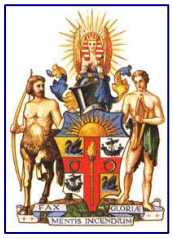
Vascular surgery in Victorian public hospitals 2006-07

Annual Report of the Melbourne Vascular Surgery Quality Initiative

Report to the Public

M.V.S.A.



State Government Victoria Department of Human Services

Contents

Introduction:

"Quality is not an act. It is a habit."
Aristotle 384BC-322BC, Greek philosopher and scientist

The Melbourne Vascular Surgical Association (MVSA) was formed in 1995 by the vascular surgeons working in Melbourne. The MVSA now comprises vascular surgeons working in Melbourne, Geelong, Frankston and several country areas and it has a membership of approximately 36 active vascular surgeons.

The MVSA commenced an independent audit of its members' operative results in 1999. As a result all the Melbourne public hospitals as well as 2 large rural hospitals are represented in the Association. Metropolitan surgeons consult in Shepparton, Bendigo and Gippsland and bring patients to the city for major arterial surgery. A significant amount of privately performed vascular surgery has also been submitted by members so that the dataset represents the vast majority of all vascular surgery performed in Victoria. The MVSA, the Quality Unit of the Victorian Department of Human Services (DHS) the Royal Australasian College of Surgeons (RACS) and the Australian and New Zealand Society for Vascular Surgery entered into a co-operative arrangement whereby the MVSA Audit would provide Victorian public hospital vascular surgery results to the DHS. The Department of Human Services agreed to provide funding to facilitate production of an annual report of the results of vascular surgery in Victoria from 2003.

Following discussions with the DHS, five different areas of vascular surgery were determined to be appropriate for audit in order to assess performance of Victoria's Vascular Surgical Units.
The reporting periods are for the 12 months from 1 July to the subsequent 30 June. It is also intended to include cumulative data covering several years. This is necessary since some operations are performed infrequently or the incidence of complications is very low. In such cases, it is only by summing the data over several years that adequate numbers can be accrued to permit meaningful analysis. Although both private and public data are collected, these reports are confined to public hospital data.

Five aspects of vascular surgical practice are assessed and presented in this report:

- Mortality after aortic aneurysm (AA) repair
- Complications after carotid endarterectomy-mortality, stroke and cranial nerve injury
- Occlusion rate after infra-inguinal bypass
- Amputation rate after infra-inguinal bypass
- Length of hospital stay for AA repair, carotid endarterectomy and infrainguinal bypass

These terms are explained in more detail later in the report.

Endovascular surgery:

An increasing number of patients will have therapeutic interventions for arterial disease performed by way of an "endoluminal" or "endovascular" approach. This is done via a needle puncture into an artery and the operation is then completed.

Due to such procedures being less invasive and frequently requiring a lesser depth and/or duration of anaesthetic, the complication rate at the time of the operation may be lower. Such procedures are performed in the operating theatre with X-ray equipment but increasingly, vascular surgeons are doing the operations in dedicated and specially equipped radiology suites. Some forms of arterial disease are not suitable for an endoluminal approach and vascular surgeons will continue to treat arterial disease using both open operations and endovascular approaches.

Endovascular techniques are used for treating Aortic aneurysms, carotid disease and narrowed arteries in the legs. This has evolved rapidly and is increasing in use as technology evolves. It is noteworthy that vascular surgeons in Australia have embraced this new technology and become proficient in both traditional open procedures and the newer endovascular techniques. This skill acquisition by the vascular surgical workforce has been advantageous for patients in that it removes a major bias in terms of treatment recommendations by vascular surgeons, ie., they are in a position to recommend what the consider to be the best form of intervention and are not limited in their recommendations by their capabilities.

The overall process for surgery auditing exists under the auspices of the Melbourne Vascular Surgery Quality Initiative (MVSQI). The following thirteen public hospitals participate in the audit process.

Table 1: Participating public hospitals

Hospital	**Surgeon monitoring data collection**
Alfred Hospital	Mr Geoff Cox
Austin Hospital	Mr Gary Fell
Ballarat Hospital	Mr Michael Condous
Box Hill Hospital	Mr Barry Beiles
Dandenong Hospital	Mr Roger Bell
Frankston Hospital	Mr Wai-Leng Chue
Geelong Hospital	Mr David McClure
Monash Medical Centre	Mr Roger Bell
Northern Hospital	Mr Bernard Allard
Royal Melbourne Hospital	Mr Bernard Allard
St. Vincent's Hospital	Mr Mark Westcott
Western Hospital	Mr Barry Beiles
Williamstown Hospital	Mr Gary Frydman

Data Processes:

The vascular surgery units in all the reporting public hospitals use standardised data collection forms. In a similar manner, standardised discharge data forms are also used. Data is entered onto a database developed by the MVSA. Whilst the public hospital data is complete, private hospital data although collected is not complete and not included in this report.

Requests for data correction are made to each individual site. Data is collected in a centralised database for analysis. De-identified audit results are then provided to the MVSQI steering committee. Following this, the results from the audit are reviewed, and are used to assist in further development of appropriate standards and actions.

The data analysed in this report has been risk-adjusted (except for carotid endarterectomy where no suitable model could be generated) and has been subjected to further statistical analysis, which can detect poor outcomes in a timely manner. All hospitals have been allocated a random code in this report.

MVSQI Steering Committee members:

MVSA audit committee representatives:
Mr C B Beiles FRACS
Mr G Cox FRACS
Prof. M Grigg FRACS

DHS representative:
Mr S McConchie

RACS representatives:
Dr D Hillis MHA, FRACGP, FRACMA, Chief Executive Officer
Ms D Spence

Aggregate Results:

The three categories that characterise vascular surgical practice are Abdominal Aortic Aneurysms (AAA), Infrainguinal bypasses and Carotid Endarterectomy. Data collected for this financial year (2006-2007) were combined to examine the demographic features, emergency status and mortality in the dataset as a whole prior to discussing these individually later in the report.

This dataset consists of 1022 **patients** with a mean age of 73. The population is elderly as shown in fig.1, with 1/4 of the patients aged over 80. There is a preponderance of males (4:1) as shown in fig. 2.

Fig.1: Age distribution in combined vascular dataset (n=1022).

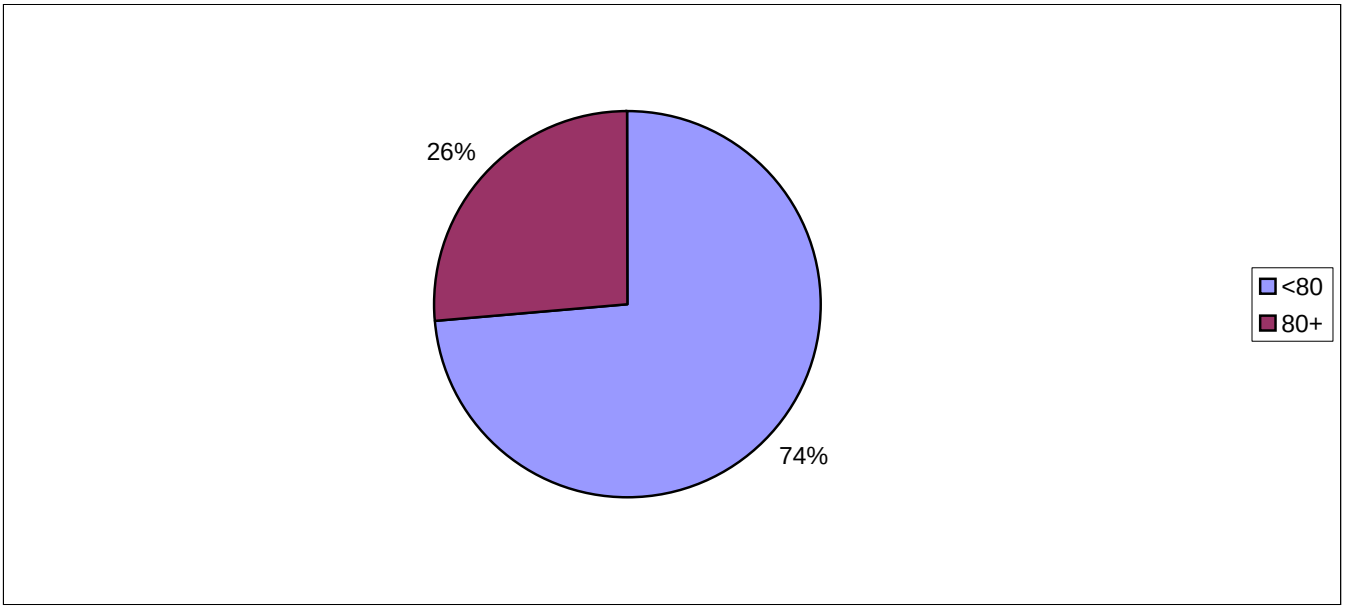
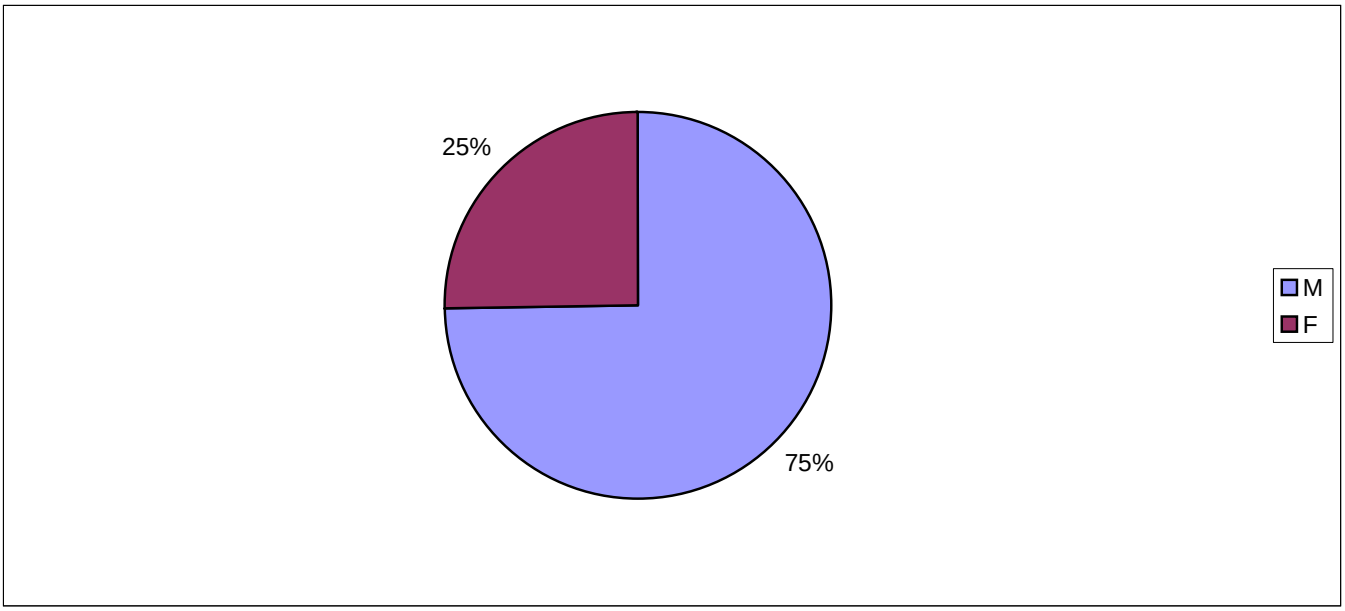
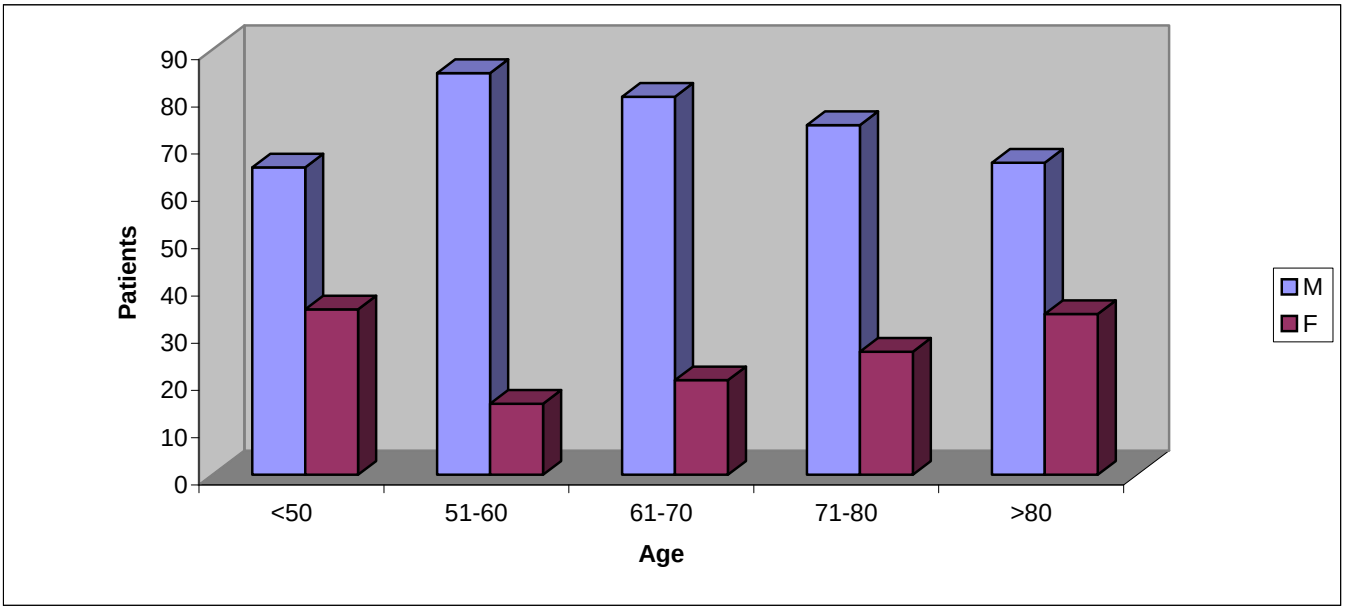


Fig. 2: Sex distribution in combined vascular dataset (n=1022).



The sex distribution for categories of age is shown in fig. 3, revealing that the male predominance is maintained across all age ranges, but is least in the patients < 50 and >80.

Fig. 3: Sex ratio across age categories.



Risk Factors

Patients with arterial disease commonly have 1 or more risk factors present, and these are shown in fig. 4. Unfortunately, the data is not complete for these, as 3% of the risk factors were not entered during data collection. This figure is low because of structural changes to the database since the last report. Definitions of the risk factors entered is:

Diabetes: Biochemically diagnosed, whether or not on treatment.

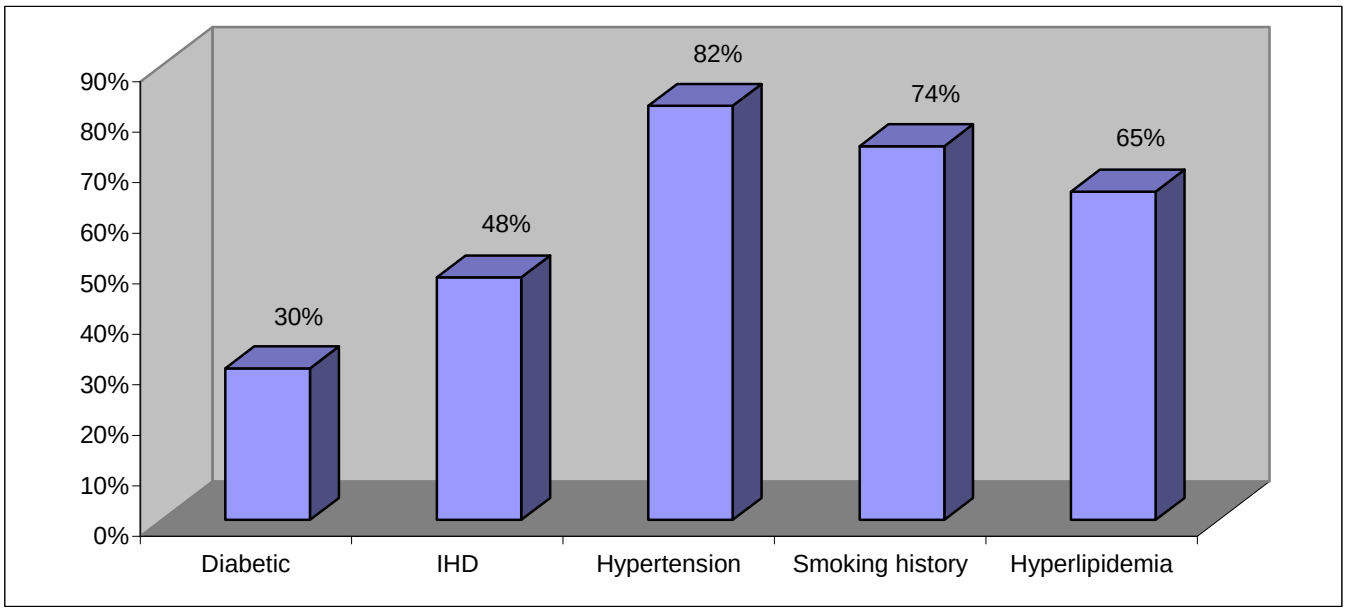
Ischaemic Heart Disease (IHD): On history (Coronary bypass, myocardial infarction, angina, angioplasty) or ECG/stress test

Hypertension: On treatment or clinically if systolic > 140 or diastolic > 90 (W.H.O. definition)

Hypercholesterolemia: If total cholesterol > 6mmol/L or LDL > 4mmol/L (National Heart Foundation), or if on treatment.

Smoking: "Current" means within 2 weeks of surgery. “Past” is if the patient ever smoked.

Fig. 4: Risk factors in the dataset (n=1022). Note that smoking history includes past and current smokers. Most patients had >1 risk factor.

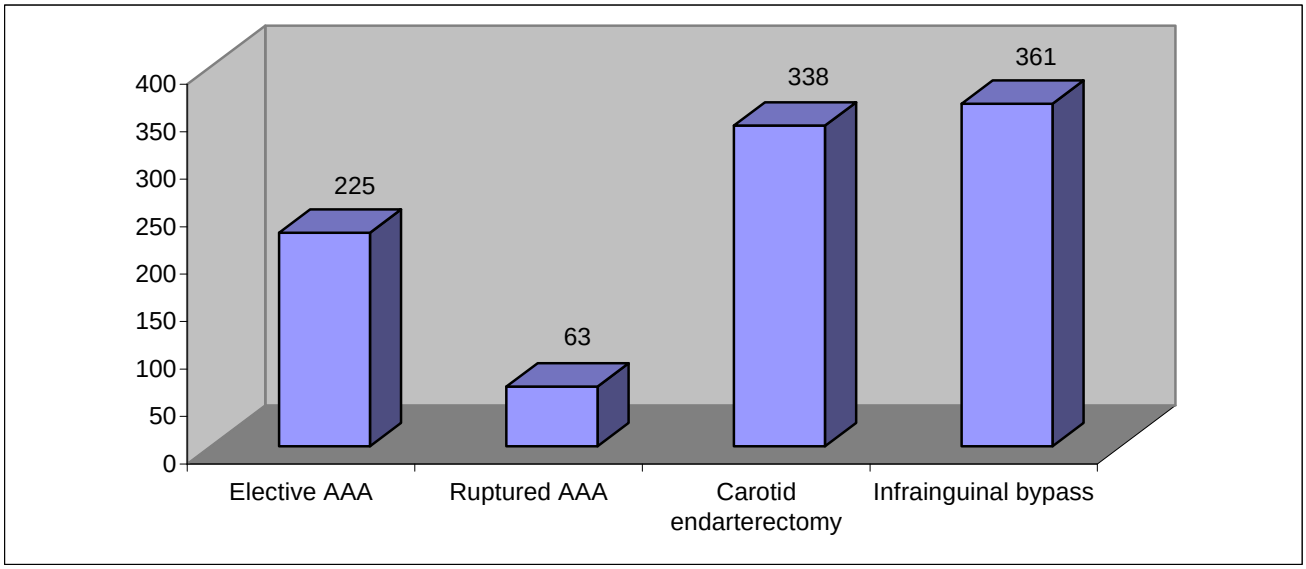


Emergency status:

The urgency required to treat vascular patients undergoing arterial operations is dependent upon the pathophysiology of the presenting condition. Emergency surgery is required for ruptured aneurysms where the patient’s life is at risk unless the bleeding aorta is repaired, or in the acutely ischemic limb where the arterial supply is occluded and there is significant risk to the viability of the limb unless blood flow is restored. In this dataset 9% of patients were treated as an emergency, and in only 5 patients (0.5%) was the emergency status not recorded.

Operation types and numbers are shown in fig. 5.

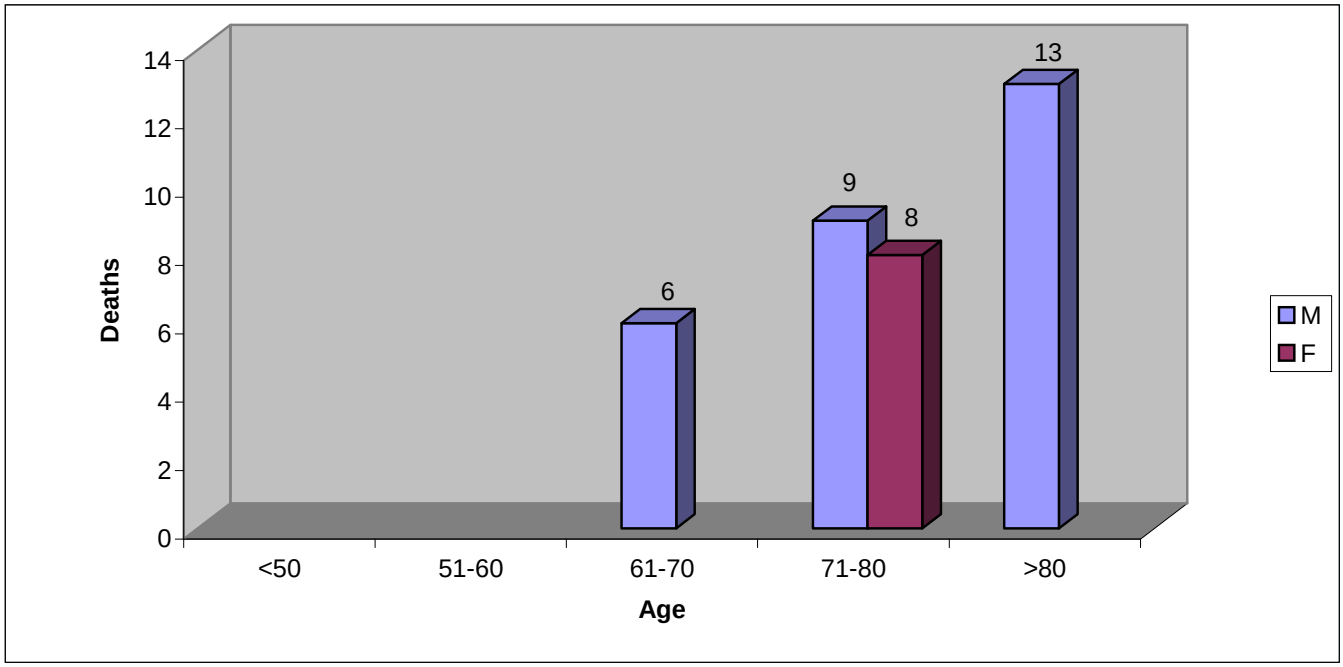
Fig. 5: Operation type and number 2006/7(n=1022). AAA=Abdominal Aortic Aneurysm.



Adverse events:

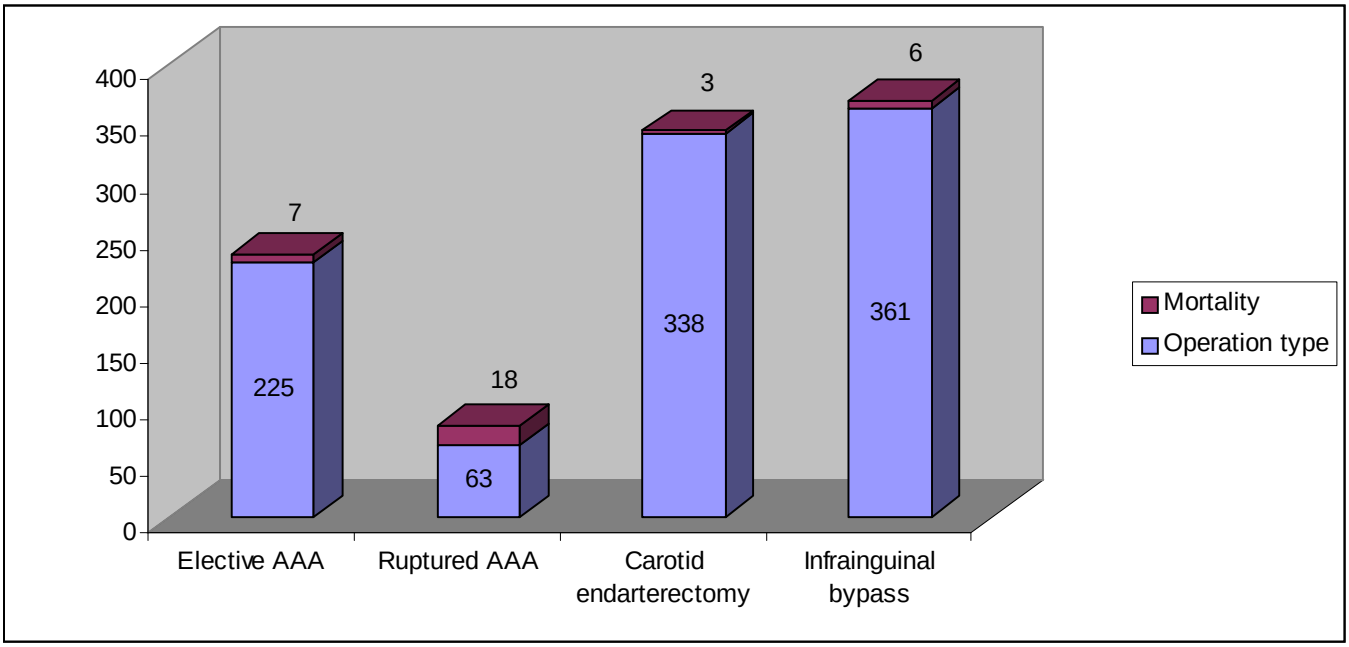
There were 36 deaths in this combined group of patients (3.5%). These deaths occurred in the older age groups as shown in fig 6.

Fig. 6: Mortality by age and sex in dataset (n=1022)



If one examines mortality in each major operation type (fig. 7), it is not surprising to find the highest mortality in the ruptured AAA group, as these are always emergency procedures in unstable elderly patients. These patients will be examined in greater detail in a later section of the report.

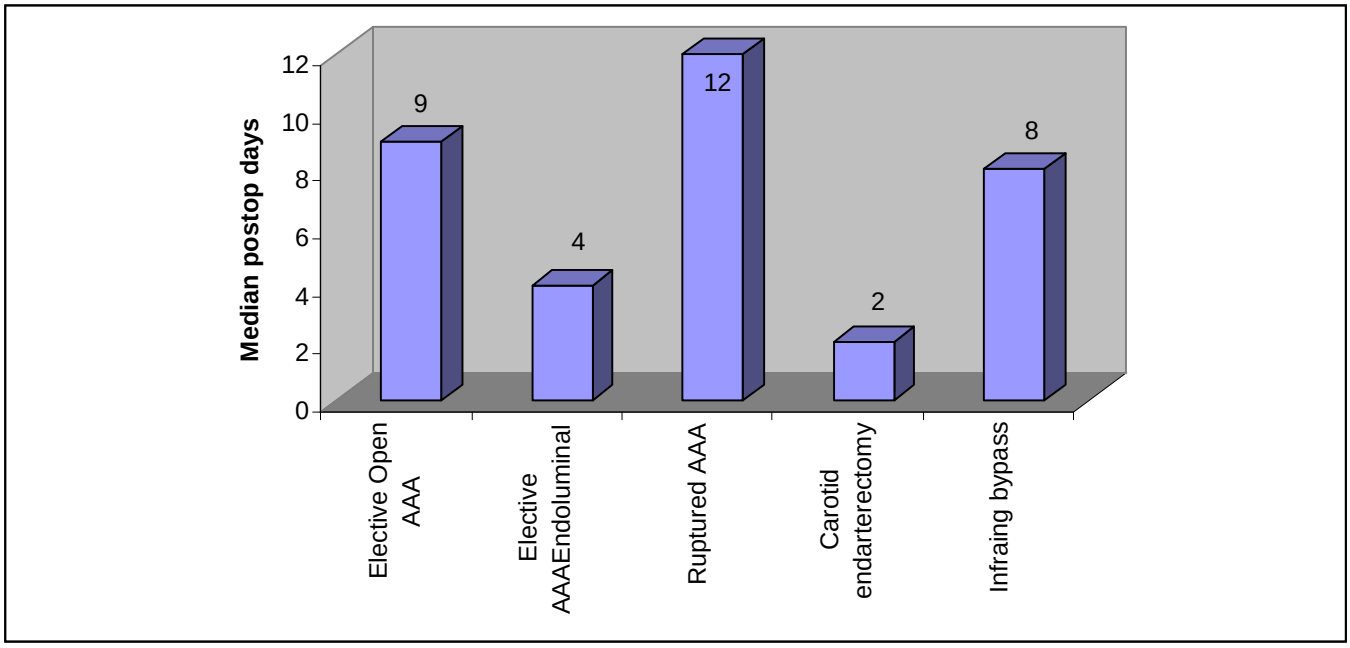
Fig. 7. Mortality (number of patients) by operation type.



Postoperative length of stay

The length of hospitalisation will depend upon the general state of health of the patient population, the underlying pathology presenting for treatment and the skill of the surgical team. The last point is relevant because the presence of post-operative complications will extend the duration of hospitalisation. Thus it is illustrative to assess this indicator across the different categories, as shown in fig. 8.

Fig. 8. Median postoperative length of stay for patient type.



Carotid Endarterectomy

Carotid endarterectomy refers to an operation performed to correct a narrowing of the carotid artery. The wall of the carotid artery in the neck can become sufficiently thickened to encroach upon the lumen of the artery. The resultant severe narrowing (typically 70% or greater) is removed to prevent a stroke. There is a carotid artery on each side of the neck and between them the carotid arteries supply 80% of the blood flowing to the brain. The operation is performed in association with control of the risk factors for arterial disease, namely:

- Lowering cholesterol to below 5 mmol/L
- Cessation of smoking
- Control of high blood pressure
- Control of diabetes

In addition, patients will have been commenced on anti-platelet drugs such as aspirin if there are no contraindications to the use of such agents.

The operation may be undertaken after a patient has already experienced a “mini-stroke”, more properly called a transient ischaemic attack (TIA) or a stroke. Patients can also have transient loss of vision or “amaurosis”. Subsequent investigation may identify the severe narrowing in the carotid artery in the neck and exclude other possible causes of symptoms.

The other indication for the operation is in the patient who is identified with a severe narrowing but the patient has not had a symptom from the narrowing. This type of severe narrowing is often identified after the carotid artery is listened to with a stethoscope and the examining doctor hears a noise. The site and the characteristics of the noise alert the doctor that the noise is arising from a severely narrowed artery. This suspicion is then confirmed with a duplex scan or possibly an angiogram.

The operation can be technically challenging and is seen by vascular surgeons as an excellent index of a surgeon’s abilities.

Whilst the operation is performed to prevent the patient from experiencing a stroke, or to prevent them having another stroke, there is a risk that the operation itself may precipitate a stroke. Many studies of the operation in the medical literature indicate the operative risk of a stroke with the operation needs to be less than 5% to be of benefit to the majority of patients having the operation when a previous stroke or mini-stroke is the reason for the surgery.

Demographic factors

There were 338 patients who underwent carotid endarterectomy in 2006-7. Mean age was 74 and there was a 4:1 male to female ratio (figs. 9 & 10)

Fig. 9. Carotid endarterectomy age distribution

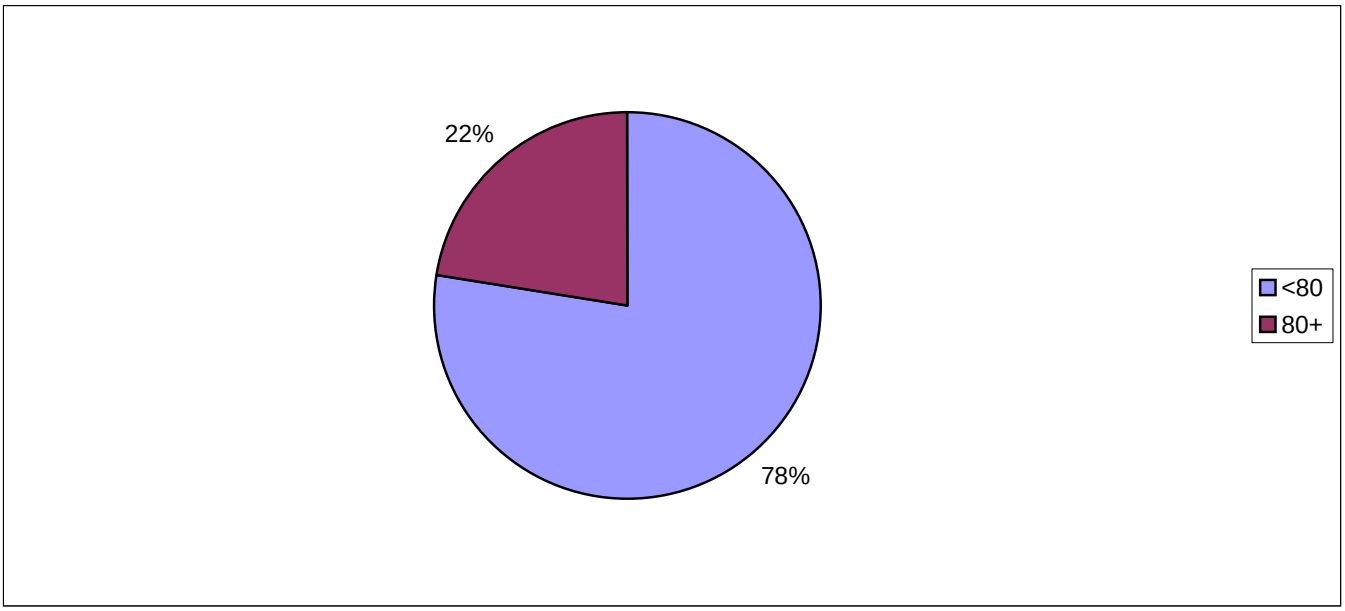
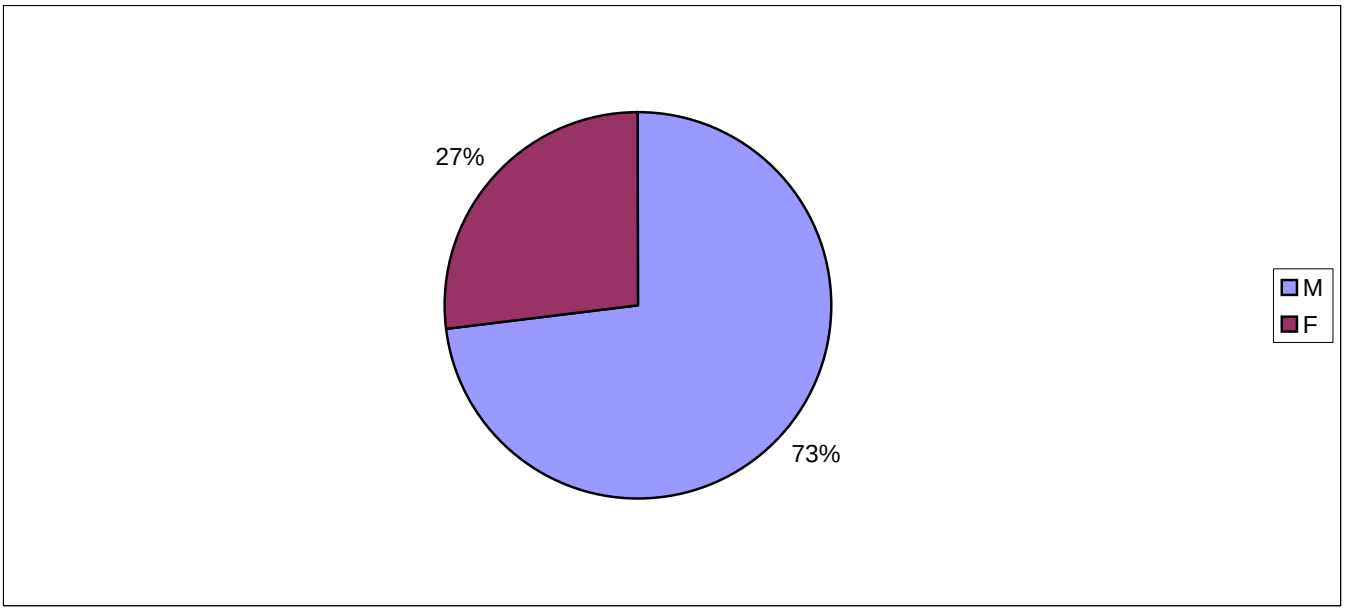
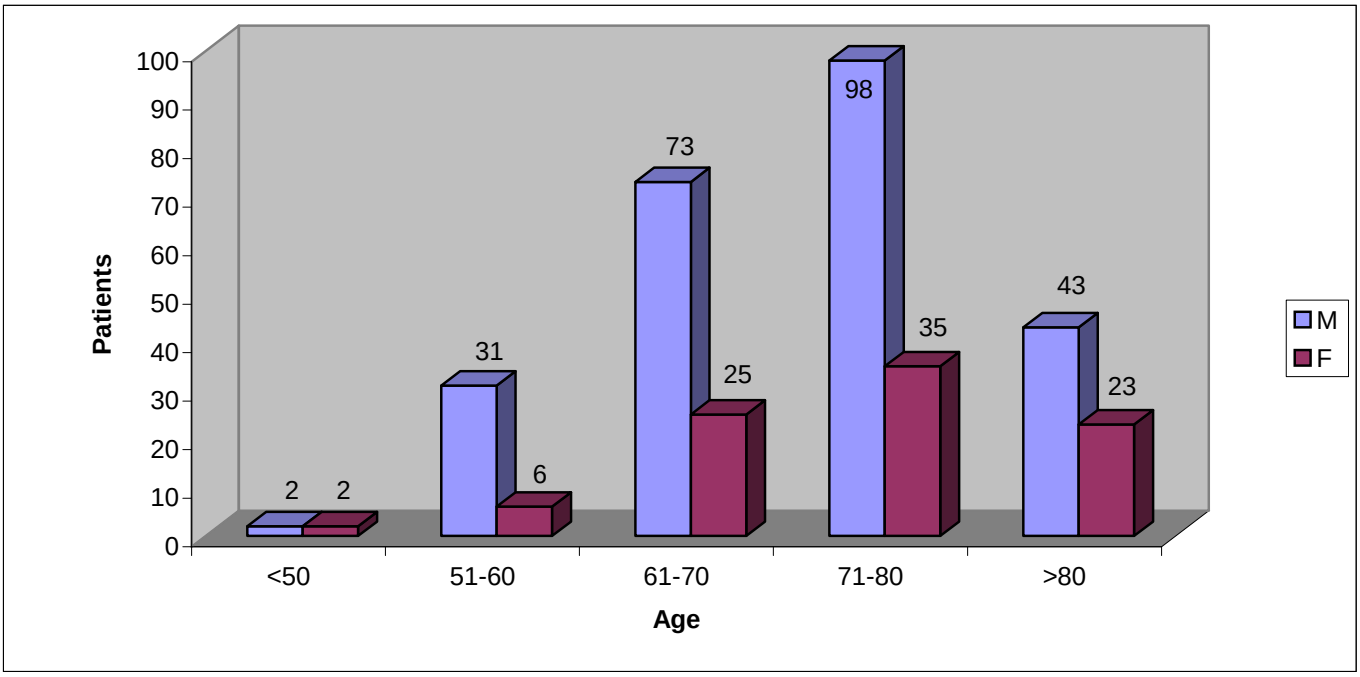


Fig. 10. Carotid endarterectomy sex distribution



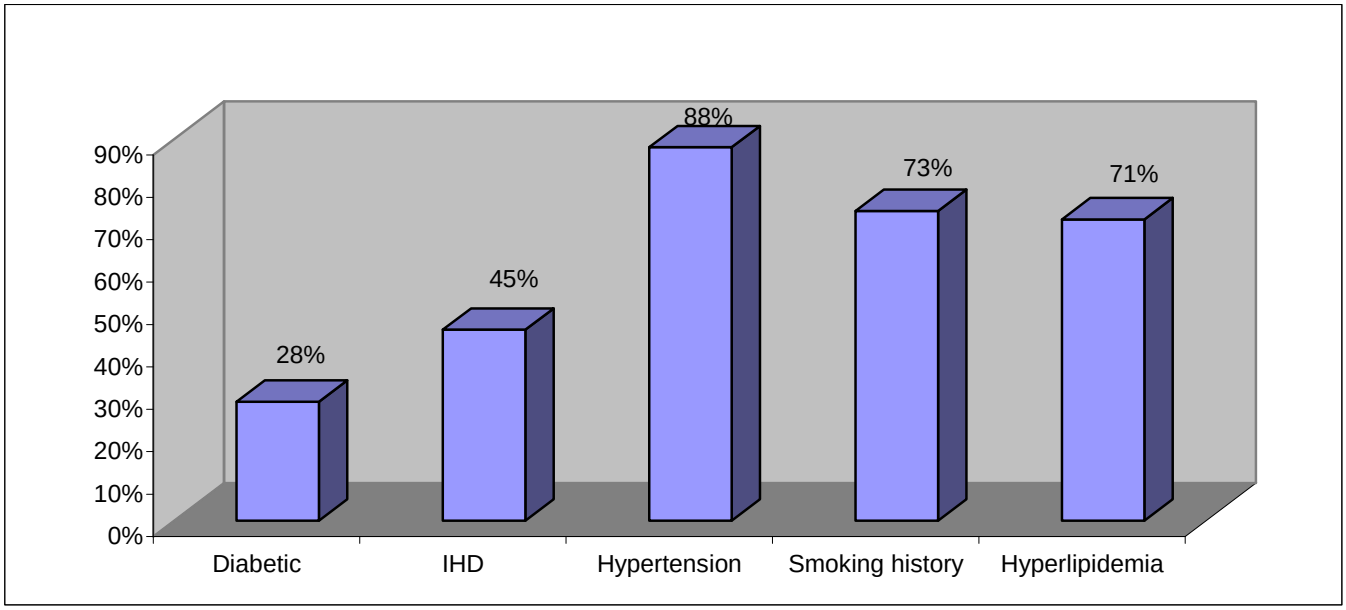
Sex distribution by age category is shown in fig.11, with male predominance across all ranges.

Fig.11. Sex distribution by age category for carotid endarterectomy.



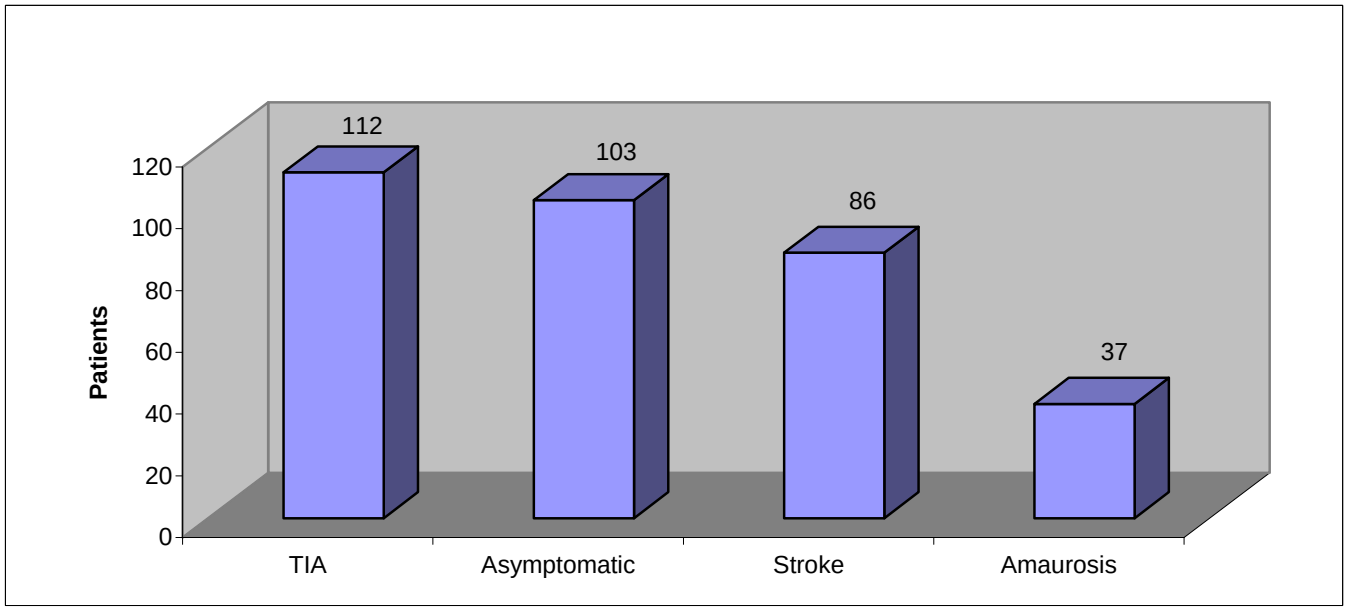
Risk factors in this group of patients is seen in fig. 12, and most patients had >1 risk factor present.

Fig.12. Risk factors present in Carotid endarterectomy patients (n=338)



The indication for surgery is shown in fig.13. It is now appreciated that there is only a small benefit to be gained by operating on asymptomatic patients, who will only benefit if they are in good condition and likely to survive at least 5 years, and the postoperative stroke rate needs to be low. There is still a large proportion of asymptomatic patients compared to European registries

Fig.13. Indication for Carotid endarterectomy (n=338)



The treatment of carotid disease and its complications:

Carotid endarterectomy is performed to prevent the patient from experiencing a stroke, or to prevent them from having another stroke. Stroke is also the most common major complication of the operation and this may occur during or immediately after the procedure. Many studies of the operation in the medical literature indicate the operative risk of a stroke with the operation needs to be less than 5% to be of benefit to the majority of patients having the operation when a previous stroke or mini-stroke is the reason for the surgery.

The contemporary literature addressing major complications following carotid endarterectomy usually combines the mortality and the permanent stroke rate. Death after the operation is infrequent and may be due to a major stroke or a post-operative heart attack ("myocardial infarction").

Nerve damage with the operation:

During the operation of carotid endarterectomy there are several nerves that are at risk of being damaged, which may cause disability. The procedure is performed with an incision on the side of the neck, overlying the artery. Dividing the nerve that supplies sensation below the jaw line is unavoidable. This results in an area of numbness that may recover over several months.

In exposing the artery, a small nerve that runs and dips below the jaw line can be damaged resulting in paralysis of the small muscles around the angle of the mouth. To clear the artery of the cholesterol deposit, approximately 7cm of the carotid artery is exposed and carefully separated from the surrounding structures, including several nerves, damage to which the surgeon tries to avoid. Damage to these nerves can result in a hoarse voice or difficulty swallowing or paralysis of the muscles of the tongue on the side of the operation. The risk of damage to one or more of these nerves is increased if there has been previous surgery on the same area or previous radiotherapy to the region for an unrelated condition. The patient will be warned of these increased risks during the obtaining of informed consent.

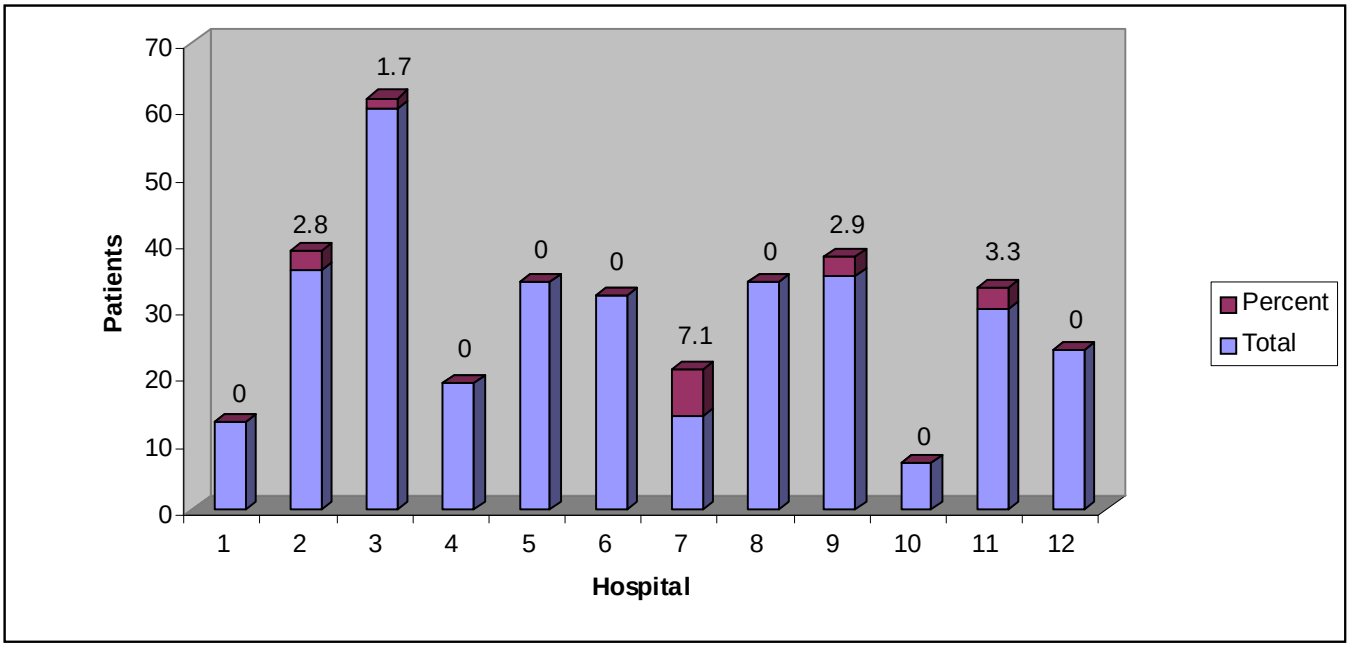
Results from the MVSQI:

Cranial nerve trauma was only reported in 1 patient (0.3%), but it is unknown how many patients had a postoperative neurological review. Postoperative stroke occurred in 2 patients (0.6%), both of whom died as a result. 3 patients died including the 2 postoperative stroke patients (0.9%), giving a combined stroke and death rate of 1.5% (5/338). These results are outstanding compared with national and international reported series. The results for each hospital are presented in table 1 and fig. 14.

Table 1. Stroke and death (S/D) by hospital.

Hospital	S/D	Total	Percent
1	0	13	0
2	1	36	2.8
3	1	60	1.7
4	0	19	0
5	0	34	0
6	0	32	0
7	1	14	7.1
8	0	34	0
9	1	35	2.9
10	0	7	0
11	1	30	3.3
12	0	24	0

Fig.14. Percent stroke and death by hospital.

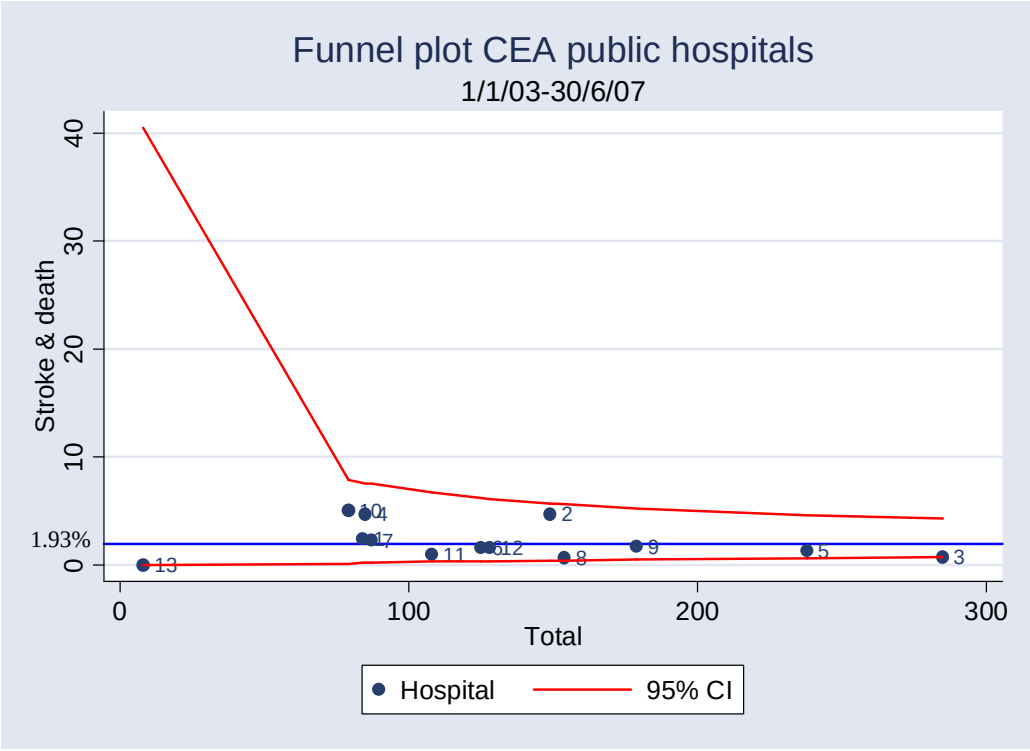


No hospital has been shown to perform below standard on detailed statistical testing.

The best method of comparing results between hospitals is a modified funnel plot (see Appendix). As the event rate for the adverse outcomes assessed in this report are low,

data from 1/1/2003 to 30/6/2007 was used to produce it, which is seen for stroke and death after carotid endarterectomy in fig.15.

Fig.15. Funnel plot for stroke and death after carotid endarterectomy 1/1/03-30/6/07 (n=1709). Note that all hospitals are below the upper 95% Confidence Interval (CI) shown in red. The mean stroke & death rate for the group is 1.93% (blue line).



Infra-Inguinal Bypass

Similar to the carotid arteries in the neck and the coronary arteries in the heart, the arteries in the lower limbs can become partly or completely blocked by cholesterol deposits. The patients affected by arterial disease are most often the elderly who have multiple associated conditions including heart disease, diabetes, hypertension and smoking-related lung disease.

When the leg arteries are blocked the patient may experience no symptoms or have pain in the legs when walking. This is referred to as claudication. This pain can range from mild to severe and can occur at rest (rest pain). Sudden onset of advanced blood flow deprivation is called “acute ischaemia” and requires emergency treatment to save the leg. Ulceration or gangrene of the leg tissue can also occur with chronic advanced ischaemia. Finally, a dilatation or aneurysm of the artery behind the knee can develop and risk causing occlusion or embolism (clots formed in the aneurysm detach and block the arteries downstream). These are bypassed usually before they cause these complications. When the symptoms of claudication are severe, or if the survival of the leg is threatened, then the blood flow to the leg will need to be improved by either:

• Angioplasty (stretching the wall of the artery with a balloon)
• Bypass operation, or
• A combination of both.

Bypass is performed if the vessel disease is advanced or unsuitable for angioplasty. A graft is inserted to bypass the blockage and conduct blood from the groin artery above the blockage to the artery at the knee level below the blockage. This procedure is called an infra-inguinal (below the groin) bypass. The graft used for the bypass is usually a vein from the leg. Another option used where venous grafting is unsuitable or unavailable involves the use of a vein from the arm or a synthetic (plastic) graft.

Demographic data for infrainguinal bypass

361 patients were studied over the period of the report. Median postoperative length of stay was 8 days.

A consistent male predominance of 2.7:1 remains in this group as shown in fig.16, and 73% of patients are over 80 years (fig.17). The mean age was 72 years.

Fig.16. Infrainguinal bypass sex distribution (n=361).

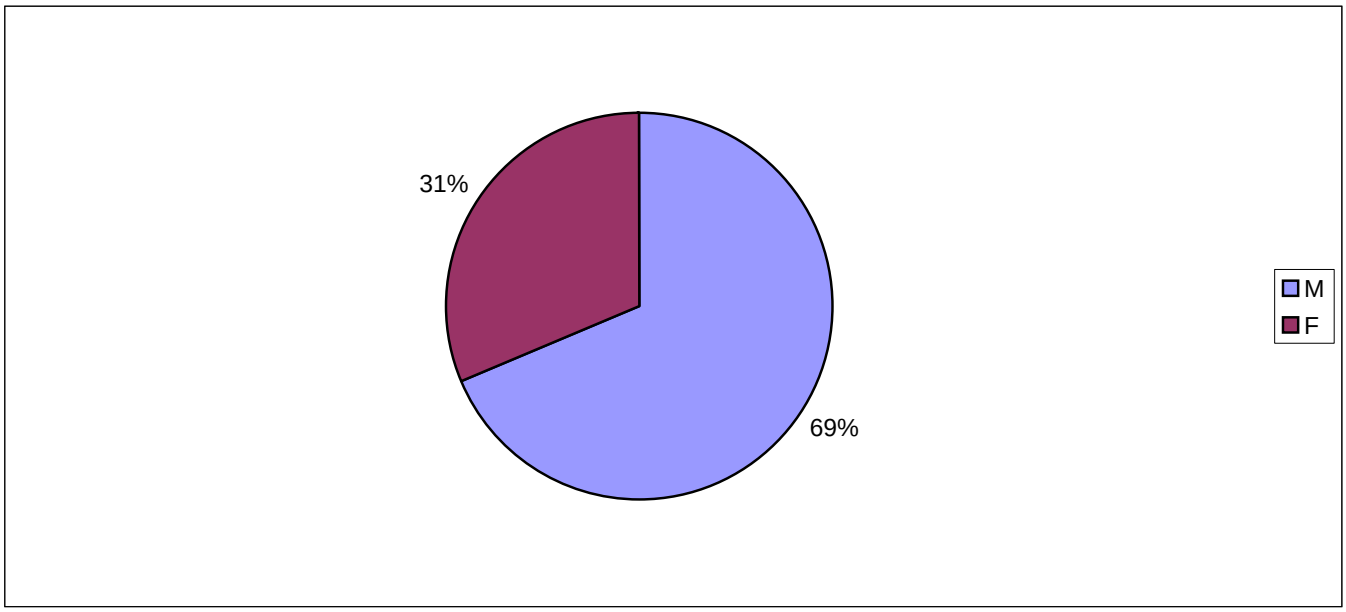
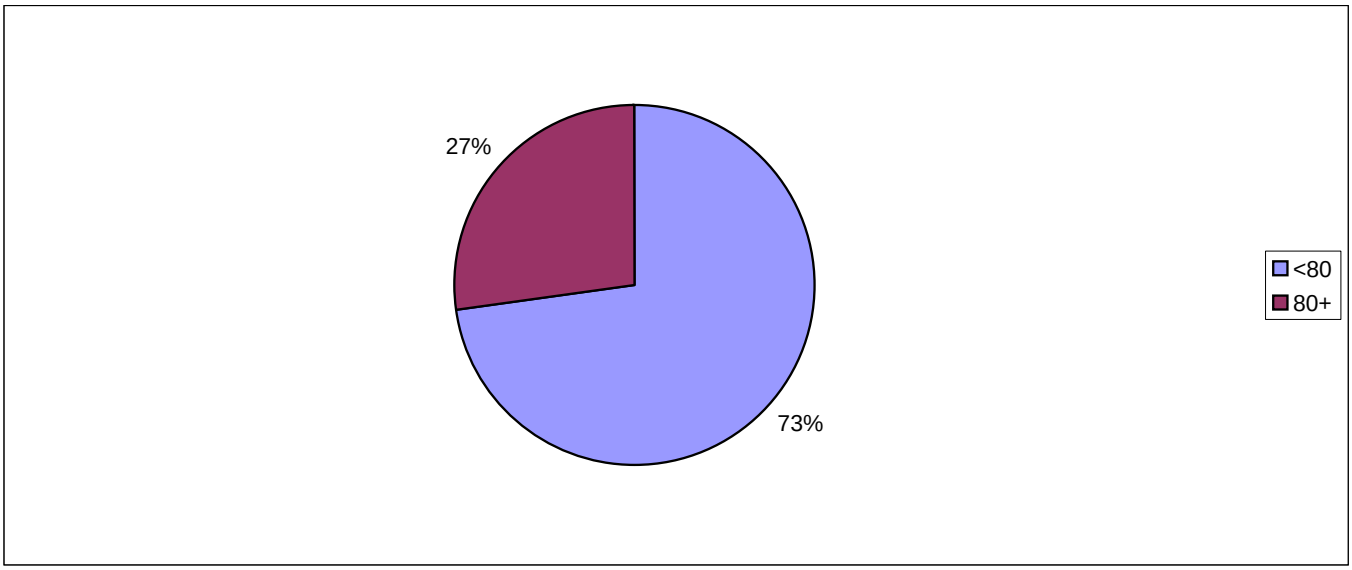
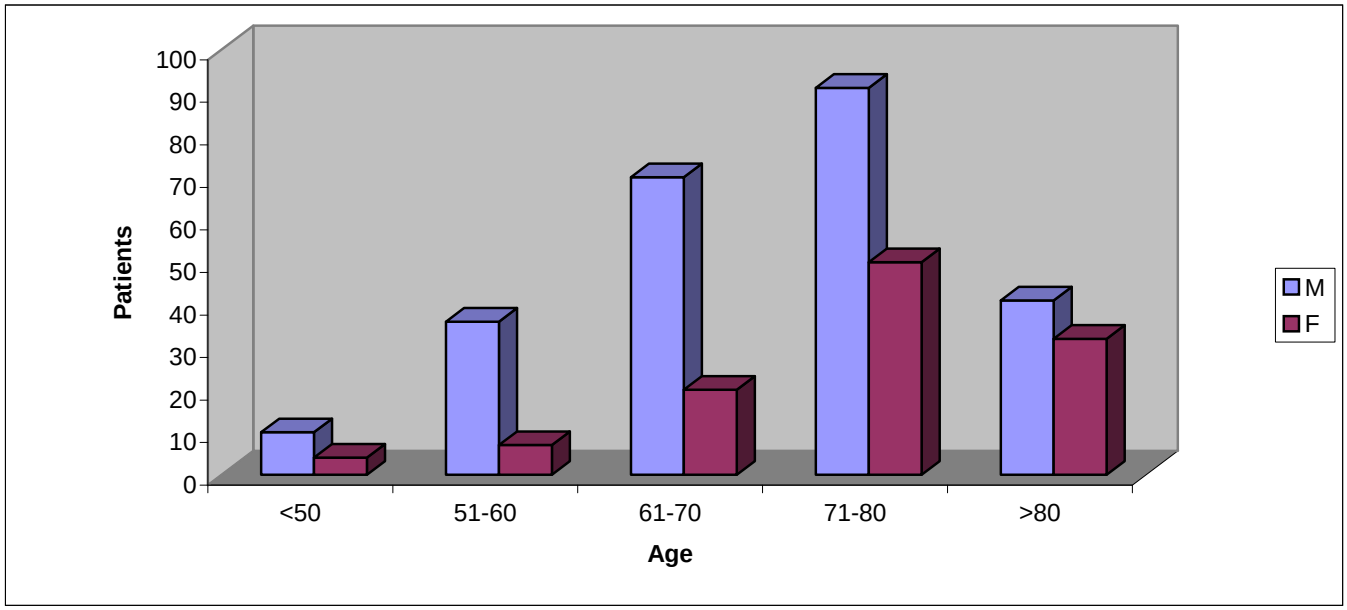


Fig.17. Infrainguinal bypass age distribution (n=361).



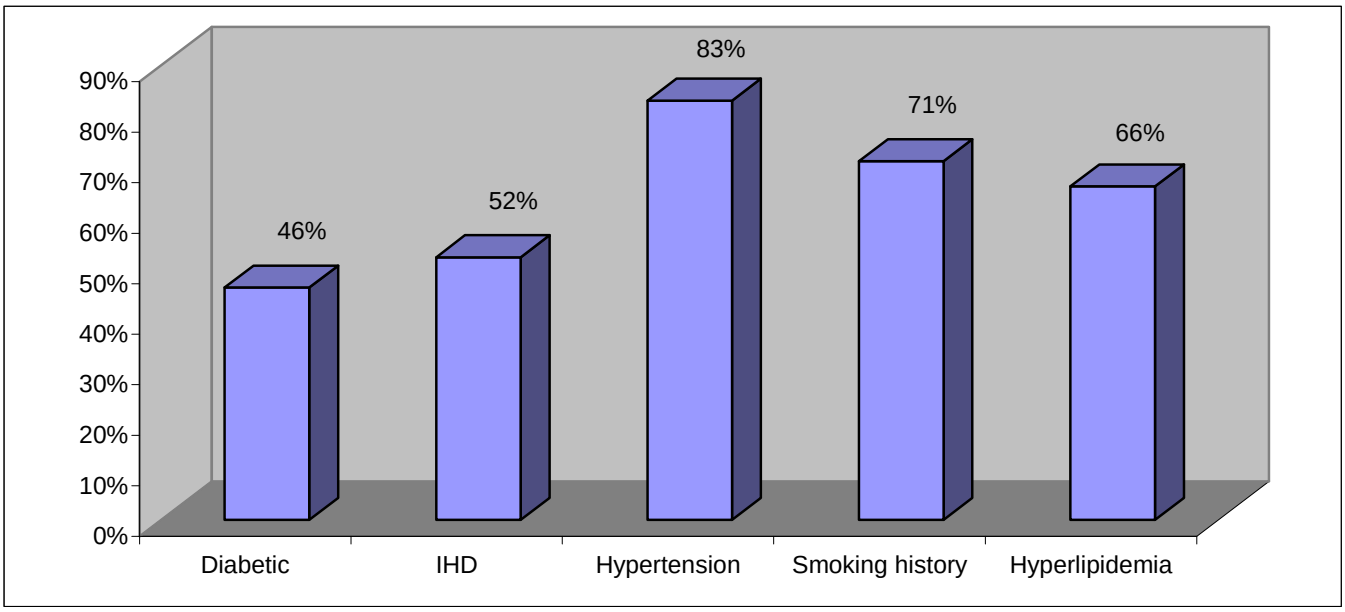
If sex is grouped by age category, a male predominance is present across all groups but is least in the over 80 category (fig.20).

Fig.18. Infrainguinal bypass sex distribution by age category (n=361)



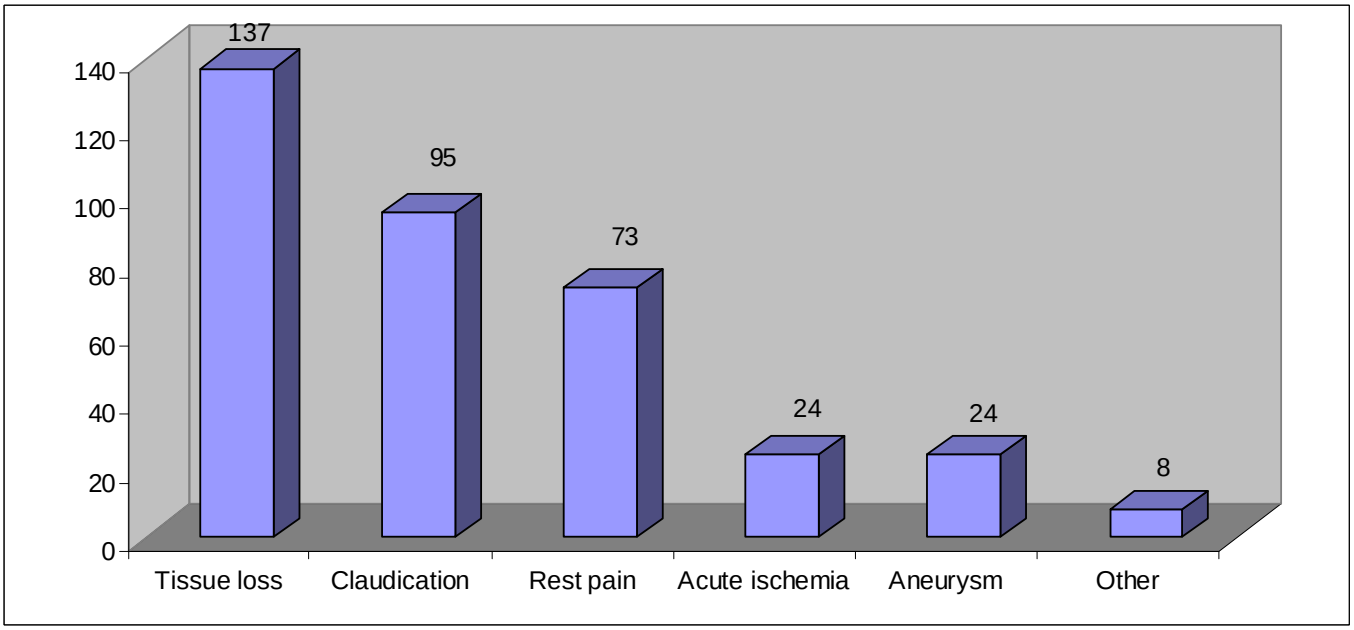
Risk factors for arterial disease were widespread in this group, with a higher incidence of diabetes (46%) than in the carotid patients (28%) or in the entire dataset (30%). These are seen in fig.19.

Fig.19. Infrainguinal bypass risk factors 2006-7 (n=361)



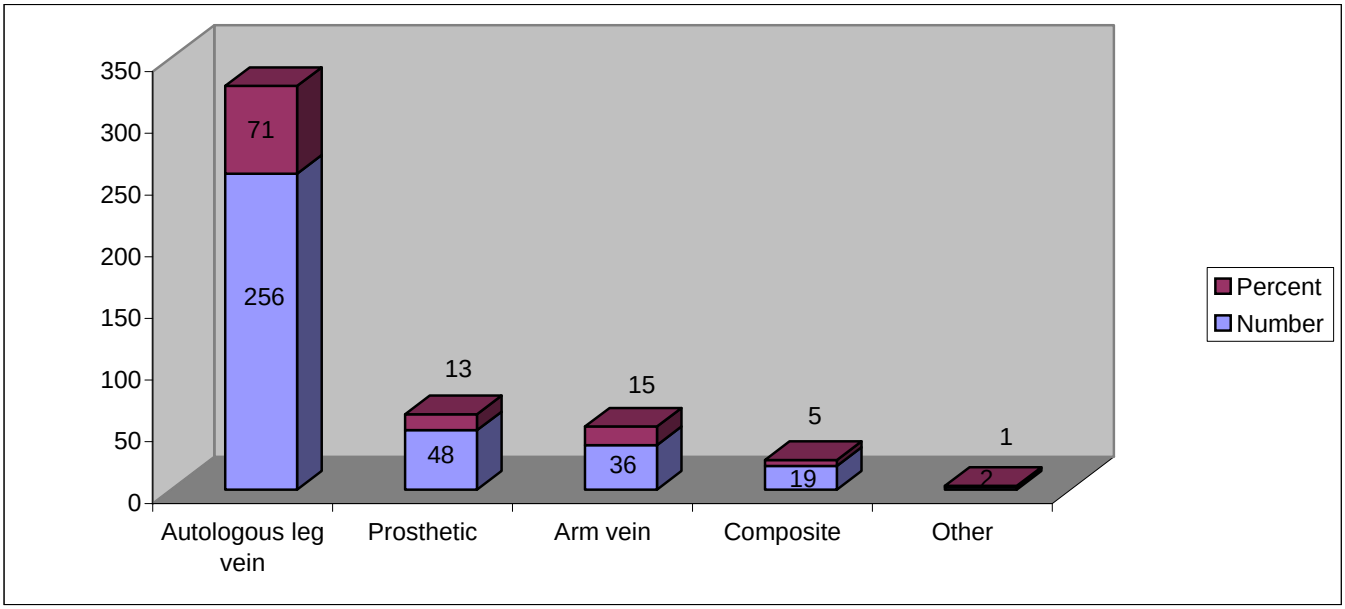
The indications for bypass have been explained in the introduction to this section and they are shown in fig.20. The highest numbers of bypasses were performed for tissue loss.

Fig.20. Indications for infrainguinal bypass (n=361)



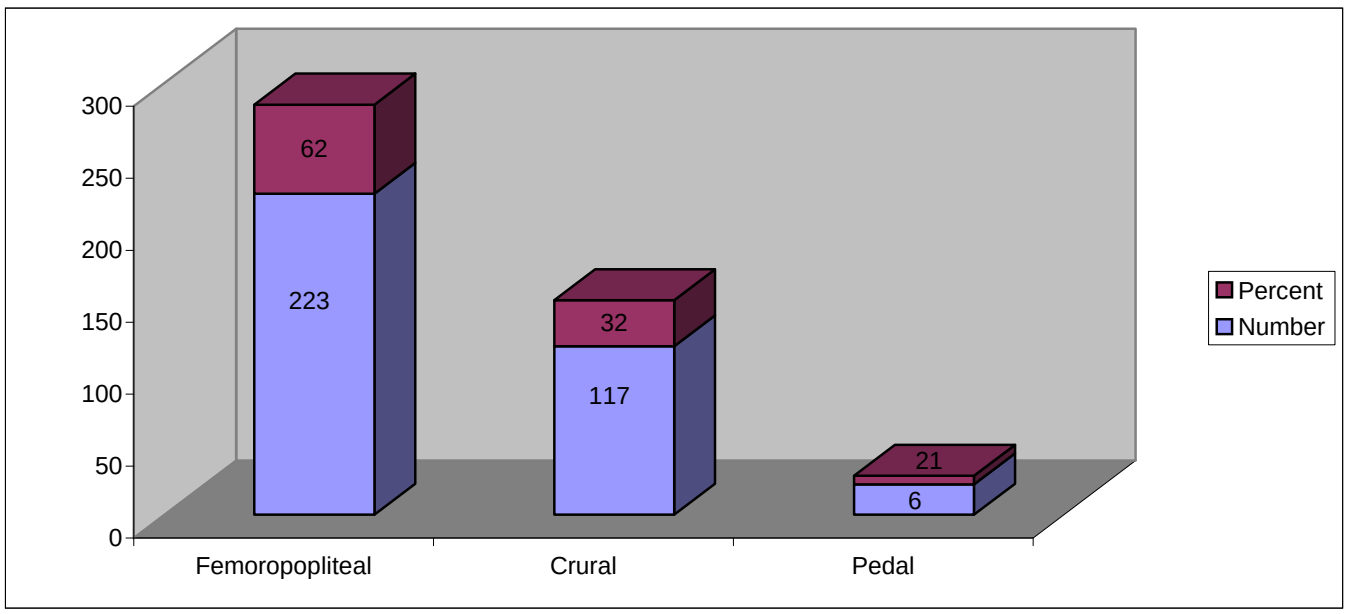
The material used for the bypass is dependent upon the availability of suitable leg vein, which is the optimum conduit for long-term patency. Conduit used is shown in fig.21.

Fig.21. Conduit used for infrainguinal bypass (n=361)



The location of the bypass will depend upon the preoperative angiogram, which reveals the site of arterial blockage and provides a “road-map” for placing the graft to conduct blood from above the blockage to below the blockage. Fig.22 shows the 3 main locations with most bypasses ending around the region of the knee.

Fig.22. Infrainguinal bypass-location of bypass (n=361)



Results from the MVSQI:

Early graft occlusion is usually the result of a technical problem, and thus is one of the key indicators of performance selected for this report. Data from the 13 hospitals is shown in table 2. The crude in-hospital occlusion rate was 5.3%. No suitable model for risk adjustment was achieved, but by combining data from 1/1/2003 to 30/6/2007, a predictive model was obtained. The risk adjusted occlusion rate for the 1954 patients in this larger dataset was 6.1%. The significant variables predicting early graft occlusion were:

- Emergency operation
- Crural bypass
- Pedal bypass

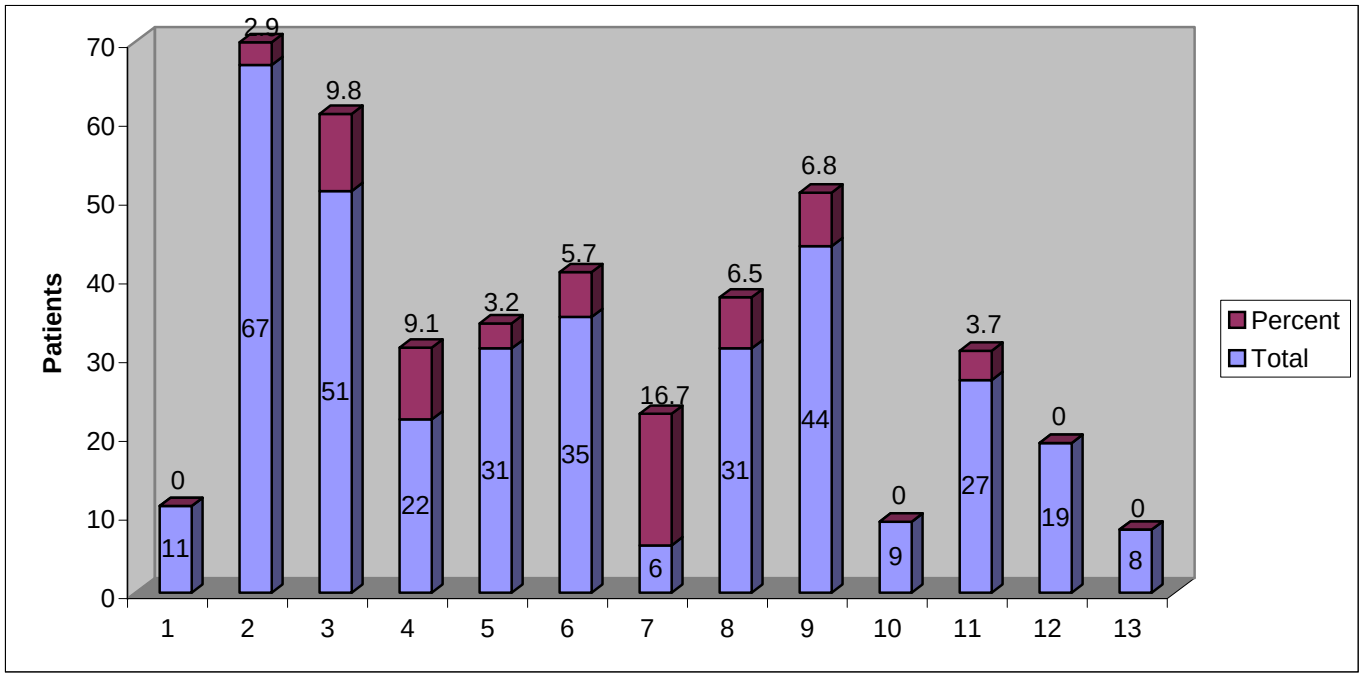
The latter 2 variables refer to a bypass that extends well below the knee to the calf or foot. It should be noted that previously significant predictive variables have changed from previous reports, which serves to remind us that our population is not static, and models that served us well in previous years are not transferable. It is necessary to create suitable predictive models annually.

It is important to recognise that comparison of performance for infra-inguinal bypass outcomes with other publications is difficult because most series report results at 30 days, whereas the MVSQI assesses results at the time of discharge.

Table 2. Crude early graft occlusion by hospital (n=361)

Hospital	Occlusion	Total	Percent
1	0	11	0
2	2	67	2.9
3	5	51	9.8
4	2	22	9.1
5	1	31	3.2
6	2	35	5.7
7	1	6	16.7
8	2	31	6.5
9	3	44	6.8
10	0	9	0
11	1	27	3.7
12	0	19	0
13	0	8	0

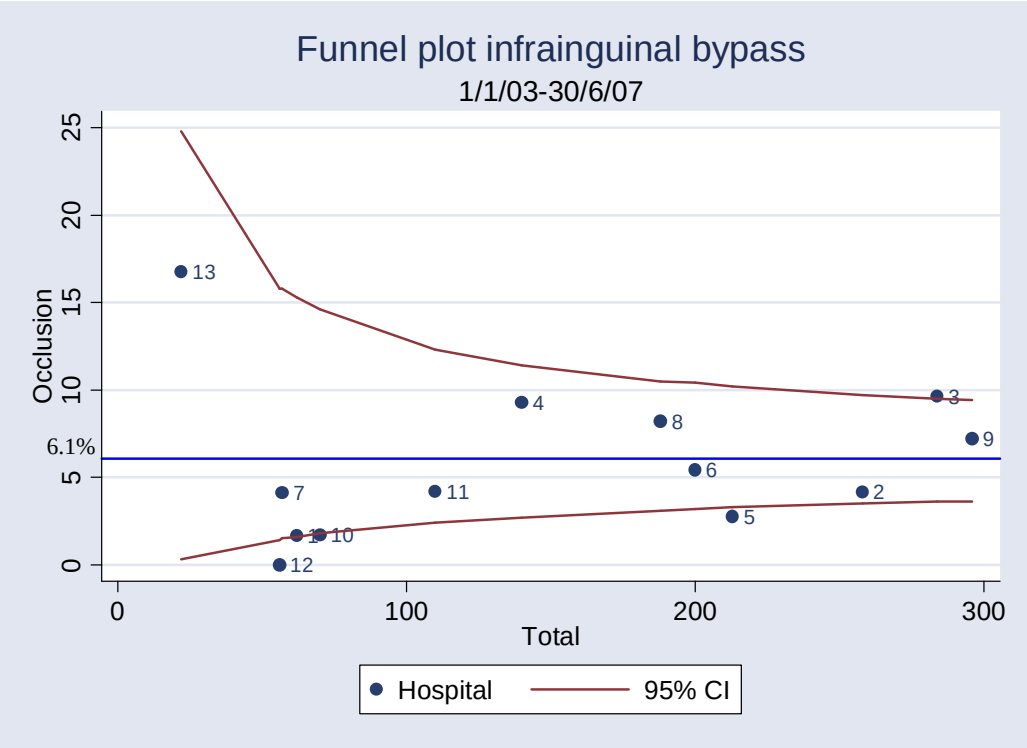
Fig.23. Crude graft occlusions by hospital (n=361). Total = total number of bypasses



No hospital has been shown to perform below standard on detailed statistical testing.

A risk-adjusted funnel plot was constructed on bypasses performed between 1/1/2003 and 30/6/2007, and this also shows that there is no outlier, although hospital 3 is on the upper 95% confidence interval (fig.24). On individual analysis of hospital 3, there was no statistical signal of underperformance. It is also relevant to note that hospital 5 and 12 are below the lower 95% Confidence Interval, indicating excellent performance.

Fig.24. Risk-adjusted funnel plot for occlusion after infrainguinal bypass 2003-7 (n=1954). Note the risk adjusted pooled occlusion rate of 6.1% in blue.



Amputation following infrainguinal bypass:

Although graft patency is the desirable outcome of infrainguinal bypass, salvaging a threatened limb and avoiding amputation is the ultimate objective. It is disappointing if a limb is lost despite a patent bypass graft. This occurs usually in the diabetic patient where aggressive ongoing necrosis and local infection makes salvage of the extremity impossible.

In this report, 3 patients of the 361 lost their leg (0.8%). In all 3 the bypass was patent. 2 patients were diabetic, and the indication for surgery was acute ischaemia in 1 and tissue loss in 2. The adverse event rate was too low for any risk-adjustment.

Aortic Aneurysms:

An abdominal aortic aneurysm is an enlargement, dilatation or bulging of the main artery (aorta) in the abdomen. This results from a weakening of the wall of the normal aorta. The majority (96%) begin below the renal (kidney) arteries. The risk of rupture of the aneurysm increases progressively with increasing aneurysm size. Once the maximum diameter of the aneurysm exceeds 5.5 centimetres the risk of rupture rises sharply. The expected surgical mortality after elective repair of non-ruptured aortic aneurysms is relatively low while surgical repair following rupture of an abdominal aortic aneurysm is associated with significant morbidity and mortality. Aneurysms are encountered in three states; elective (unruptured), painful (warning of impending rupture) and ruptured. There are other rare aneurysms that are also included eg. occluded and mycotic (infected).

The traditional technique of open surgical repair of abdominal aortic aneurysm, which has been performed over the last fifty years, replaces the aneurysmal artery with an artificial or prosthetic (usually Dacron) graft. The aorta above and iliac arteries below the aneurysm are temporarily clamped off. A graft is then hand stitched to the non-aneurysmal artery above and below the aneurysm. The graft may be either a ‘tube’ (straight) or ‘trouser’ (bifurcated) configuration depending on the extent of the aneurysmal disease. Open surgical repair was performed in all cases of ruptured aneurysms or a bifurcated or a “trouser” graft attached to each of the iliac arteries.

An alternative to open surgical repair has been practiced since 1991 using a minimally invasive ‘keyhole’ approach. In this procedure a prosthetic stent graft, which is mounted on a metal skeleton, is introduced via the femoral arteries in the groin and placed in

position within the aneurysm like an ‘internal sleeve’. Blood then flows from the normal, non-aneurysmal aorta through the stent graft and on into the arteries below the aorta. The long-term results of endovascular aortic repair (EVAR) continue to be evaluated worldwide. More recently, ruptured aortic aneurysms have been treated with endografts and early encouraging results have been reported.

Demographic data for patients undergoing aortic aneurysm surgery

The total number of aortic aneurysms (AA) was 323. The male to female ratio was 5:1 and 30% were aged over 80 years (figs 25, 26). Mean age was 75 years. The sex distribution for different age categories is shown in fig. 27 again confirming male predominance across the age groups.

Fig.25. Aortic aneurysm sex distribution (n=323)

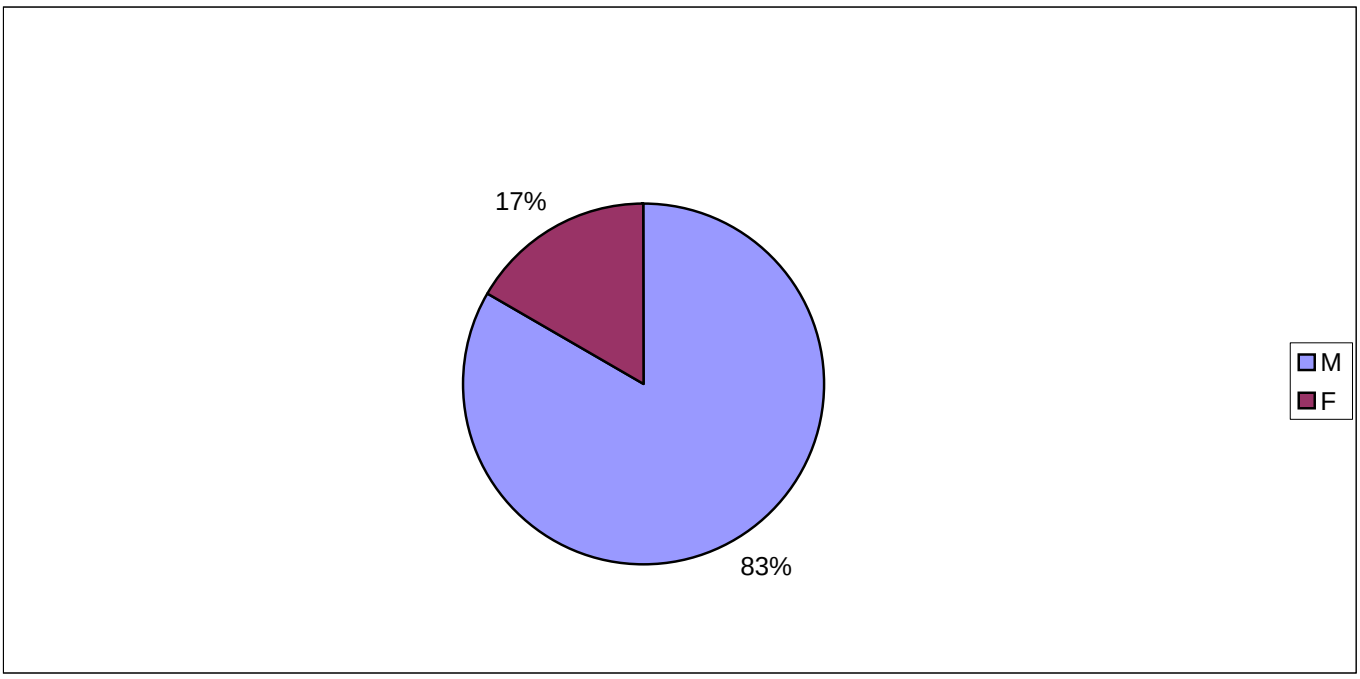


Fig.26. Aortic aneurysm age distribution (n=323)

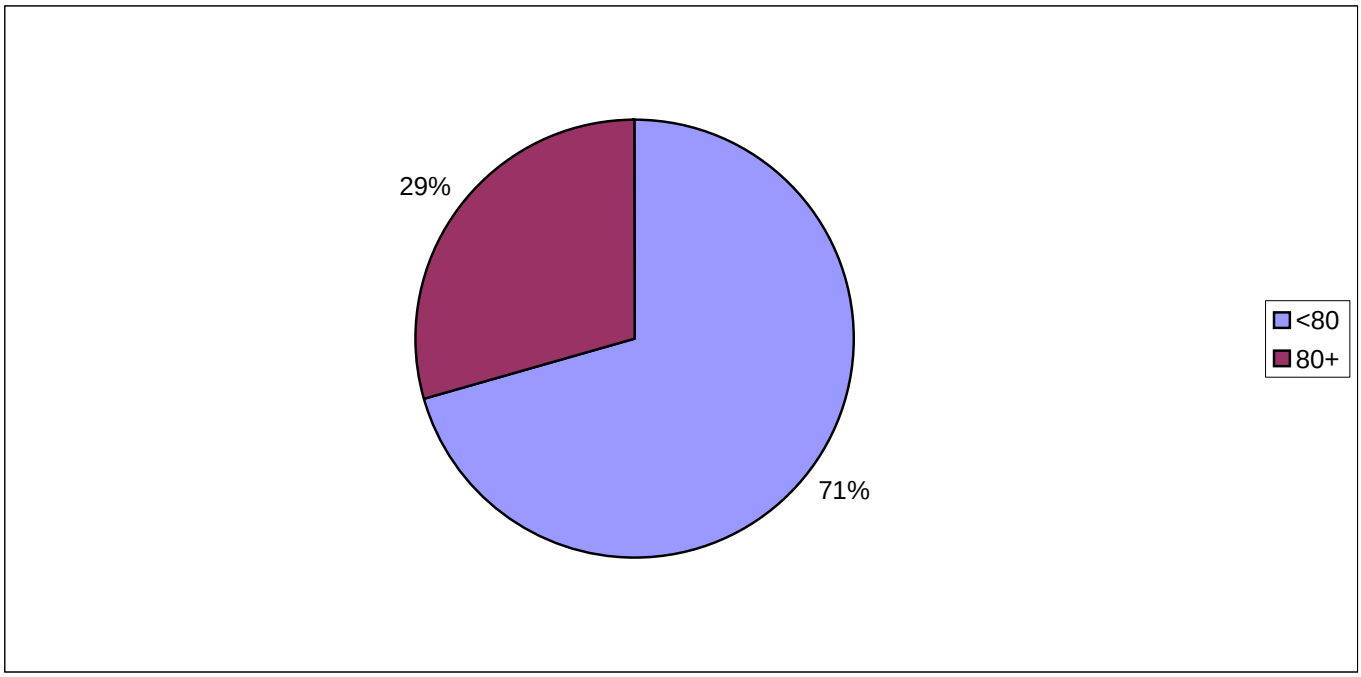
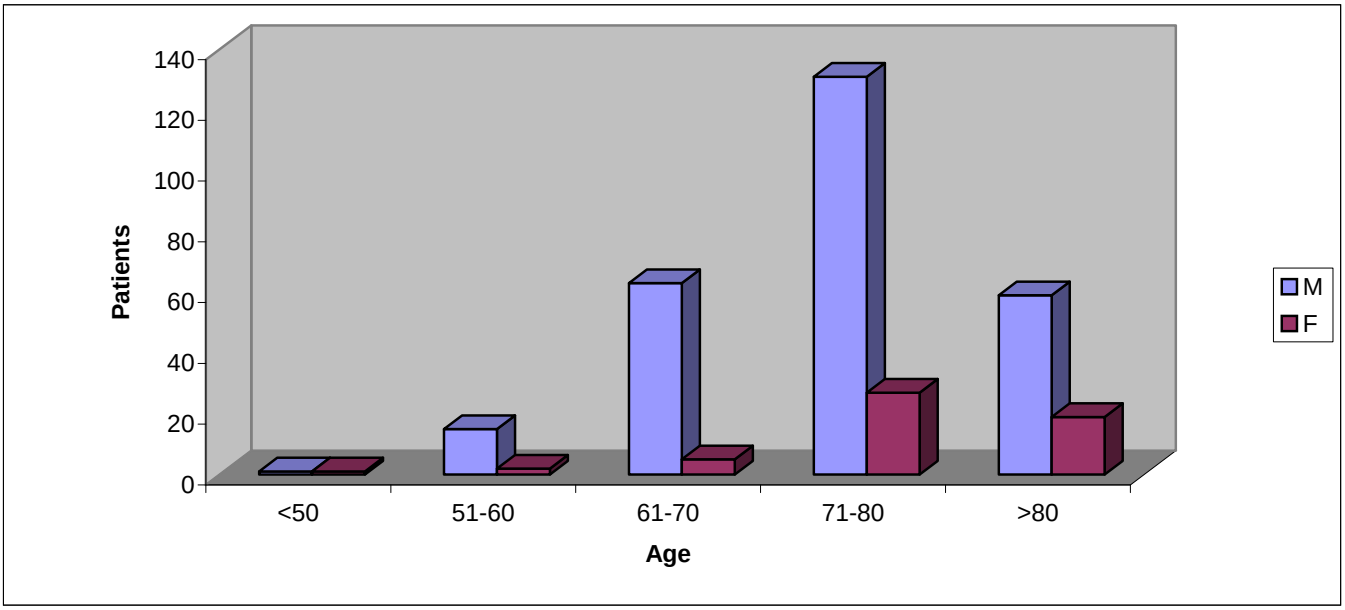
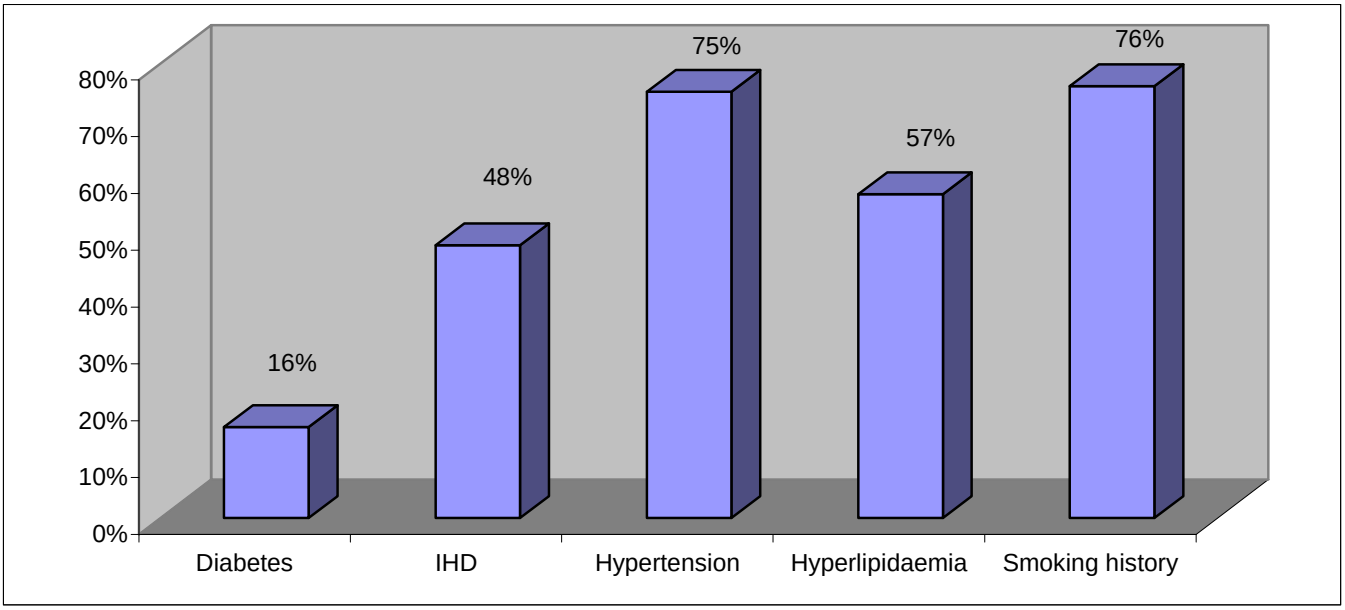


Fig.27. Aortic aneurysm sex by age category (n=323)



Risk factors present in the AA dataset are shown in fig.28.

Fig.28. Risk factors present in Aortic aneurysms (n=323)



Median postoperative length of stay was 7 days and 66 were operated on as emergencies (ruptured and painful AA). The breakdown of the AA is shown in fig.29, with the majority (70%) having an elective procedure.

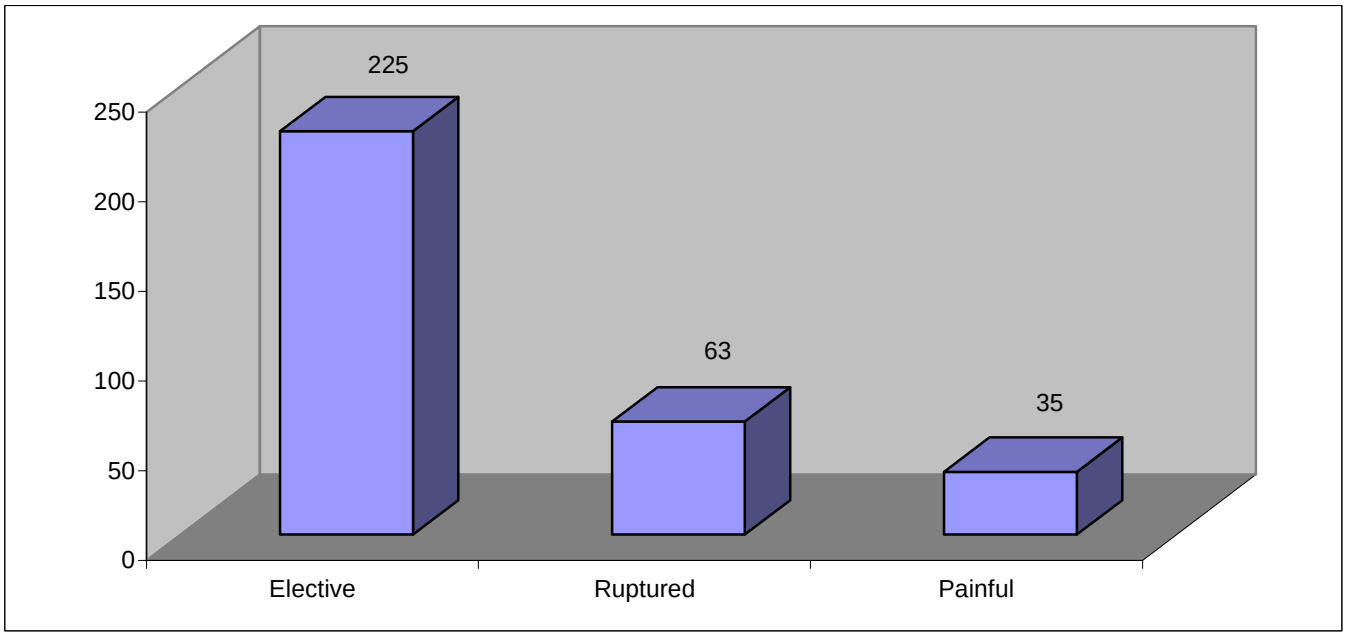


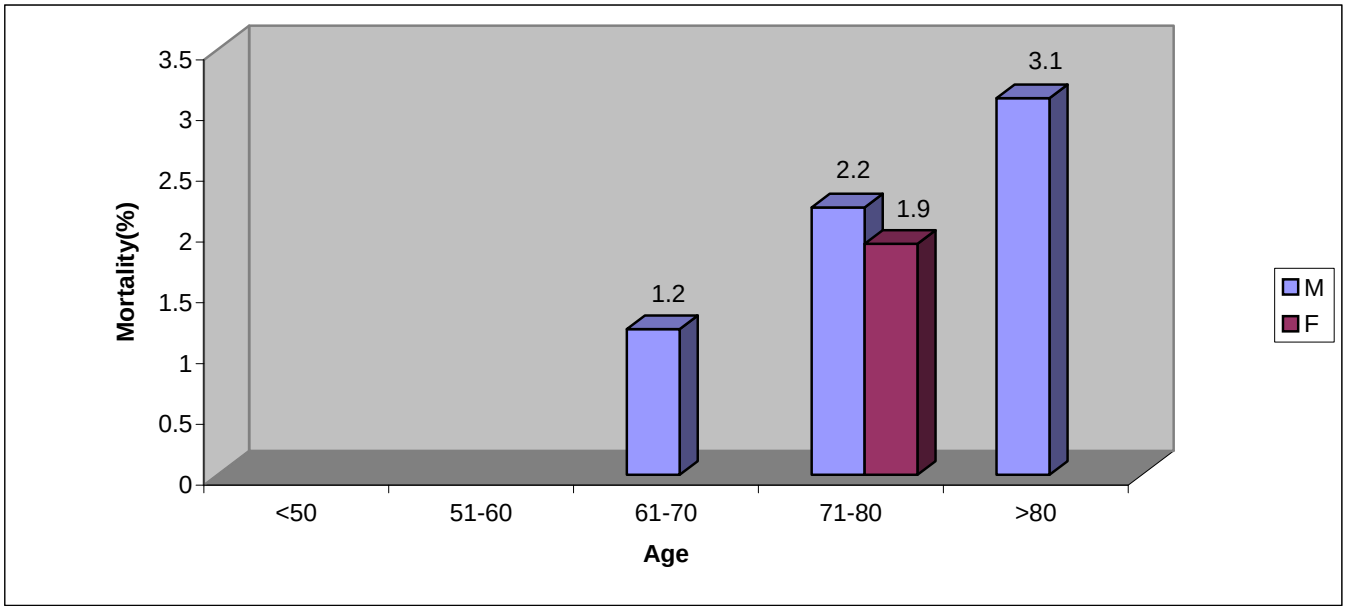
Fig.29. Aortic aneurysm repair by indication for surgery 2006/7 (n=323)

The type of operation performed for all 323 aortic aneurysms (elective, painful and ruptured) was open operation in 174 (54%) and endoluminal in 149 (46%).

Results from the MVSQI:

Crude mortality for the dataset was 8.4% and this was more evident in the older group of patients and was mostly male. (Fig.30)

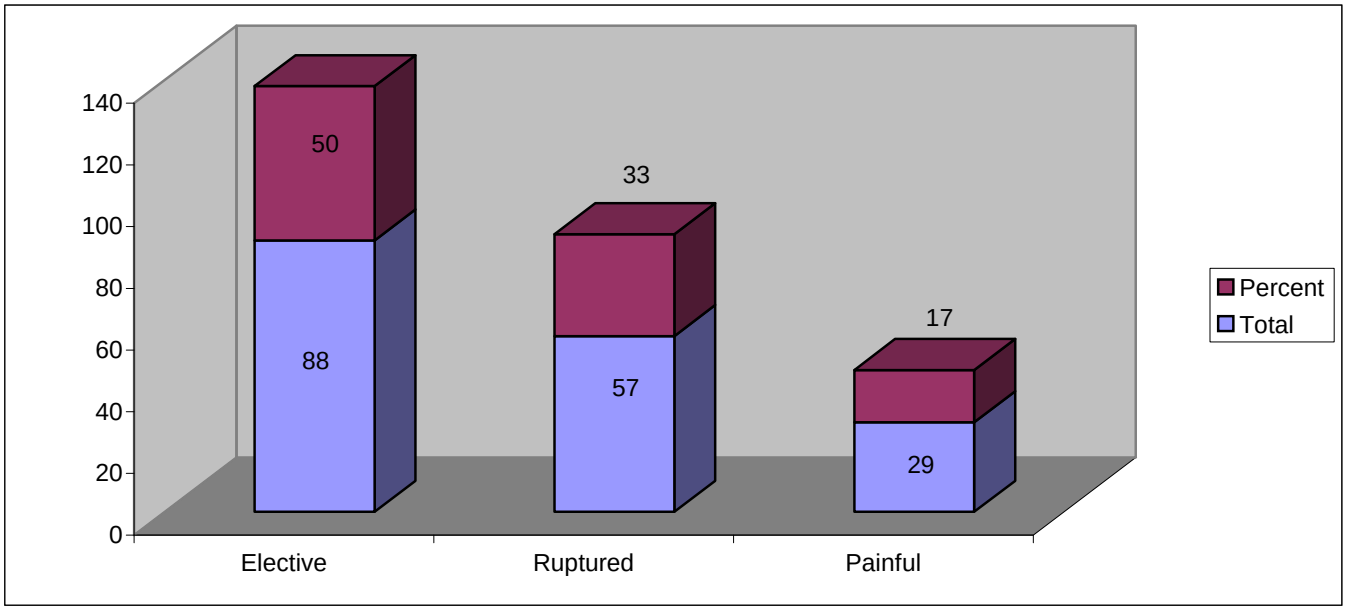
Fig.30. Mortality after aortic aneurysm repair by sex and age category 2006/7 (n=323)



Open repair:

Of the 323 AA patients, 174(54%) had an open operation. This group included **elective** repair, **ruptured** aneurysms and **painful** aneurysms (fig.31)

Fig.31. Open aortic aneurysm repair by indication 2006/7. (n=174)



Sex and age demographics were similar to the group as a whole with males comprising 80% of the subgroup and 25% of were over 80 years of age (c.f. all AA-83% and 29% respectively). Mean age was 74 years. Median postoperative length of stay was 9 days and the crude mortality rate was 12.6%. There were 58 emergency operations in the open group and there were 6 thoracoabdominal repairs (where the aneurysm extends into the chest). Risk adjustment revealed only 2 significant variables that predicted mortality in the 174 open aortic aneurysm repairs;

- Suprarenal aortic aneurysm (above the kidney arteries)
- Ruptured aneurysm

Thus a combined dataset from 1/1/2003 to 30/6/2007 was again studied (n=1045) and the significant variables were:

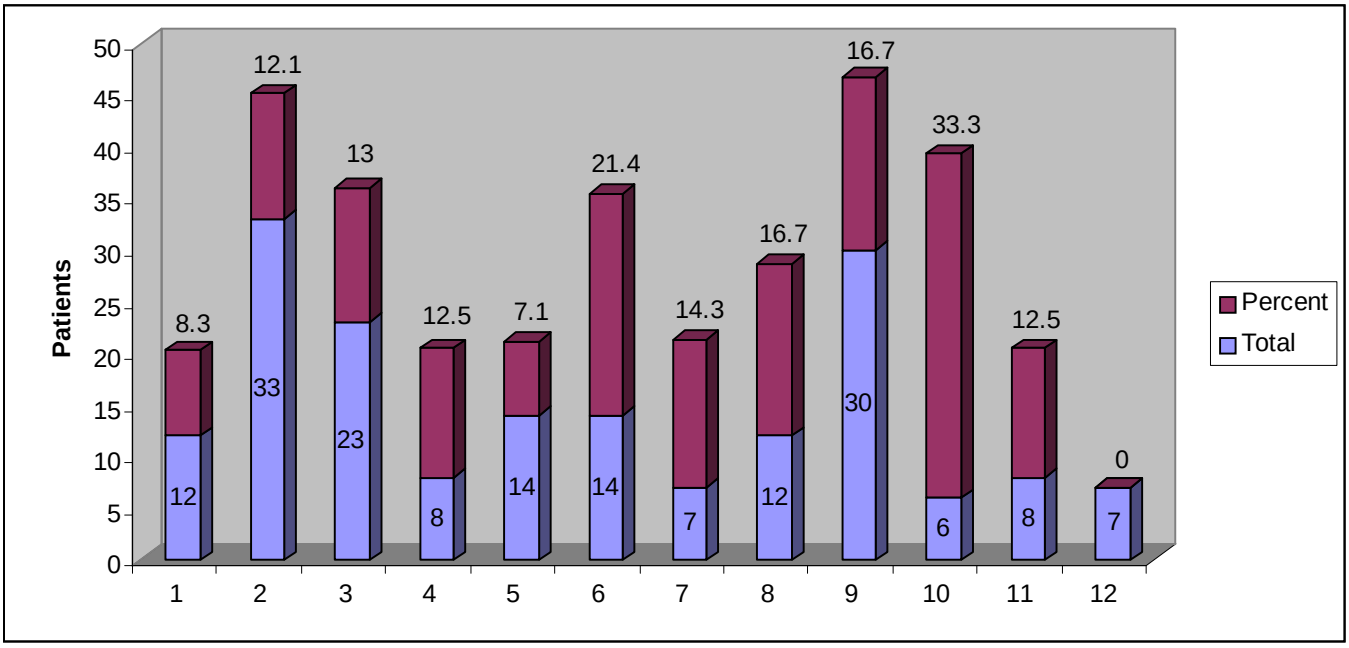
- Suprarenal aortic aneurysm
- Ruptured aneurysm
- Suprarenal clamping
- Ischemic heart disease
- Female
- Age > 80

(The dataset was 93% complete, and the missing variables were obtained by the statistical technique of multiple imputation). The crude mortality by hospital is shown in table 3.

Table 3. Crude mortality for open aortic aneurysm repair by hospital 2006/7 (n=174)

Hospital	Death	Total	Percent
1	1	12	8.3
2	4	33	12.1
3	3	23	13
4	1	8	12.5
5	1	14	7.1
6	3	14	21.4
7	1	7	14.3
8	2	12	16.7
9	5	30	16.7
10	2	6	33.3
11	1	8	12.5
12	0	7	0

Fig.32.Mortality for open aneurysm repair by hospital 2006/7 (n=174)



No hospital has been shown to perform below standard on detailed statistical testing.

Funnel plots were constructed for 2006-7 as well as for the larger dataset from 1/1/2003-30/6/2007. These are displayed in figs.33, 34.

Fig.33. Funnel plot of mortality for open aortic aneurysm repair 2006/7 (n=174)
Note the pooled risk-adjusted mortality of 13.36% (blue line). No outliers are apparent.

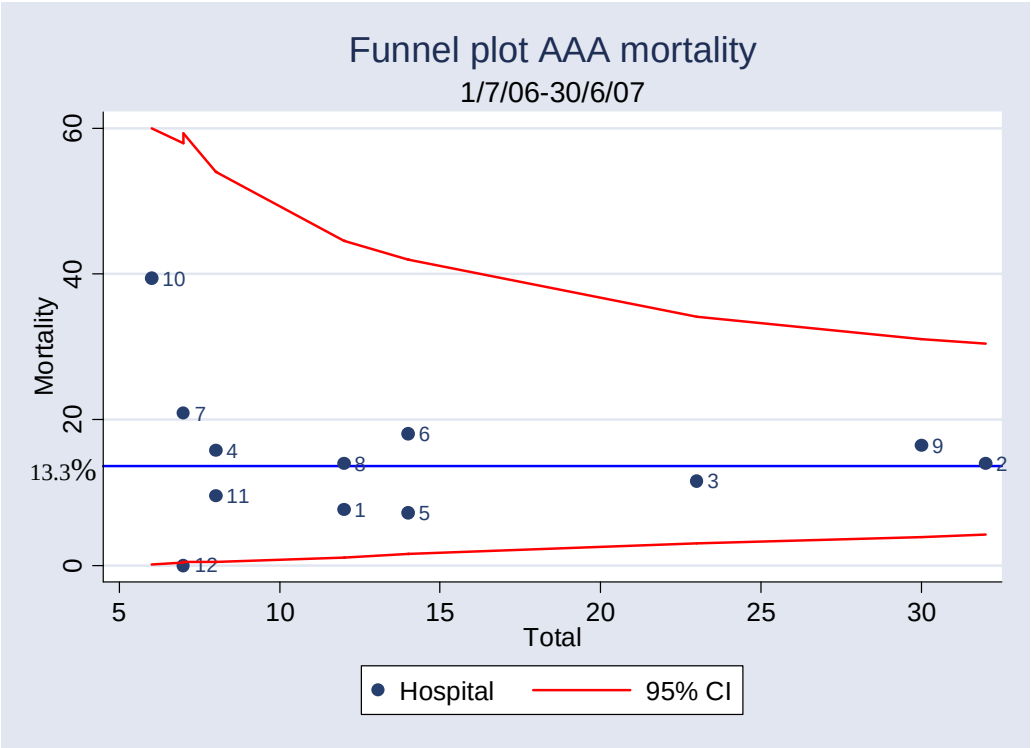
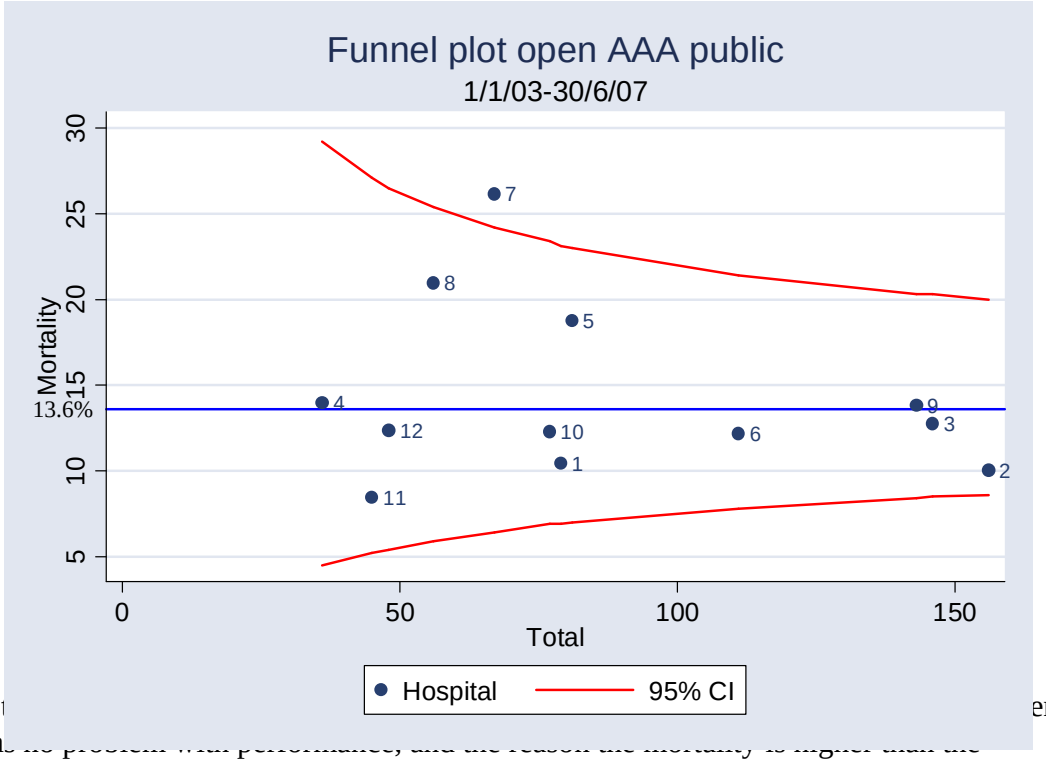


Fig.34. Funnel plot of mortality for open aortic aneurysm repair 03-07. (n=1045)



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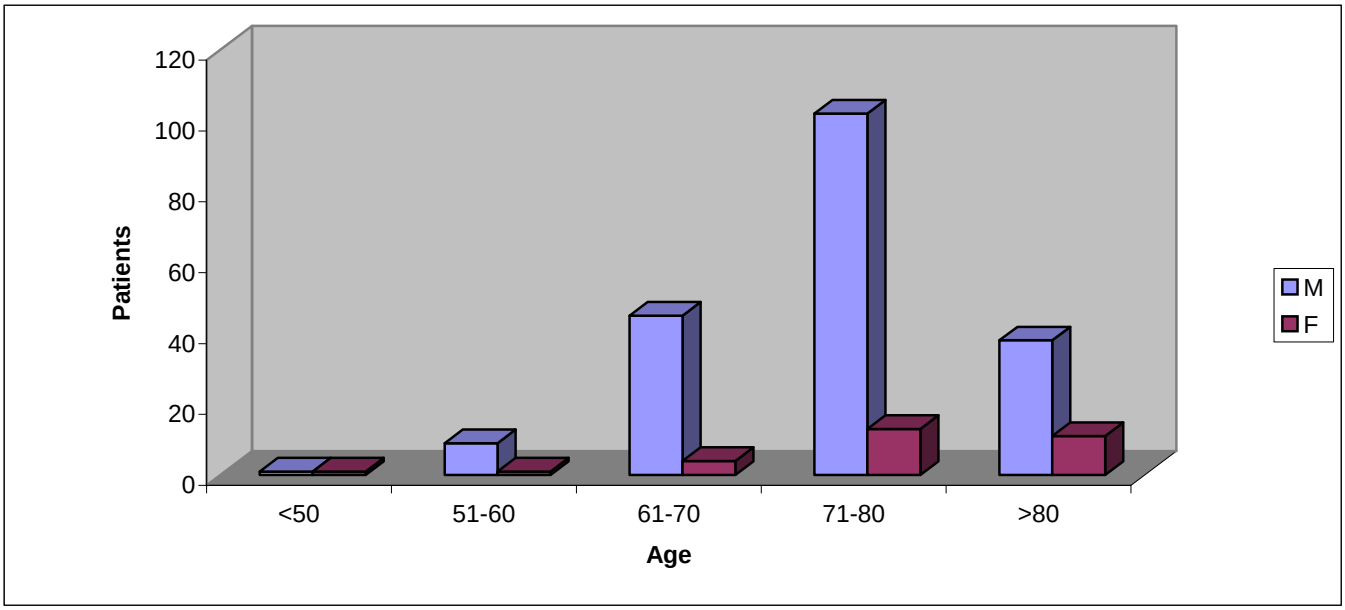
acceptable statistical limit is that this hospital had a high percentage of ruptured aneurysms.

Elective aortic aneurysms:

As previously mentioned, elective aneurysms are treated by both open and endoluminal methods. There were 225 elective aneurysms treated in 2006/7. Open operation was used in 88 patients and endoluminal repair in 137. The sex distribution for each age category is shown in fig.35.

Fig.35. Elective aortic aneurysm sex distribution by age category (n=225)



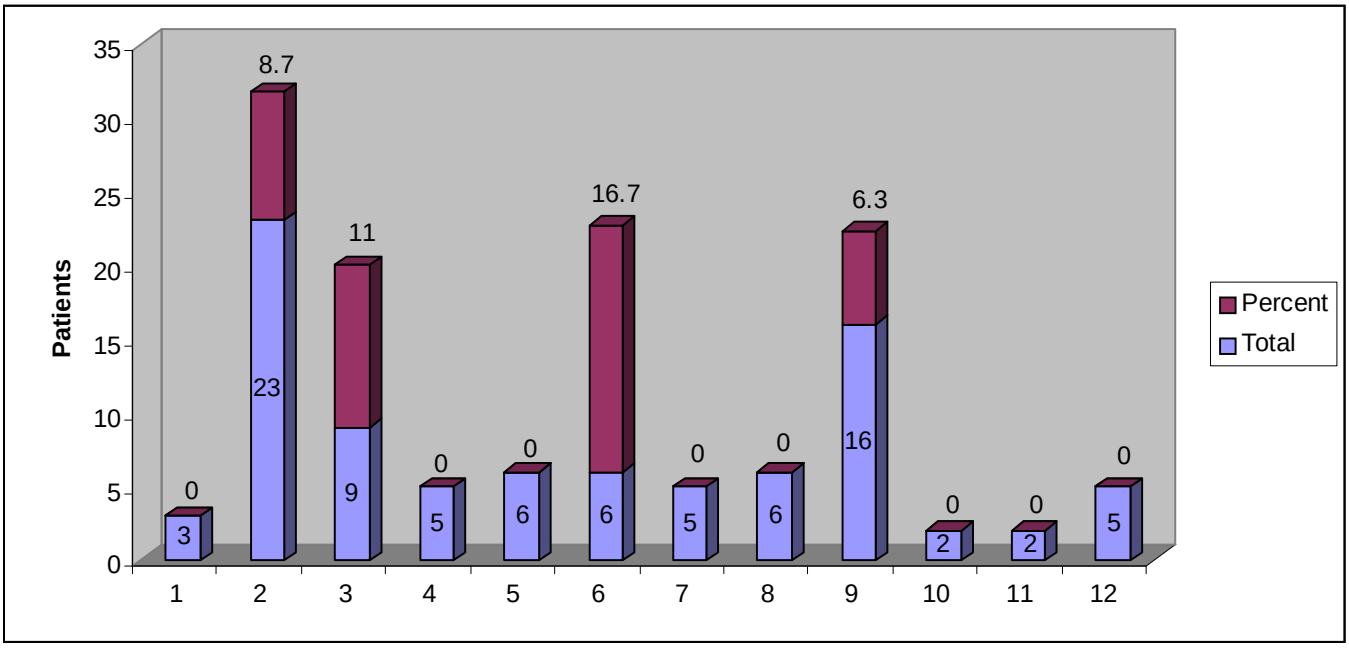
The crude mortality rate for all elective aortic aneurysm repair was 7/225 (3.1%) and the median postoperative length of stay was 8 days. Mortality in the open repair group was 5/88 (5.7%) and mortality for endoluminal repair was 2/137 (1.5%). Median postoperative length of stay for the open elective repair group was 9 days, and was 4 days for the endoluminal group. The mortality for open elective aneurysm repair by hospital is shown in table 4.

Table 4. Mortality of open elective aneurysm repair by hospital 2006/7. (n=88)

Hospital	Mortality	Total	Percent
1	0	3	0
2	2	23	8.7
3	1	9	11
4	0	5	0
5	0	6	0
6	1	6	16.7
7	0	5	0
8	0	6	0
9	1	16	6.3

10	0	2	0
11	0	2	0
12	0	5	0

Fig.36. Mortality of open elective aneurysm repair by hospital 2006/7 (n=88)



No hospital has shown substandard performance in this reporting period.

Endoluminal aneurysm repair:

Overall there were 149 endoluminal grafts placed for aneurysm in 2006/7. Mean age was 75 and 34% were >80 years of age. Indications for endoluminal grafts were elective in 137, pain in 6 and rupture in 6. Crude mortality for all endoluminal grafts was 6/149 (4%). Mortality for each indication is shown in table 5.

Table 5. Mortality of endoluminal repair by indication (n=149)

	Died	**Total**
Elective aneurysm	2	137
Painful aneurysm	1	6

Ruptured aneurysm	3	6

Ruptured aortic aneurysm:

Ruptured aortic aneurysms have traditionally been treated by emergency open repair, and carry a significant mortality. More recently there have been large series of patients treated by endoluminal grafting, usually in centres where there is great experience and expertise in endoluminal techniques and logistic issues of staffing and equipment at inconvenient times have been overcome. The reason for this swing is that the mortality in some of these series has been considerably lower than the open method.

There were 63 ruptured aneurysms during 2006/7. The mean age was 76 years and the median postoperative length of stay was 12 days. The patients were older than the elective group and 40% were >80 years of age (fig.37). The vast majority were male (figs.38, 39)

Fig.37.Age distribution ruptured aortic aneurysms (n=63)

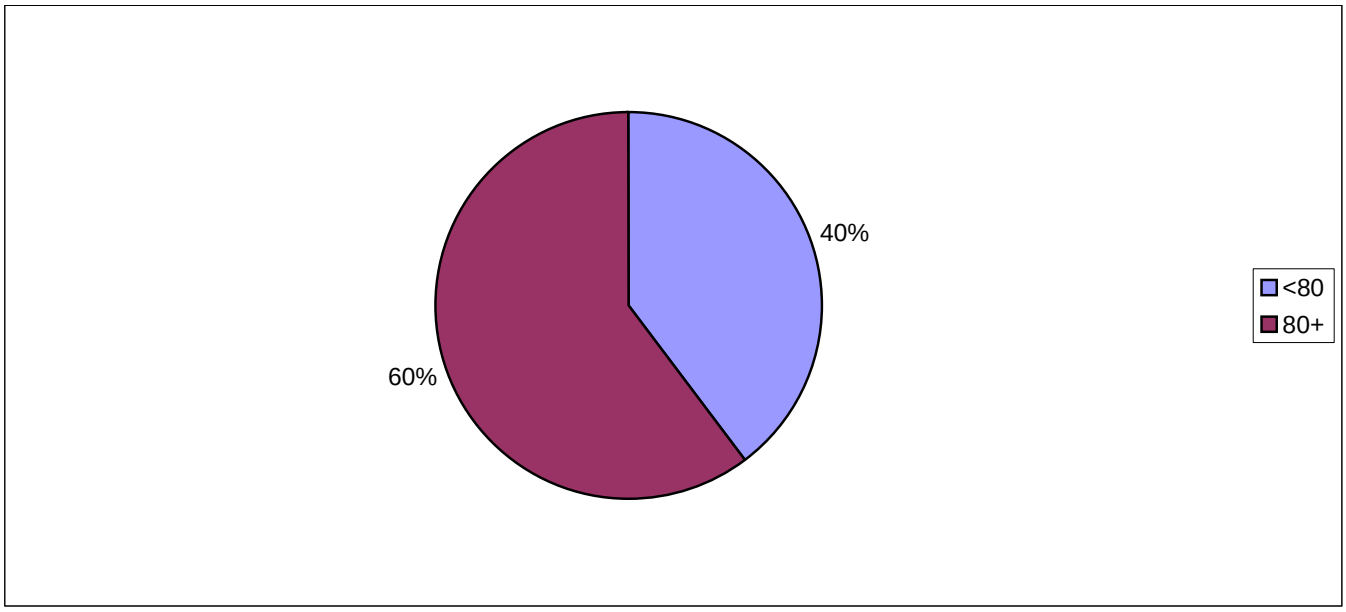


Fig.38. Sex distribution ruptured aortic aneurysms (n=63)

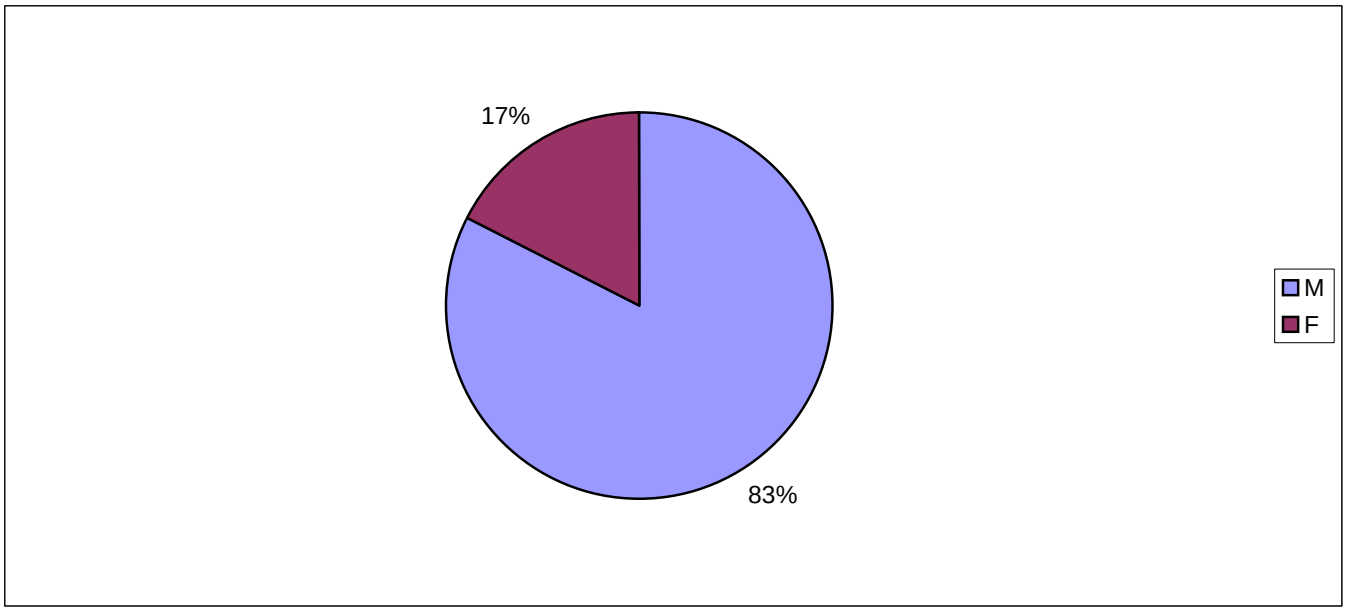
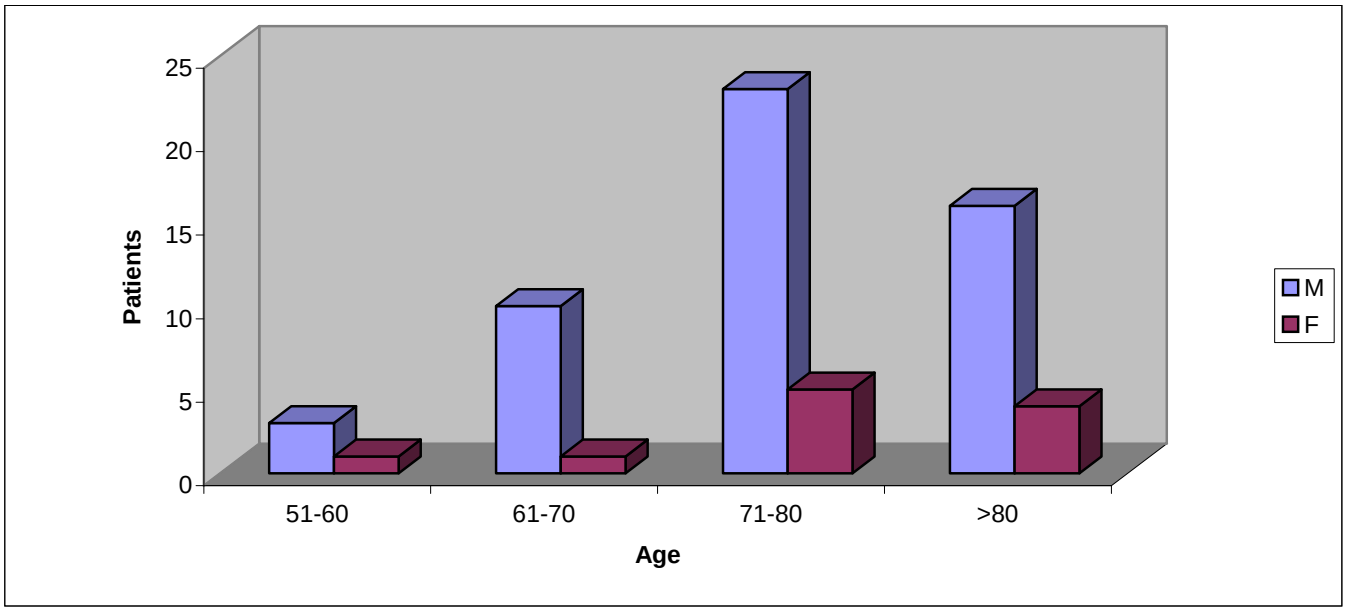
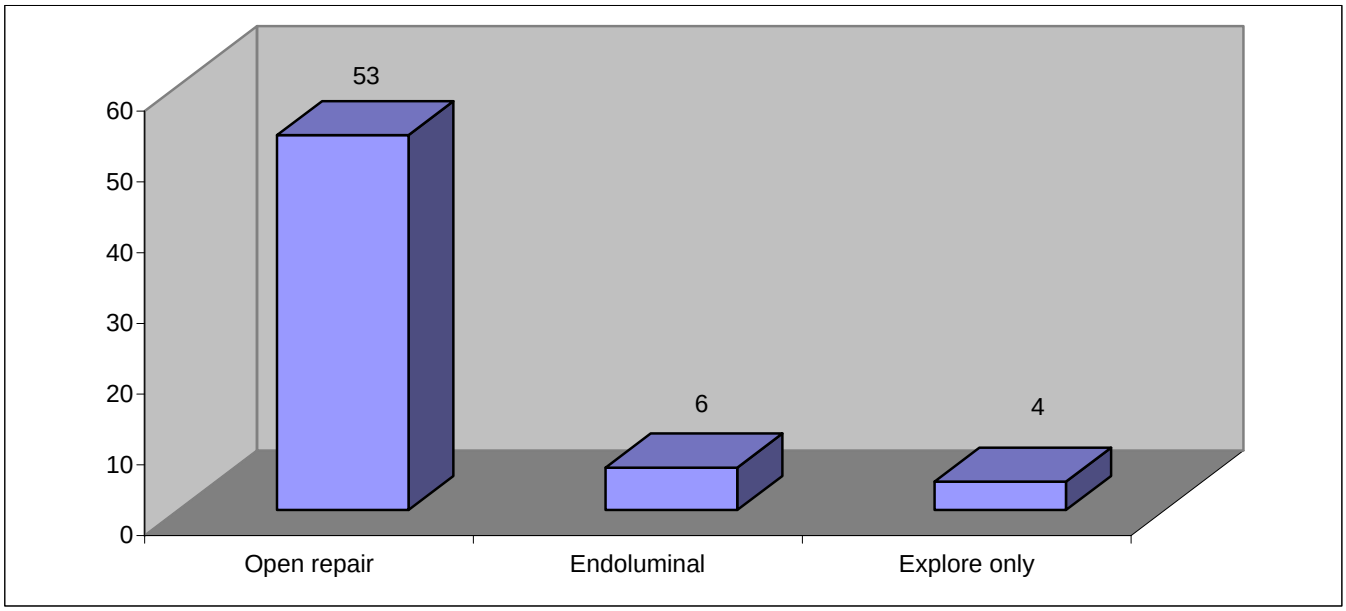


Fig.39. Ruptured aneurysms-sex distribution by age category (n=63)



Of the 63 ruptured aneurysms the vast majority (84%) were repaired by open operation. 4 patients were opened with the intention of bypass grafting, but died before this could be accomplished (fig.40).

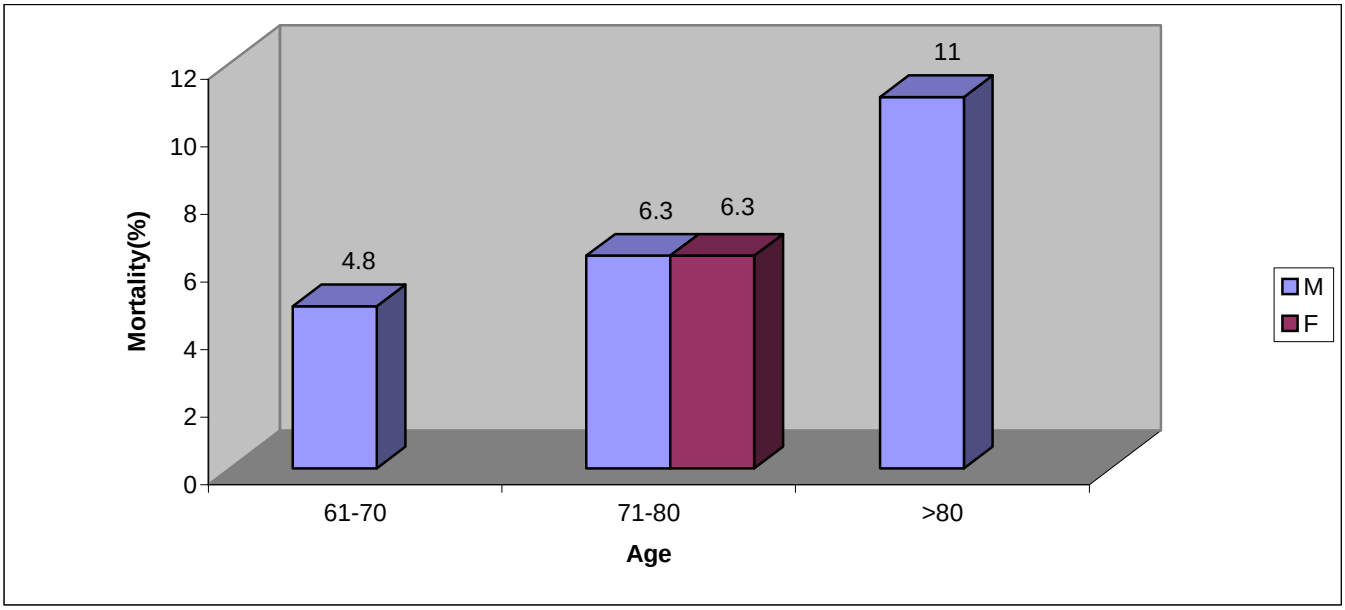
Fig.40. Ruptured aortic aneurysm-type of operation (n=63)



Outcome for ruptured aortic aneurysms:

Crude mortality was 29% (18/63). 11/53 bypasses died (21%) and 3/6 endoluminals died (50%). Thus in this small series, no advantage of endoluminal repair was evident. All 4 patients who were explored only died. Mortality for ruptured aneurysms across sex and age category is shown in fig.41. Not surprisingly, the older patients had the highest mortality, comprising over a third of the mortality of the series (11% out of the 29% total mortality).

Fig.41. Ruptured aortic aneurysm-mortality by sex and age category (n=63)



It is important to appreciate that if mortality is broken down into age categories and assessed within age groups, then it is apparent that there is not a great difference in the proportion of deaths. The implication of this is that surgery should not be withheld in the >80 category, as the mortality in the 20 patients in this group was a respectable 35% (fig.42)

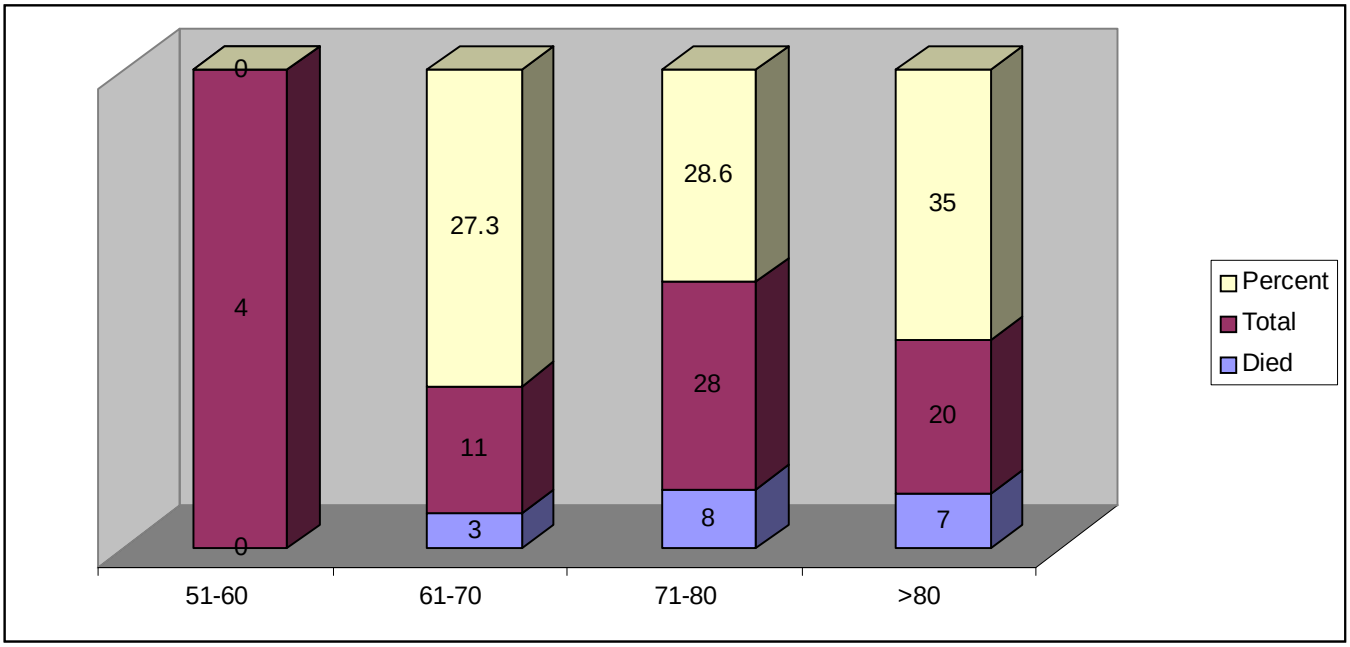


Fig.42. Ruptured aneurysm mortality by age category.

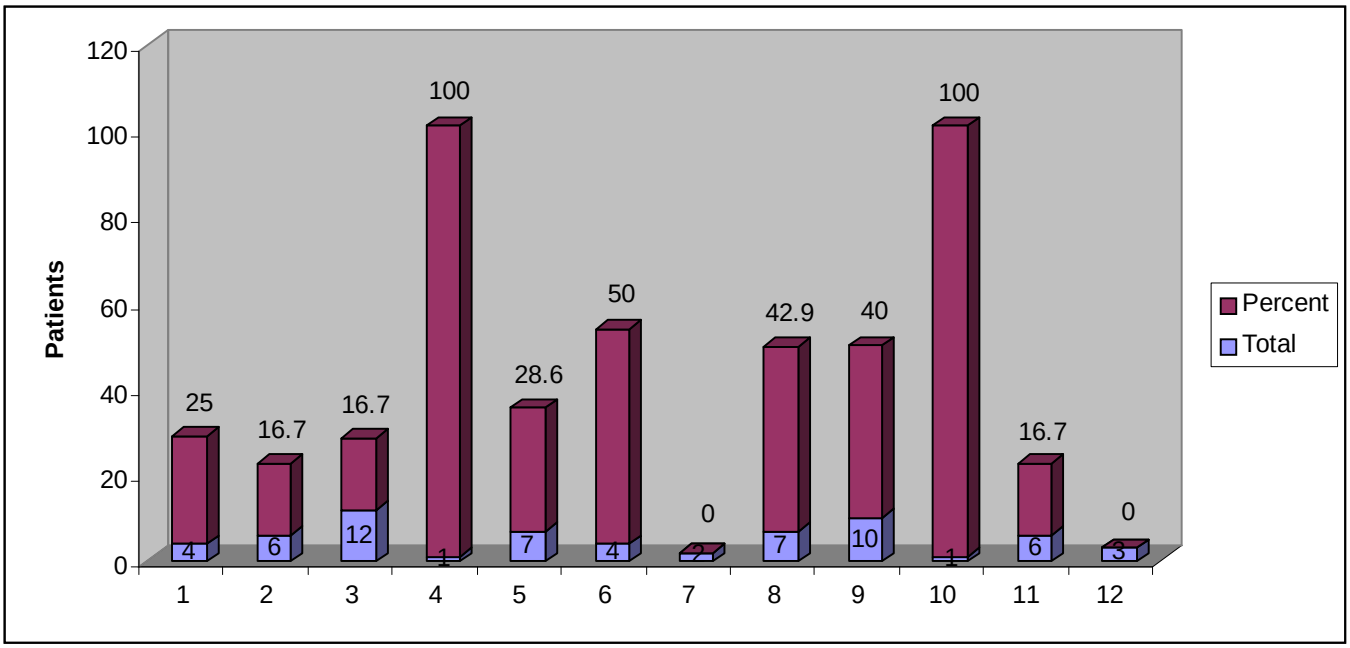
Mortality by hospital is shown in table 5. Note that percentages are misleading when dealing with small numbers.

Table 5. Mortality of ruptured aortic aneurysm by hospital 2006/7 (n=63)

Hospital	Death	Total	Percent
1	1	4	25
2	1	6	16.7
3	2	12	16.7
4	1	1	100
5	2	7	28.6
6	2	4	50
7	0	2	0
8	3	7	42.9
9	4	10	40
10	1	1	100
11	1	6	16.7

12 0 3 0

Fig.43. Mortality of ruptured aortic aneurysm by hospital 2006/7 (n=63)



Conclusion

This report assures the community that they receive a very high standard of treatment for arterial disease in Victorian public hospitals. The report has focused on the three most common surgical procedures used to treat cerebrovascular disease, aortic aneurysmal disease and occlusive disease of the lower limbs. The MVSA Audit has been and continues to be focused on risk adjustment, as this is crucial if meaningful comparisons are to be made internally and externally with the wider international vascular surgical community.

This report will continue to be published on an annual basis to ensure that this high standard is maintained.

Low numbers of complications, such as with carotid endarterectomy, make analysis difficult. Similarly, when the infra-inguinal data was checked for each individual hospital there were no identifiable problems but the number of operations in this group was low at some hospitals. There is no detectable issue of competence when the group as a whole is assessed.

A careful process of clinical evaluation and review by experienced clinicians has been adopted by the MVSA as the definitive step in assessing whether or not there has been unacceptable performance. This has been refined after lengthy debate, and membership of the MVSA implies compliance with this process of peer performance review.

The publication of this report demonstrates the value of having a professional group such as the MVSA auditing clinical performance. This publication has only been possible because of the involvement of the Department of Human Services. This is expected to be an ongoing arrangement in order to ensure that Victorians receive the highest possible quality of health care by vascular units in the state.