

# Coronary artery bypass surgery in the elderly: is it worthwhile?

Alexander Manché

## Abstract

**Objectives:** To evaluate the early outcomes after coronary surgery in the elderly.

**Methods:** A retrospective analysis (April 1995-January 2012) of mortality, morbidity and hospital stay, derived from a single surgeon's practice. Outcomes of patients over 70 (group A,  $n=785$ ) were compared with those of controls under 70 (group B,  $n=2772$ ).

**Results:** Intervention rate was significantly higher ( $1502/10^6$  vs  $467/10^6$ ,  $p<0.0001$ ). There were significantly fewer single and quintuple grafts, and significantly more double grafts in group A. The use of an internal thoracic artery (ITA) was lower in group A ( $748/785$ , 95.3% vs  $2695/2772$ , 97.2%,  $p=0.006$ ). Mortality for the entire coronary surgical practice was 1.2%. The overall mortality was 2.7% in group A and 0.8% in group B ( $p<0.0001$ ). Freedom from any post-operative complication occurred in 57.7% in group A and in 75.6% in group B ( $p<0.0001$ ). Cardiac complications (except for perioperative MI and atrial flutter) were significantly higher in group A, as were major neurological, renal and respiratory complications, as well as minor wound complications.

All complications resulted in patient morbidity but cerebrovascular accident had the worst impact, contributing to perioperative death in 8 of the 18 cases in group A and in 4 of the 24 cases in group B ( $p=0.049$ ). Average length of stay on intensive care was similar ( $1.19\pm 1.84$  days for group A and  $1.13\pm 1.48$  days for group B,  $p=0.38$ ). The average HDU stay was longer in group A ( $1.43\pm 2.70$  vs  $0.95\pm 3.68$  days,  $p=0.006$ ) as was the average ward stay ( $4.00\pm 3.33$  vs  $3.25\pm 2.23$  days,  $p<0.0001$ ).

**Conclusions:** Although mortality and morbidity remain significantly higher, taken in the context of the overall clinical problem, cardiac surgery has much to offer in this select group of patients.

## Keywords

Coronary surgery, elderly, outcome

## Introduction

Life expectancy and the demand for a meaningful and satisfying quality of life are increasing steadily every year. At the millennium Maltese males could expect to reach the age of 75 and females that of 79 years.<sup>1</sup> Twelve years later these figures increased to 78 and 82 years respectively.<sup>2</sup> This, in large part, reflects a higher standard of living with its attendant improved health care facilities. The treatment of cardiovascular disease, one of the major contributors to premature death, plays a role in achieving this goal.<sup>3</sup> Physicians' and patients' attitudes are evolving with the realisation that surgery can achieve a worthwhile improvement in longevity and quality of life with acceptable morbidity.<sup>4</sup> Suffice it to say that 30 years ago patients over 65 were likely to be refused admission to an intensive care facility because of their age, and yet 28% of local patients were over 70 at the time of their coronary bypass surgery in 2011.

Alexander Manché MPhil, FRCS(CTh), FETCS  
Department of Cardiac Services  
Mater Dei Hospital  
manchea@maltanet.net

## Patients and methods

A retrospective analysis of a single surgeon's coronary patient population was undertaken, from the start of the local cardiac surgical service in Malta in April 1995 until January 2012 ( $n=3557$ ). For the purposes of this study elderly patients were defined as those over 70 years old (group A,  $n=785$ ) and their data and outcomes were compared with those of patients under the age of 70 (group B,  $n=2772$ ). Patients were referred for surgery on the basis of the clinical picture and coronary angiography. The decision to operate was determined by the suitability for surgical correction, the symptomatic class as well as the possible prognostic benefit attributed to the procedure. Although projected increased longevity from surgery played a major role in group B, it has been increasingly applied to group A, particularly in the absence of serious co-morbid conditions. The possible risk/benefit assessment of surgery was openly discussed with the patient before a decision to proceed was taken. Risk stratification was calculated in all patients, using the Parsonnet score for the entire study period and the EuroSCORE for the years 2000-2011.

Peri-operative death was defined as death within 30 days of surgery or at any time during the postoperative in-hospital stay. Complications were classified according to system and further assigned to a major or minor category (Table 1).

**Table 1: Complications by system**

System	complication	group A (n=785)		group B (n=2772)		p value
		n	%	n	%	
cardiac	major	61	7.3	96	2.9	<0.0001
	IABP	33	3.9	60	2.2	0.002
	peri-operative MI	4	0.5	10	0.4	0.56
	permanent pacemaker	6	0.7	4	0.2	0.004
	ventricular arrhythmia	18	2.3	22	0.8	0.0004
	minor	394	50.2	698	25.2	<0.0001
	inotropes >24hr	218	27.8	402	14.5	<0.0001
	atrial fibrillation	165	21.0	260	9.4	<0.0001
	atrial flutter	11	1.4	36	1.3	0.82
neurological	major					
	CVA/RIND (>24hr)	18	2.3	24	0.9	0.001
	minor	8	1.0	19	0.8	0.34
	transient ischaemic attack	5	0.6	10	0.4	0.29
	confusion	1	0.1	7	0.3	0.51
peripheral neuropathy	2	0.3	2	0.1	0.18	
renal	major					
	dialysis	41	5.2	44	1.6	<0.0001
	minor					
doubling of creatinine	20	2.5	51	1.8	0.21	
gastro-intestinal	major					
	abdominal catastrophe	3	0.4	5	0.2	0.29
	minor					
haemorrhage	9	1.1	23	0.8	0.41	
respiratory	major					
	ventilation >24hr	23	2.9	44	1.6	0.02
	minor	18	2.3	40	1.4	0.10
	chest infection	9	1.1	26	0.9	0.60
chest drainage	9	1.1	14	0.5	0.06	
infective	major					
	septicaemia/endocarditis	12	1.6	31	1.2	0.35
	minor	6	0.8	16	0.6	0.55
	major wound infection	6	0.8	15	0.6	0.47
	minor					
minor wound infection	25	3.2	52	1.9	0.03	

Complications were recorded by attending medical staff on a daily ward round and entered into the database when the patient was discharged from hospital.

## Clinical protocol

### Cardiac

Drugs were not routinely used as prophylaxis for atrial fibrillation. All preoperative drugs were continued until surgery except Aspirin and Clopidogrel, which were stopped one week before when possible. The decision to use inotropic support was taken in the operating theatre on the basis of the preoperative ventriculogram and renal function, coupled with the prevailing haemodynamic status. The post-operative weaning of these drugs was also determined by the patient's clinical status. Swan-Ganz catheters were used selectively to monitor continuous cardiac output and venous saturation, as well as other derived parameters. Intra-aortic balloon counterpulsation was employed when inotropic support coupled with appropriate preload and afterload manipulation were insufficient to achieve a stable haemodynamic situation. The diagnosis of peri-operative myocardial infarction was made on the basis of new Q waves on the 12 lead ECG coupled with the clinical picture. A permanent pacemaker was implanted for 2nd or 3rd degree heart block following a suitable period of observation.

### Neurological

Cerebrovascular accident (CVA) with permanent sequelae as well as reversible ischaemic neurological deficit (RIND) lasting more than 24 hours were classified as major neurological complications. Transient ischaemic attack (TIA), with complete recovery within 24 hours, was classified as a minor complication but was investigated and treated appropriately. Post-operative confusional state and peripheral neuropathy were also included as minor neurological complications. Preoperative carotid Doppler study, followed by angiography where appropriate, was performed in the presence of a carotid bruit, history of CVA or TIA or the presence of peripheral vascular disease and concomitant carotid endarterectomy performed when indicated.

### Renal

When renal impairment was present preoperatively every effort was made to achieve an optimal haemodynamic state in order to maintain adequate glomerular filtration rate. Temporary hyperkalaemia was treated with insulin/dextrose infusion and/or oral calcium resonium. Haemodialysis was instituted when these measures failed to maintain fluid, electrolyte and pH balance.

**Gastrointestinal**

Ranitidine or omeprazole were used prophylactically when there was a clear history of peptic ulcer disease or gastritis documented by endoscopy. Aspirin was administered routinely, starting on the first post-operative day.

**Antibiotics**

Prophylactic antibiotics consisted of Cefuroxime 750mg iv. at induction and 2 subsequent doses at 8 hour intervals. Further antibiotics were administered according to the clinical picture and bacteriological results.

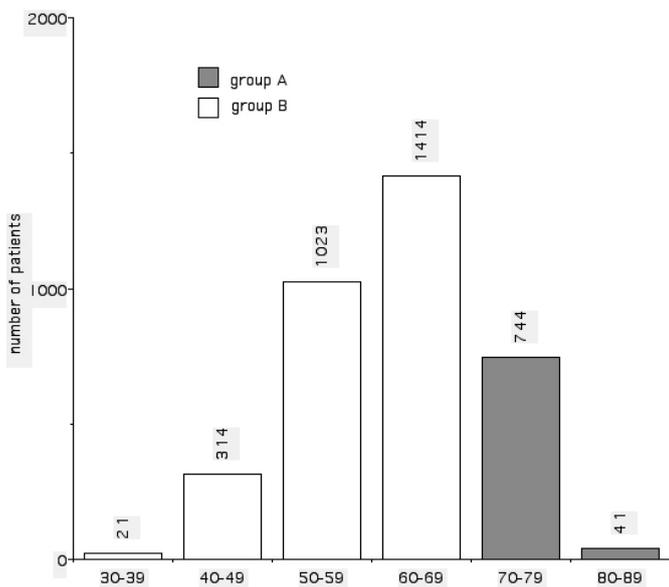
**Statistical analysis**

Statistical analysis was performed using Excel software (Microsoft, Redmond, USA, version 11.6.5 2004). Pearson's chi squared test and Fisher's exact test were used to assess differences between categorical variables. Chi squared test with Yates correction was used to calculate significance of trends. Students t test was used to assess differences between populations. Differences were considered significant for p values less than 0.05.

**Results**

**Age distribution**

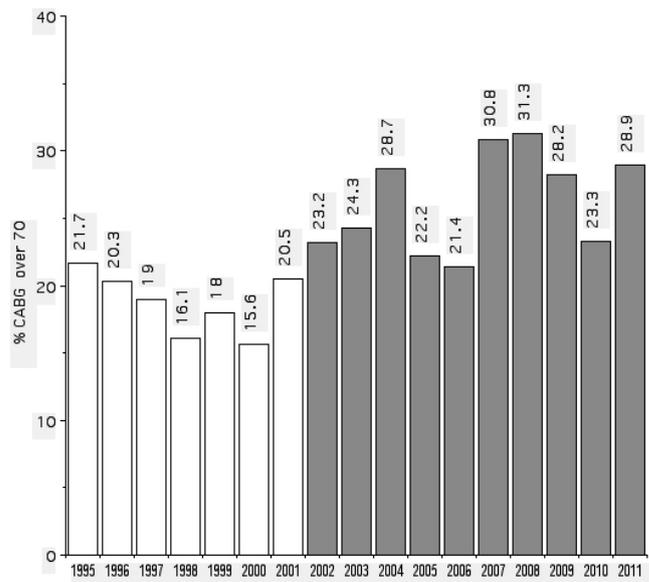
The age distribution for both groups is illustrated (Figure 1).



**Figure 1: Age distribution**

The mean age of the total surgical population was 61.9 years (61.0 in 1995, rising to 63.3 in 2011). The mean age±SD for group A was 73.5±3.21 and for group B was 58.6±7.21. The annual percentage of patients over 70 ranged from 15.6% to 31.3% (mean

23.1%). The mean for the years 1995-2001 was 18.7% and the mean for 2002-2011 was 26.2% (Figure 2).



**Figure 2: Annual percentage of patients over 70**

**Intervention rate**

The mean intervention rate up to 2001 (after which the service was increased to 3 consultants) was of 1502 per million per year in group A (population 30,735 at end December 1999) and 467 per million per year in group B (population 349,466,  $p<0.0001$ ).<sup>1</sup> Repeat operations were performed in 0.51% in group A and in 0.47% in group B ( $p=0.055$ ).

**Risk stratification**

The mean Parsonnet risk stratification score was 12.8 for group A and 4.4 for group B. This is in keeping with the increased incremental score attached to age exceeding 70, 75 and 80 years.<sup>5</sup> The trends in Parsonnet score with time in Group A and B are presented in Figures 3 and 4. The mean EuroSCORE risk stratification score was 4.8 for group A and 1.9 for group B. The trends for EuroSCORE, for the years 2000-2011, are presented in Figures 5 and 6.

**Grafting strategy**

Triple coronary artery bypass grafting was the commonest procedure (group A average 3.1 grafts per case, group B average 3.2). Figure 7 shows the graft distribution per case. There were significantly fewer single and quintuple grafts, and significantly more double grafts in group A. The use of an internal thoracic artery (ITA) was lower in group A (748/785, 95.3%) than in group B (2695/2772, 97.2%,  $p=0.006$ ).

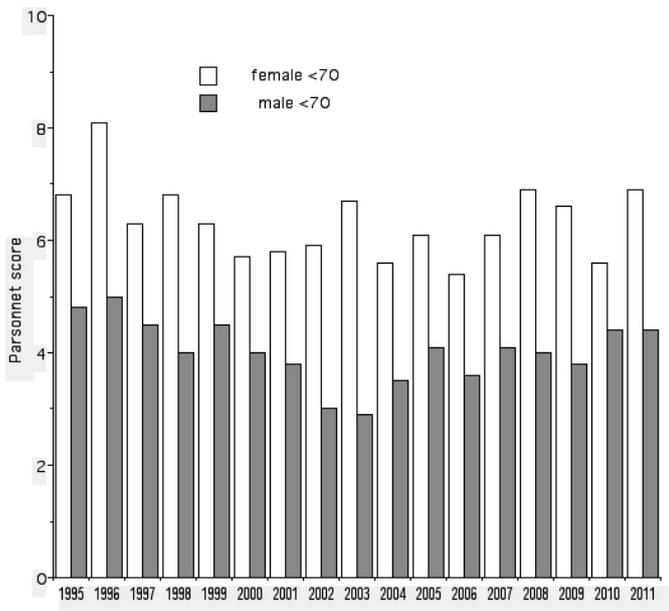


Figure 3: Parsonnet trends group A

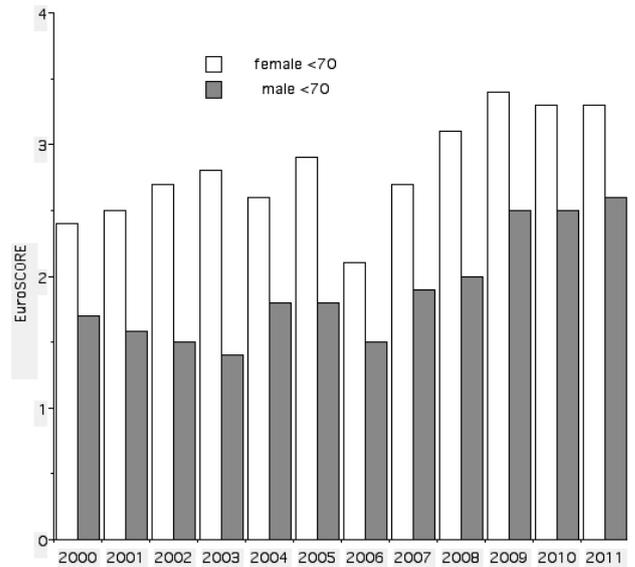


Figure 5: EuroSCORE trends group A

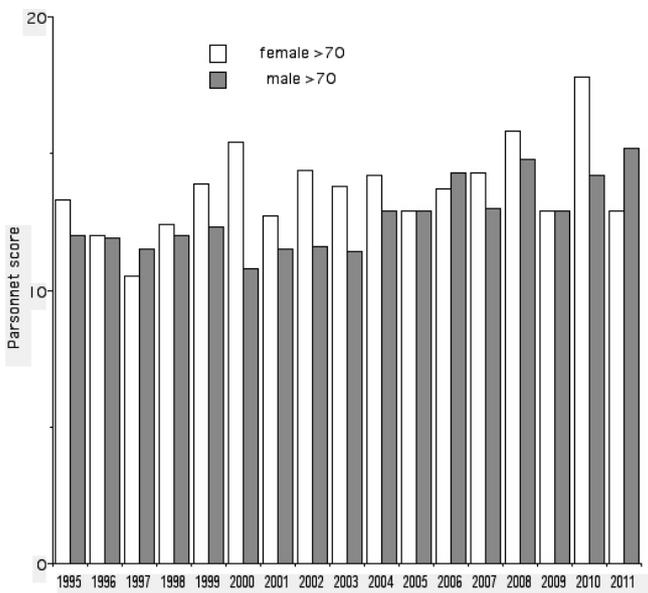


Figure 4: Parsonnet trends group B

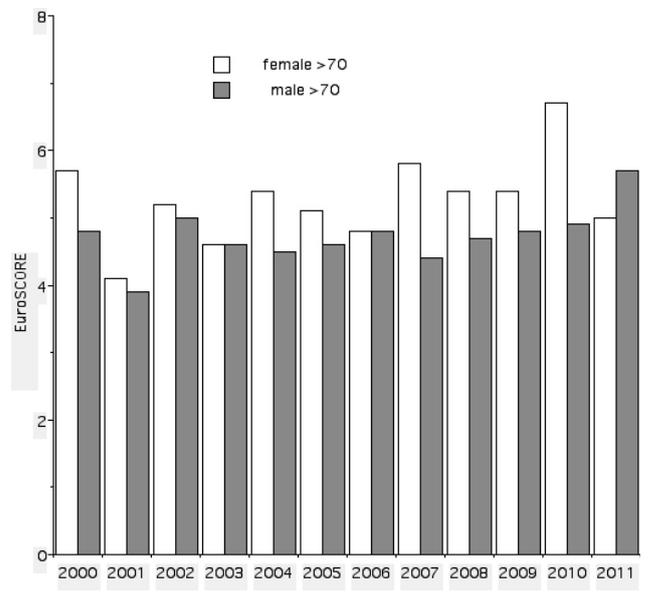


Figure 6: EuroSCORE trends group B

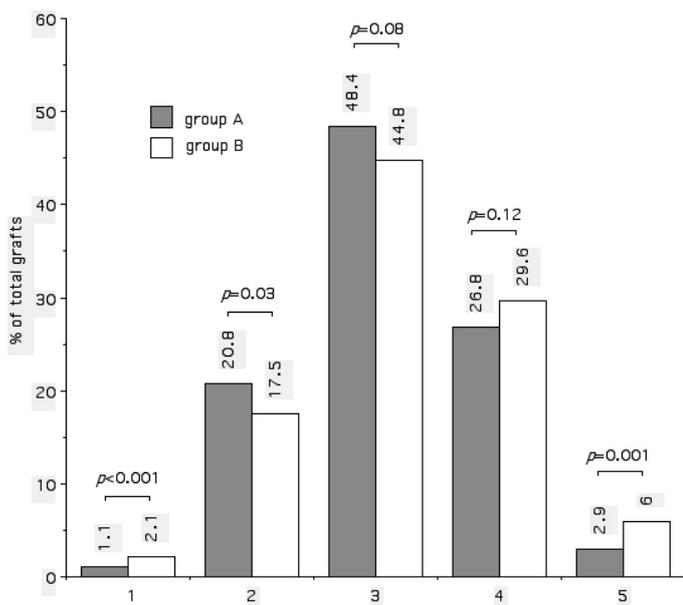


Figure 7: Percentage graft distribution

**Mortality**

Mortality for the entire coronary surgical practice was 1.2%. The overall mortality was 2.7% in group A and 0.8% in group B ( $p < 0.0001$ ). In 2006 and 2011 there was no mortality. In 11 of the remaining 15 years mortality was higher for group A (Figure 8).

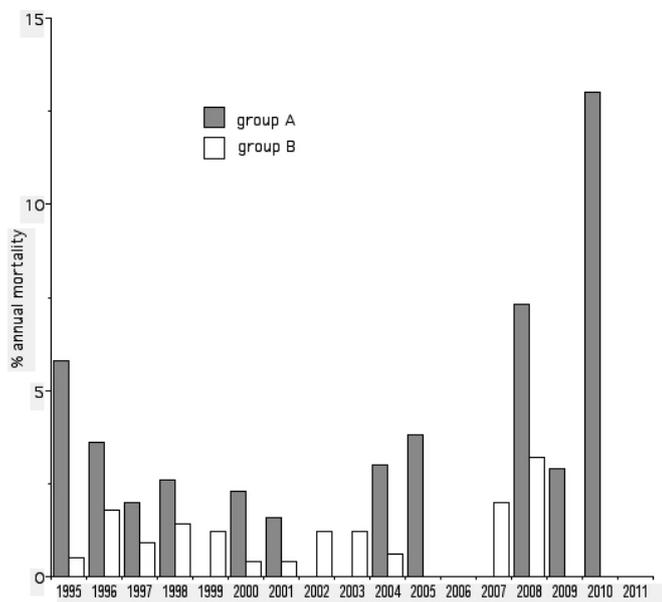


Figure 8: Percentage annual mortality

**Morbidity**

Cardiac complications (except for perioperative MI and atrial flutter) were significantly higher in group A, as were major neurological, renal and respiratory complications and minor wound complications (Table 1). These differences reached statistical significance in keeping with other studies.<sup>6-7</sup>

Freedom from any post-operative complication occurred in 57.7% in group A and in 75.6% in group B ( $p < 0.0001$ ). All complications resulted in patient morbidity but cerebrovascular accident had the worst impact in that it contributed to perioperative death in 8 of the 18 cases in group A and 4 of the 24 cases in group B ( $p = 0.049$ ). Other complications resolved with time and some patients required further treatment on an out-patient basis. No patient required long term dialysis.

Ninety six percent of patients who developed new atrial fibrillation were cardioverted before discharge; the remaining few were anticoagulated for three months, within which time they were successfully cardioverted. The incidence of this post-operative complication was comparable to that in other units employing perioperative pharmacologic prophylaxis.<sup>8-9</sup> Patients requiring a permanent pacemaker observed the usual follow-up protocol.

Gastrointestinal catastrophes secondary to ischaemic bowel and perforated diverticulitis were rare but uniformly fatal. Two cases of perforated duodenal ulcer underwent successful surgery. Gastroduodenal haemorrhage was commoner and was always treated conservatively.

The requirement for ventilation beyond 24 hours because of poor respiratory function was rare but significantly greater in group A.

**Hospital stay**

Figure 9 shows the post-operative hospital stay on the intensive care unit (ITU), high dependency unit (HDU) and the cardiac surgical ward (CSW). Average length of stay on intensive care was similar ( $1.19 \pm 1.84$  days for group A and  $1.13 \pm 1.48$  days for group B,  $p = 0.38$ ).

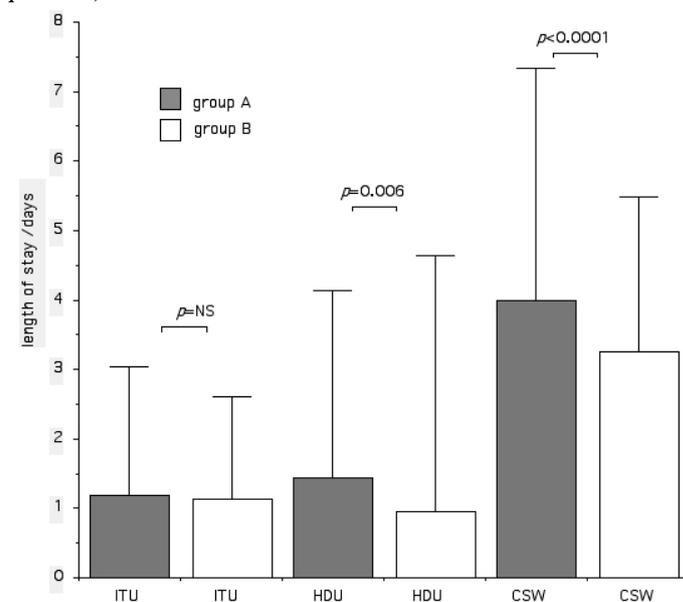


Figure 9: Hospital length of stay

The average HDU stay was longer in group A (1.43±2.70 vs 0.95±3.68 days,  $p=0.006$ ) as was the average CSW stay (4.00±3.33 vs 3.25±2.23 days,  $p<0.0001$ ).

### The very elderly

Figure 10 shows the trends in patients over 75 and over 80 in the female and male populations, expressed as a percentage of the total surgical populations for three consecutive 5 year periods (females in groups A and B, males in groups A and B). There was a significant increase in both female and male patients over 75 from the period 95-00 to 01-05 ( $p=0.0005$  for females,  $p=0.00003$  for males), and in male patients over 80 for the same period ( $p=0.006$ ). Although the trend remained upwards in recent years, with 19% of females and 11.9% of males over 75, the rise did not reach statistical significance.

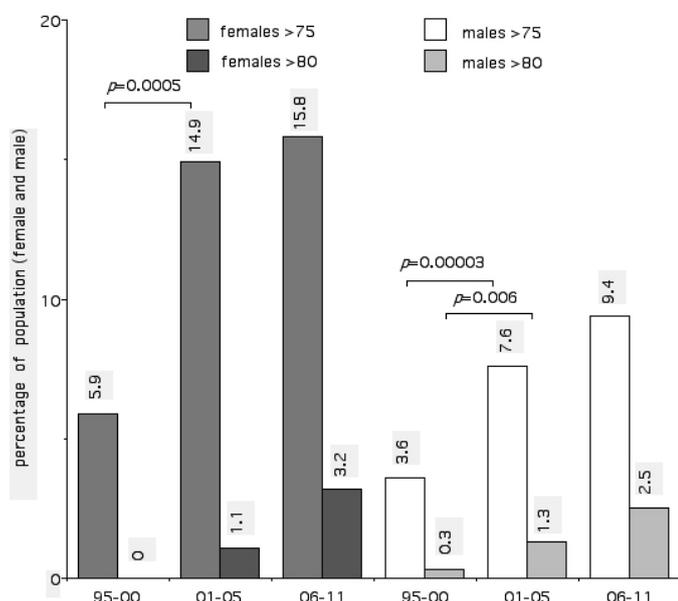


Figure 10: The very elderly cohorts

### Discussion

The incidence of cardiovascular disease increases with advancing age and presents a continuing health care challenge in an aging population, such as ours. Finite health service provisions necessitate an allocation of resources to those patients who are more likely to benefit from treatment both on symptomatic and prophylactic grounds. Hospital stay reflected perioperative morbidity, the extent of the rehabilitation programme and an evolving health care mission for earlier discharge.

Group A patients required an additional half day of high-dependency care and an additional 0.75 days on the cardiac surgical ward. This study demonstrates an intervention rate in the elderly 3.2 times that in younger patient with a demonstrable increase over the 17 years. Coronary artery bypass grafting was as

extensive and complete in the elderly. The significantly lesser utilisation of the internal thoracic artery was not based on age alone but on technical considerations at surgery, including more distal coronary disease as well as an unsuitable ITA because of intrinsic disease or small size when grafting the distal left anterior descending (LAD) coronary artery. Since bypass grafting has not been shown to influence the ten-year survival in the over 70's<sup>4</sup> we have generally tended to offer surgery to those patients with significant symptoms not amenable to other treatment modalities. However, in a subgroup with significant left main stem or proximal LAD disease, surgery was considered the first line of treatment. We were also more likely to advocate medical therapy or angioplasty in preference to re-operation for recurrent coronary artery disease in this group because of increased mortality and reduced long-term survival.<sup>10</sup> The overall mortality was significantly higher in this group with multiple cardiovascular as well as co-morbid factors influencing this outcome. Our growing experience has resulted in an increased awareness of the expected complications and a more aggressive approach in managing them.<sup>11</sup>

Both the Parsonnet and EuroSCORE risk stratification systems weight female gender with one unit, and this partially explains the higher scores in the vast majority of years. However, when one factors in further weighting due to advancing age, this gender difference assumed less prominence.

Postoperative cardiac complications were higher in this group, necessitating more intensive treatment, a longer hospital stay with attendant costs, but rarely affecting the long-term outcome. Our policy of early intervention with pharmacological or electrical cardioversion for atrial fibrillation and flutter lessened the impact of this common complication on resource utilisation.

In contrast, permanent neurological damage remains a major problem, with a 2.6-fold increased incidence in the elderly. As in other studies<sup>12</sup> it was more likely to result in early postoperative death, and in the survivors rehabilitation was likely to be more prolonged and ultimately less effective. Our increased awareness of this clinical problem and its treatment with carotid endarterectomy at the time of cardiac surgery should improve patients' outlook over the subsequent years but is unlikely to lower the immediate postoperative neurological complication rate.<sup>13</sup>

### Conclusion

The demand for cardiac surgical intervention in the elderly is high and likely to increase if we are to

follow the trend in more developed nations. The switch from a health funded to a privately funded service may also impact on service provision. Although mortality and morbidity remain significantly higher, taken in the context of the overall clinical problem, cardiac surgery has much to offer in this select and growing population.

## References

1. National Statistics Office 1999. The Demographic Review of the Maltese Islands 1999.
2. Malta Demographics Profile 2012. Central Intelligence Agency World Factbook 2013.
3. NICE public health guidance 15 (National Institute for Health and Clinical Excellence). Reducing the rate of premature deaths from cardiovascular disease and other smoking-related diseases: finding and supporting those most at risk and improving access to services. Sept 2008. [www.nice.org.uk/PH015](http://www.nice.org.uk/PH015).
4. Canver CC, Nichols RD, Cooler SD, Heisey DM, Murray EL, Kroncke GM. Influence of increasing age on long-term survival after coronary artery bypass grafting. *Ann Thorac Surg* 1996;62:1123-1127.
5. Parsonnet V, Dean D, Bernstein AD. A method of uniform stratification of risk for evaluating the results of surgery in acquired heart disease. *Circulation* 1989;79: (Suppl I):I-3-I-12.
6. Leitch JW, Thomson D, Baird DK, Harris PJ. The importance of age as a predictor of atrial fibrillation and flutter after coronary artery bypass grafting. *J Thorac Cardiovasc Surg* 1990;100:338-342.
7. Bush T, Sirbu H, Aleksic I, Kazmaier S, Friedrich M, Buhre W, et al. Combined approach for internal carotid artery stenosis and cardiovascular disease in septuagenarians - a comparative study. *Eur J Cardiothorac Surg* 1999;16:602-6.
8. Paul DL, Tidwell SL, Guyton SW, Harvey E, Woolf RA, Holmes JR, et al. Beta blockade to prevent atrial dysrhythmias following coronary bypass surgery. *Am J Surg* 1997;173:419-21.
9. Redle JD, Khurana S, Marzan R, McCullough PA, Stewart JR, Westveer DC, et al. Prophylactic oral Amiodarone compared with placebo for prevention of atrial fibrillation after coronary artery bypass surgery. *Am Heart J* 1999;138:144-150.
10. Yamamuro M, Lytle BW, Sapp SK, Cosgrove DM, Loop FD, McCarthy PM. Risk factors and outcomes after coronary reoperation in 739 elderly patients. *Ann Thorac Surg* 2000;69:464-474.
11. Manché A, Casha A, Rychter J, Farrugia E, Debono M. Early Dialysis in acute kidney injury after cardiac surgery. *Interact CardioVasc Thorac Surg* 2008;7:829-832.
12. Akins CW, Daggett WM, Vlahakes GJ, Hilgenberg AD, Torchiana DF, Madsen JC, et al. Cardiac operations in patients 80 years old and older. *Ann Thorac Surg* 1997;64:606-14.
13. Rizzo RJ, Whittemore AD, Couper GS, Donaldson MC, Aranki SF, Collins JJ Jr, et al. Combined carotid and coronary revascularisation: The preferred approach to the severe vasculopath. *Ann Thorac Surg* 1992;54:1099-1108.