recent myocardial infarction	No Source Data	No Source Data	No Source Data
Pulmonary hypertension	No Source Data	No Source Data	No Source Data
Emergency procedure	No Source Data	No Source Data	No Source Data
Other than isolated CABG	No Source Data	No Source Data	No Source Data
Surgery on thoracic aorta	No Aortic Arch Procedure	0	0
Post infarct septal rupture	No Source Data	No Source Data	No Source Data
Additive EuroSCORE:	Missing data, unable to calculate score		
Logistic EuroSCORE:	Missing data, unable to calculate score		

Text printed on recycled paper with soy-based ink