Australasian Vascular Audit Public Report – 2024

AVA
AUSTRALASIAN VASCULAR AUDIT

ANZSVS
Australian and New Zealand Society for Vascular Surgery

Contents

Foreword

It is a privilege to introduce the 2024 Australasian Vascular Audit report, which represents the culmination of many hours work by all members of the society. The AVA is established as a vital pillar of the society and of vascular surgeons' professional development. Since inception in 2010, the AVA has recorded 675,000 cases. It has grown to 279 consultant contributors who entered 52,217 cases last year. Over 15 years it has identified 42 "outliers" who after review of their cases according to the defined AVA Algorithm and if required, were pro-actively remediated. Furthermore, none of those identified have ever been identified as repeat "outliers".

Much of this success is owed to the vision and persistence of the "pioneers" of our audit, in particular Barry Beiles and Bernie Bourke and the society members who founded the AVA. The ongoing conscientious efforts of the Audit monitoring committee and the tireless administration by Dr Barry Beiles, to whom we are all indebted.

The annual AVA Certificate attests that the member has participated by entering all index procedures (Carotid, Aortic, Infrainguinal Bypass, Dialysis access, Endovascular procedures for PAD, Endovenous obliteration of the saphenous vein) in both private and public hospitals. It remains the responsibility of the primary surgeon to enter these index cases but many utilise the database for complete practice audit of every surgical case. The data entry can be perceived as onerous but many surgeons have managed to enter over 500 cases per year and some more than 6000 cases over 15 years.

Unfortunately, the number of applications received this year (for the 2024 calendar year) has decreased by 15%. This may reflect a data-entry malaise, a perceived lack of benefit for time invested or an indifference or philosophical objection to the AVA process. Fundamentally, this needs to change and will be addressed.

The ANZSVS executive wants to work with RACS, governments and health services to increase the recognition of AVA participation and bolster the integrity of audit. The scoping exercise for the audit's re-design (AVA 2.0) is underway, potentially engaging a new IT provider. The IT providers tendering in this process, may potentially be able to provide and maintain an expanded framework with increased functionality but potentially less laborious data-entry (or alternative means of data-entry or periodic upload). The scoping and tendering process is underway guided by the AVA Review Working Group.

In the current climate, with a myriad of threats and challenges, the surgical fraternity are struggling to maintain reputation with governments, payers and the communities we serve. The <u>autonomy</u> of specialist societies like the ANZSVS to self-regulate provision of services to patients is increasingly threatened. Fortunately, most of the negative reports and aspersions do not relate to vascular surgeons. I believe the AVA has more to do with that than we appreciate! The AVA is uniquely, a true and complete peer-reviewed audit cycle which has correction of the outliers' practice at its core. Over the first 15 years of operation, 42 outliers have been identified. These surgeons' cases and outcomes have been clarified and reanalysed locally (independently within unit or institution) and sometimes with the assistance and to the satisfaction of the Audit monitoring committee. With improved governance and (rarely) practitioner restrictions - improved outcomes are facilitated. This is an example of structured feedback but I believe it also works ever-presently and perhaps even subconsciously for us all. Who has not reflected on the potential for a difficult case potentially experiencing a complication which may wind up as a “red-flag” in the AVA analysis? The data we obtain has also proved very valuable in improvement of our services and promotion of efficiency.

It is essential that we continue to demonstrate true “professionalism” and improve the provision of specialist vascular services for our communities. The AVA must remain a pillar of the ANZSVS and a core-activity for our entire membership. Without the AVA, this function may have already been taken out of our hands and we may potentially be expected work with poor-quality “coding” or billing data, face increasingly onerous demands from external regulatory bodies. Without the AVA we are less capable of demonstrating our position as providers of quality vascular care. With it, we already have powerful tool on which we can mount a case for ongoing self-regulation, support our current clinical practices, justify remuneration and appeal against some of the looming threats.

The demonstration of professionalism in the daily delivery of care to our patients and the way we run our units and practices is vital. Participation in a society-endorsed audit (with its complete “audit-cycle”) is the most professional activity we can all be accountable to. As a society, the AVA is perhaps the greatest demonstration of professionalism that we can hold-up and confidently reassure our potential critics. The AVA is an exemplar among the surgical subspecialties.

Mark Jackson
President ANZSVS

Introduction

The Australasian Vascular Audit (AVA) has just completed its 15th year of data collection. It was established in 2008 after constitutional changes had been adopted following a ballot with an overwhelming majority by the membership of the Australian and New Zealand Society for Vascular Surgery (ANZSVS). This had been a long-term goal of the Society with the aim of amalgamating the existing vascular audits throughout Australia and New Zealand. The audit is compulsory, with membership of the ANZSVS conditional upon participation in audit. Both public hospital and private practice data are collected at 2 points in the admission episode; at admission/operation and after discharge and only patients undergoing a surgical or endovascular procedure are entered in the database. Although all procedures are captured in the database, the following index procedures were selected for audit:

1. Aortic surgery –includes both aneurysmal and occlusive disease (survival)

   i. Open elective and emergency

   ii. non-fenestrated elective and emergency endografts

   iii. Fenestrated endografts

2. Carotid procedures (freedom from stroke/death)

   i. Open carotid endarterectomy

   ii. Carotid stents

3. Infrainguinal bypasses (patency and limb salvage)

4. AV Fistula for dialysis (patency)

5. Endovascular procedures for lower limb peripheral arterial disease (complications, amputation and death)

6. Endovenous obliteration of great and small saphenous vein

Audit monitoring committee

The executive committee of the ANZSVS has established an Audit Monitoring Committee (AMC), which consists of 4 members; the Chairman of the AMC, the immediate past-president of the ANZSVS, the administrator of the AVA, and the president or immediate past-president of the Vascular Society of New Zealand (VSNZ). These members are elected and are senior members of the ANZSVS engaged in active vascular surgical practice. Their roles and responsibilities are:

- to oversee protection of the collected data
- to ensure confidentiality of participants (both surgeon and patient alike)

- to monitor the collection of the audit data and to facilitate maximal compliance
- to prevent misuse of the data (including addressing complaints about misuse of the data)
- to investigate and verify statistical outliers according to a pre-determined algorithm
- to assess applications to determine suitability for participation in the AVA.
- to assess applications to use the collected data for non-audit purposes.
- to oversee the AVA verification process
- to provide an annual report of the AVA results for the ANZSVS AGM.
- to identify opportunities for performance improvement
- to identify opportunities for external publication
- to provide annual certificates of satisfactory vascular surgical audit participation
- to oversee the disclosure of audit data to a third party at the instigation of a participating member

Overview

This report covers the period 2024. There were 52,217 operations entered; 47,190 from Australia and 4,937 from New Zealand (Fig 1). Although the demographic data applies to all operations, the outcome analyses are based on the 51,487 discharged patients (98.6%).

Fig 1. Volume of vascular surgery by country 2024

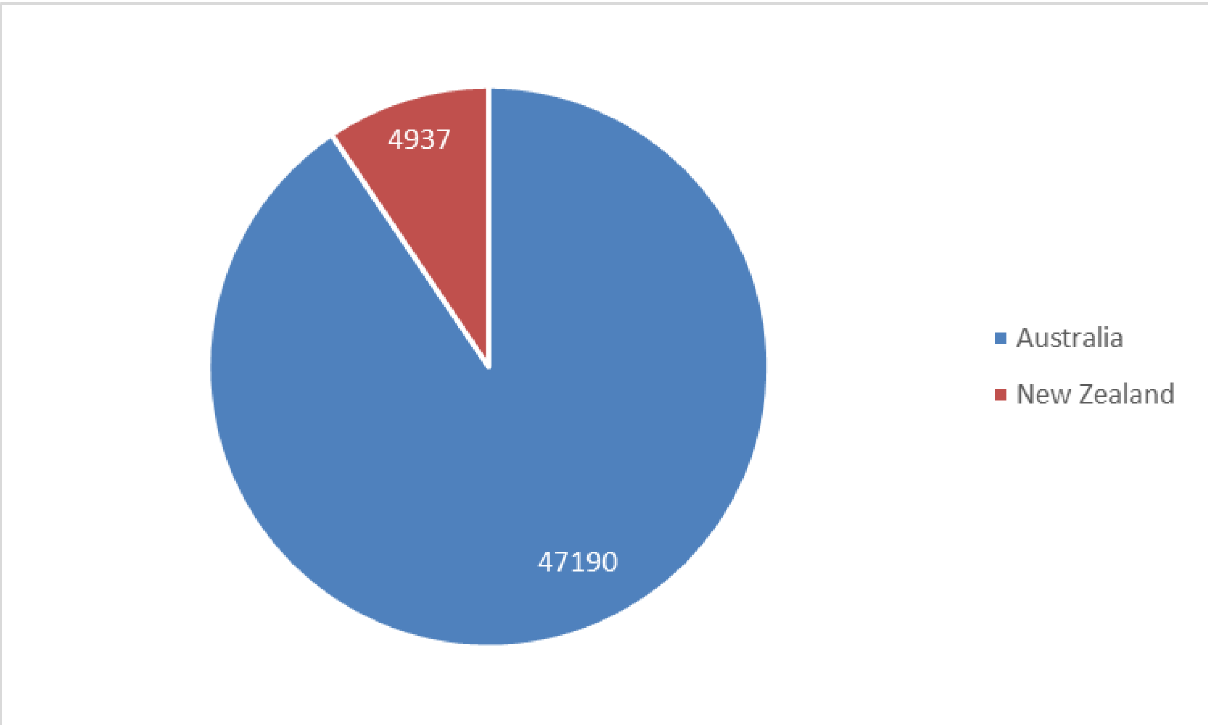
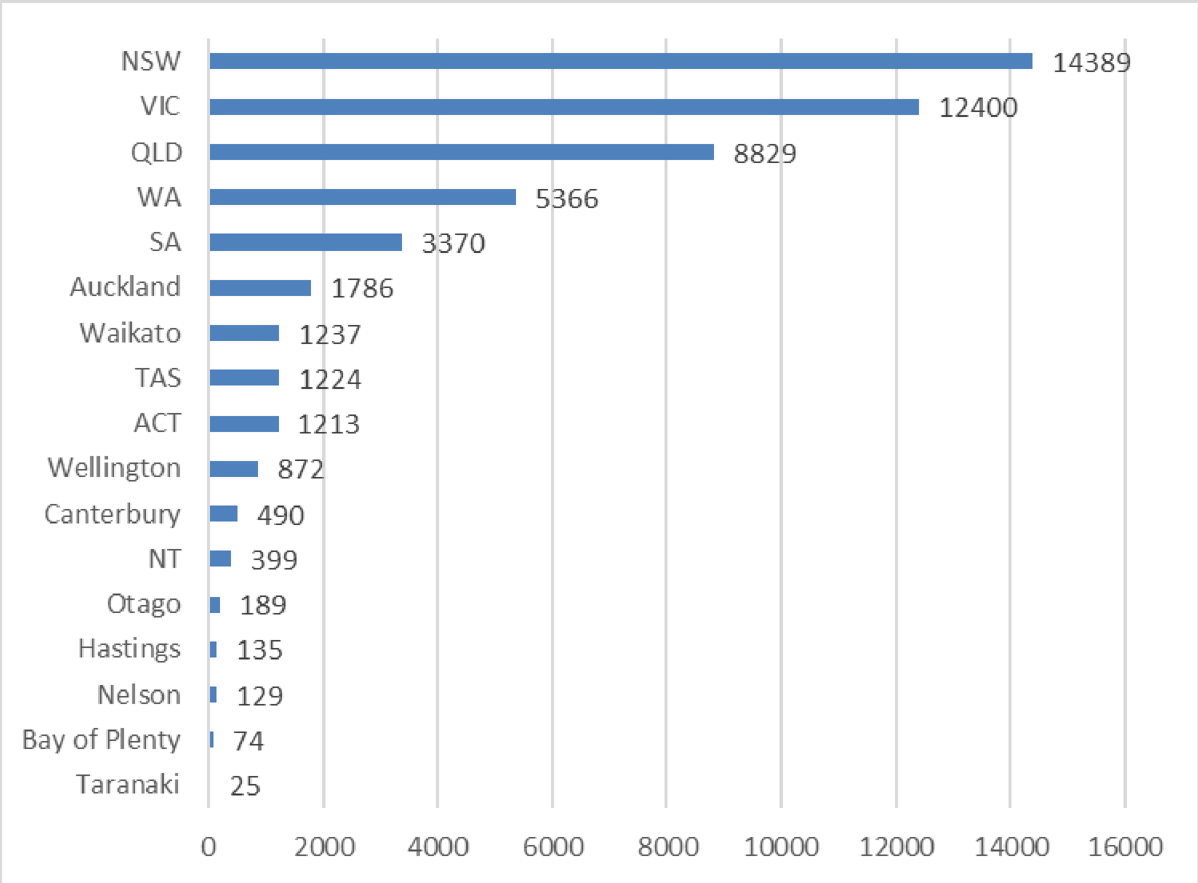


Fig 2. Operations by Australian State and New Zealand Region 2024



279 consultants entered data from 188 hospitals/clinics which are shown alphabetically in the following table. The mean number of operations was 187 with a range of 1-626.

Alfred Hospital-Melbourne
Allamanda Private Hospital-Southport
Armadale Kelmscott District Hospital-Armadale
Ascot Hospital-Remuera
Ashford Hospital-Ashford
Auckland City Hospital-Auckland
Austin Hospital-Heidelberg
Bairnsdale Hospital-Bairnsdale
Ballarat Base Hospital-North Ballarat
Ballarat Day Procedure Centre-Ballarat
Bankstown Hospital-Bankstown
Baringa Private Hospital-Coff's Harbour
Blacktown Hospital-Blacktown
Blue Mountains Hospital-Katoomba

Box Hill Hospital-Box Hill
Brisbane Waters Private Hospital-Woy Woy
Buderim Private Hospital-Buderim
Bunbury Regional Hospital-Bunbury
Cabrini Hospital-Malvern
Cairns Base Hospital-Cairns
Cairns Private Hospital-Cairns
Calvary Adelaide Hospital-Adelaide
Calvary Hospital-Lenah Valley
Calvary Hospital-Wagga Wagga
Calvary John James Hospital-Deakin
Calvary Private Hospital-Bruce
Calvary Public Hospital-Bruce
Camden Surgical Hospital-Elderslie
Canberra Hospital-Garran
Christchurch Public Hospital-Addington
Coffs Harbour Day Hospital-Coffs Harbour
Coffs Harbour Health campus-Coffs Harbour
Concord Repatriation Hospital-Concord
Dandenong Hospital-Dandenong
Dunedin Public Hospital-Dunedin
Epworth Eastern Hospital-Box Hill
Epworth Hospital-Geelong
Epworth Hospital-Richmond
Fiona Stanley Hospital-Murdoch
Flinders Medical Centre-Bedford Park
Flinders Private Hospital-Bedford Park
Frankston Hospital-Frankston
Freemasons Hospital-East Melbourne
Fremantle Hospital-Fremantle
Friendly Society Private Hospital-Bundaberg West
Glenelg Day Surgery-Glenelg
Gold Coast Hospital Robina-Robina
Gold Coast Private Hospital-Parklands
Gold Coast University Hospital-Southport
Gosford District Hospital-Gosford
Greenslopes Private Hospital-Greenslopes
Hastings Memorial Hospital-Camberley
Hobart Private Hospital-Hobart
Hollywood Private Hospital-Nedlands
Holmesglen Private Hospital-Moorabbin
Hornsby Ku-ring-gai Hospital-Hornsby
Innisfail Hospital-Innisfail
John Flynn Private Hospital-Tugun
John Hunter Hospital-New Lambton

Joondalup Health Campus-Joondalup
Knox Private Hospital-Wantirna
Lake Macquarie Private Hospital-Gateshead
Launceston General Hospital-Launceston
Lingard Private Hospital-Merewether
Lismore Base Hospital-Lismore
Liverpool Hospital-Liverpool
Macquarie University Hospital-North Ryde
Manukau Surgical Centre-Manurewa
Mater Adult Hospital-South Brisbane
Mater Hospital-Pimlico-Townsville
Mater Private Hospital-North Sydney
Mater Private Hospital-South Brisbane
Melbourne Private Hospital-Parkville
Mercy Hospital-Epsom
Mersey Community Hospital-Latrobe
Mid North Coast Diagnostic Imaging-Port Macquarie
Middlemore Hospital-Otahuhu
Mildura Private Hospital-Mildura
Mitcham Private Hospital-Mitcham
Monash Medical Centre-Clayton
Mulgrave Private Hospital-Mulgrave
National Capital Private Hospital-Garran
Nelson Hospital-Nelson
New Bendigo Hospital-Bendigo
Newcastle Private Hospital-New Lambton Heights
Noarlunga Hospital-Noarlunga
Noosa Hospital-Noosaville
North Eastern Community Hospital-Campbelltown
North Gosford Private Hospital-North Gosford
North Shore Private Hospital-St Leonards
North West Private Hospital-Burnie
North West Private Hospital-Everton Park
Northern Beaches Hospital-Frenchs Forest
Northern Hospital-Epping
Ormiston Hospital-Botany Junction
Osborne Park Hospital-Stirling
Peninsula Private Hospital-Frankston
Pindara Private Hospital-Benowa
Port Macquarie Base Hospital-Port Macquarie
Port Macquarie Private Hospital-Port Macquarie
Prince of Wales Private Hospital-Randwick
Prince of Wales Public Hospital-Randwick
Princess Alexandra Hospital-Woolloongabba
Queen Elizabeth Hospital-Woodville West

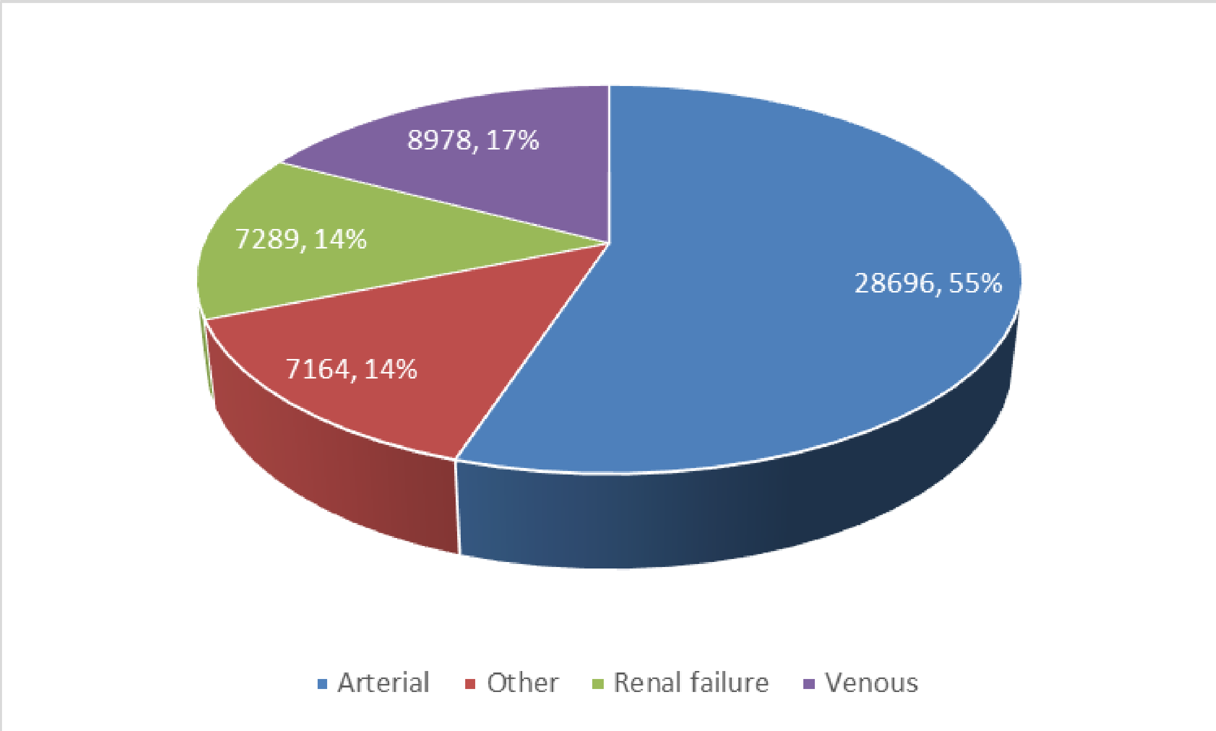
Queensland Childrens Hospital-South Brisbane
Rathdowne Rooms-Rathdowne
Riverland Regional Hospital-Berri
Royal Adelaide Hospital-Adelaide
Royal Brisbane and Womens Hospital-Herston
Royal Childrens Hospital-Parkville
Royal Darwin Hospital-Casuarina
Royal Hobart Hospital-Hobart
Royal Melbourne Hospital-Parkville
Royal North Shore Hospital-St Leonards
Royal Perth Hospital-Perth
Royal Prince Alfred Hospital-Camperdown
Seaford Day Surgery-Seaford Heights
Sir Charles Gairdner Hospital-Nedlands
Southern Cross Hospital-New Plymouth
St Andrews Private Hospital-Adelaide
St Andrews Private Hospital-Ipswich
St Andrews Private Hospital-Toowoomba
St Andrews War Memorial Hospital-Brisbane
St George District Hospital-Kogarah
St George Private Hospital-Kogarah
St JOG Hospital-Bendigo
St JOG Hospital-Berwick
St JOG Hospital-Bunbury
St JOG Hospital-Geelong
St JOG Hospital-Midland
St JOG Hospital-Murdoch
St JOG Hospital-North Ballarat
St JOG Hospital-Subiaco
St Vincents Private Hospital-Darlinghurst
St Vincents Private Hospital-East Lismore
St Vincents Private Hospital-Fitzroy
St Vincents Private Hospital-Launceston
St Vincents Private Hospital-Northside
St Vincents Private Hospital-Toowoomba
St Vincents Public Hospital-Darlinghurst
St Vincents Public Hospital-Fitzroy
Steele Street Clinic-Devonport
Strathfield Private Hospital-Strathfield
Sunshine Coast Private Hospital-Buderim
Sunshine Coast University Private Hospital-Birtinya
Sunshine Coast University Public Hospital-Birtinya
Sunshine Hospital-St Albans
Sutherland District Hospital-Caringbah
Sydney Adventist Hospital-Wahroonga

Tamworth Base Hospital-Tamworth
Taranaki Base Hospital-Westown
Tauranga Public Hospital-Tauranga
The Bays Hospital-Mornington
The Fraser Clinic-Tauranga
The Mount Hospital-Perth
The Nepean Hospital-Kingswood
The Nepean Private Hospital-Kingswood
The Prince Charles Hospital-Chermside
The Tweed Hospital-Tweed Heads
The Vein Centre-Hawthorn
The Wesley Hospital-Auchenflower
Toowoomba Base Hospital-Toowoomba
Townsville Hospital-Douglas
University Hospital-Geelong
User XXX Rooms-Footscray
User XXX Rooms-Nedlands
User XXX rooms-QLD
User XXX Rooms-Murdoch
User XXX Rooms-Greenslopes
User XXX Rooms-Melbourne
User XXX Rooms-Buderim
Vascular Solutions-Subiaco
VCCC (Peter Mac)-Parkville
Wagga Wagga Base Hospital-Wagga Wagga
Waikato Hospital-Hamilton
Warringal Private Hospital-Heidelberg
Wauchope District Hospital-Wauchope
Waverly Private Hospital-Mt Waverly
Wellington Hospital-Wellington
Western Hospital-Footscray
Western Hospital-Henley Beach
Western Private Hospital-Footscray
Westmead Hospital-Westmead
Westmead Private Hospital-Westmead
Wollongong Day Surgery-Wollongong
Wollongong Hospital-Wollongong
Wollongong Private Hospital-Wollongong
Wyong Public Hospital-Kanwal

The mean number of operations per hospital was 277 with a range of 1-1,342

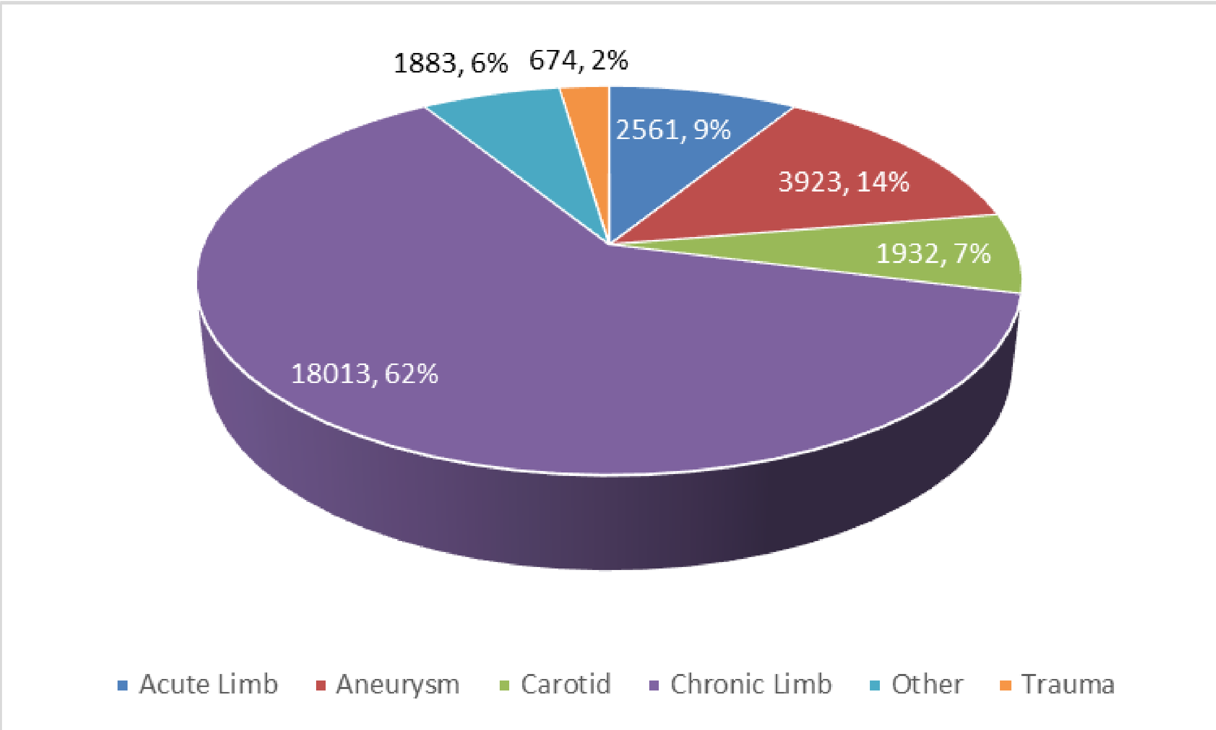
The distribution of procedures by patient type is shown in Fig. 3. The majority were arterial patients followed by venous.

Fig 3. Patient type 2024



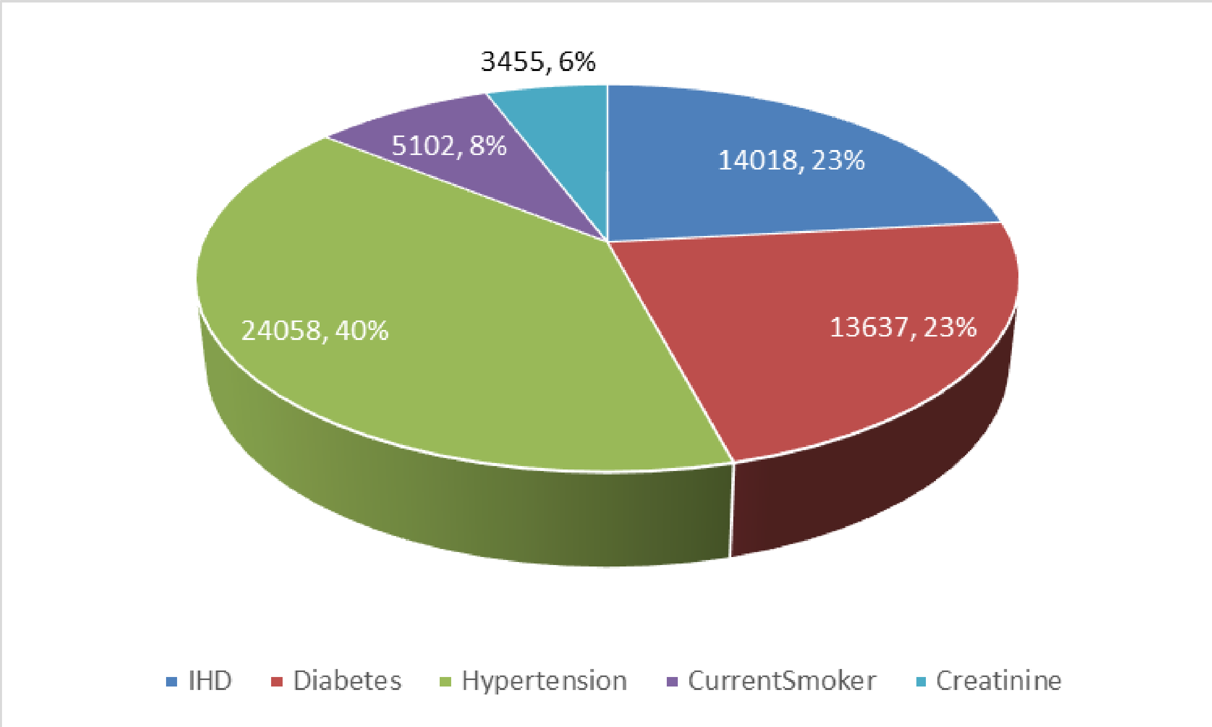
The distributions of procedures in the arterial category are shown in Fig. 4. The majority were for chronic limb operations (62%) followed by aneurysms (14%), acute limb (9%) then carotid procedures (6%).

Fig 4. Arterial categories 2024 (n=28,986)



In the arterial operations the risk factors present are shown in Fig. 5. Hypertension was the most frequent risk factor recorded followed by ischaemic heart disease (IHD) and diabetes.

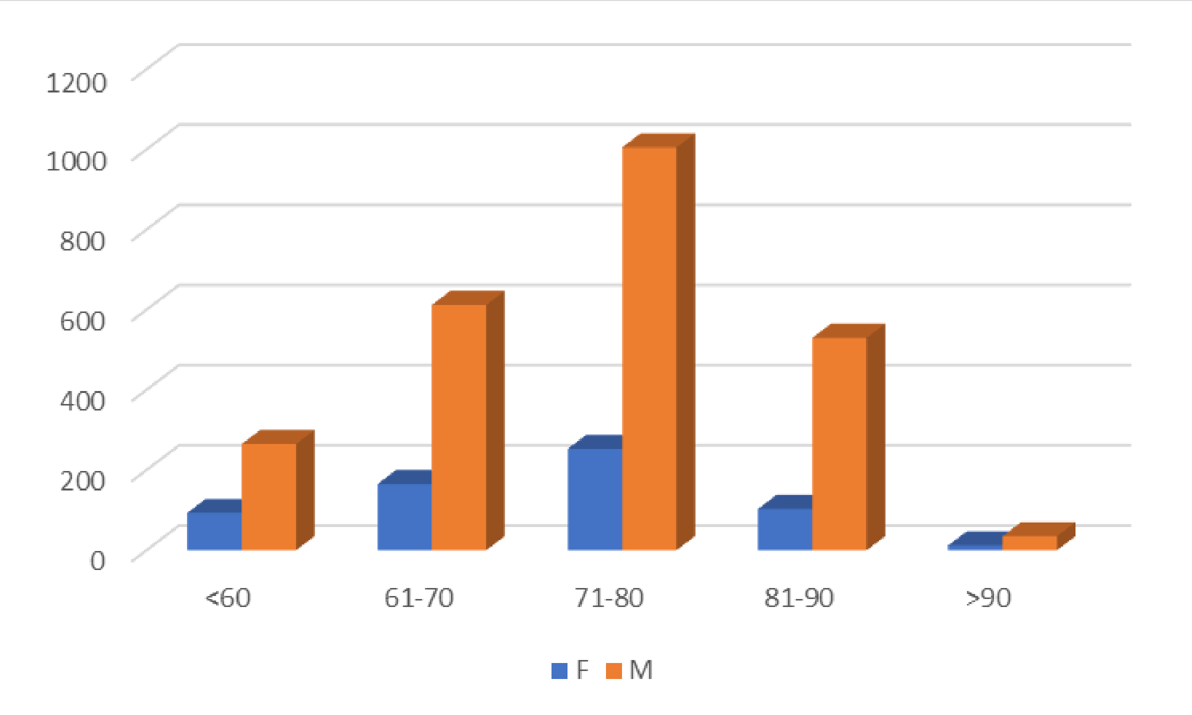
Fig 5. Risk factors in arterial operations 2024 (Creatinine = >150mMol/L)



Aortic Surgery

There were 3,098 Aortic (discharged) procedures performed in 2024. This category includes aneurysmal disease (emergency and elective), open and endoluminal (ELG) procedures and aortic operations for non-aneurysmal disease.

Fig. 6. Age and Gender Aortic surgery 2024



The distribution of procedures and crude mortality is shown in Table 1.

Table 1. Aortic surgery raw data

Category	Total
All Aortic procedures	3098
Open Aortic surgery	746
Open AAA	477
Open AAA-elective	322
Open AAA-ruptured	98
AAA-EVAR-elective	1467
AAA-EVAR-ruptured	79
Non-aneurysm abdominal aortic surgery	242
Thoracic ELG	405
Open Thoracoabdominal	15
Endo Thoracoabdominal	107

i) Open aortic surgery

This includes all aneurysm and non-aneurysm surgery. 197 surgeons performed an average of 4 procedures with a range 1-20. The indications for the 242 non-AAA procedures are shown in Table 2.

Table 2. Non-aneurysm open aortic surgery

Indication	Total
Claudication	75
Rest pain	61
Ulcer/gangrene(arterial)	35
Acute ischemia	31
Mesenteric ischemia	16
Bypass / Stent graft / Patch sepsis	5
Neoplasm-malignant	5
Aortoenteric fistula-secondary	4
Arteritis/collagenosis	2
Dissection	2
Trauma(iatrogenic)-haemorrhage	2
Trauma(non iatrogenic)-haemorrhage	2
Infection	1
Renal a stenosis/refractory hypertension-atheromatous	1

Outcomes for Open Aortic Surgery

This data was risk-adjusted using predictive models obtained by logistic regression analysis (see **Appendix 2**-statistical methods). A multilevel model was not significant so standard binary logistic regression analysis was used.

The open aortic surgery model displayed excellent calibration (a measure of the ability to predict mortality across the spectrum of low and high-risk patients), determined by "goodness of fit" tests that do not show a difference, as well as good discrimination (the ability of the model to predict mortality in any particular patient) as determined by the area under the ROC, with a value of this C-statistic of > 0.7 signifying good discrimination.

The C-statistic for the model for mortality after open aortic surgery was 0.79.

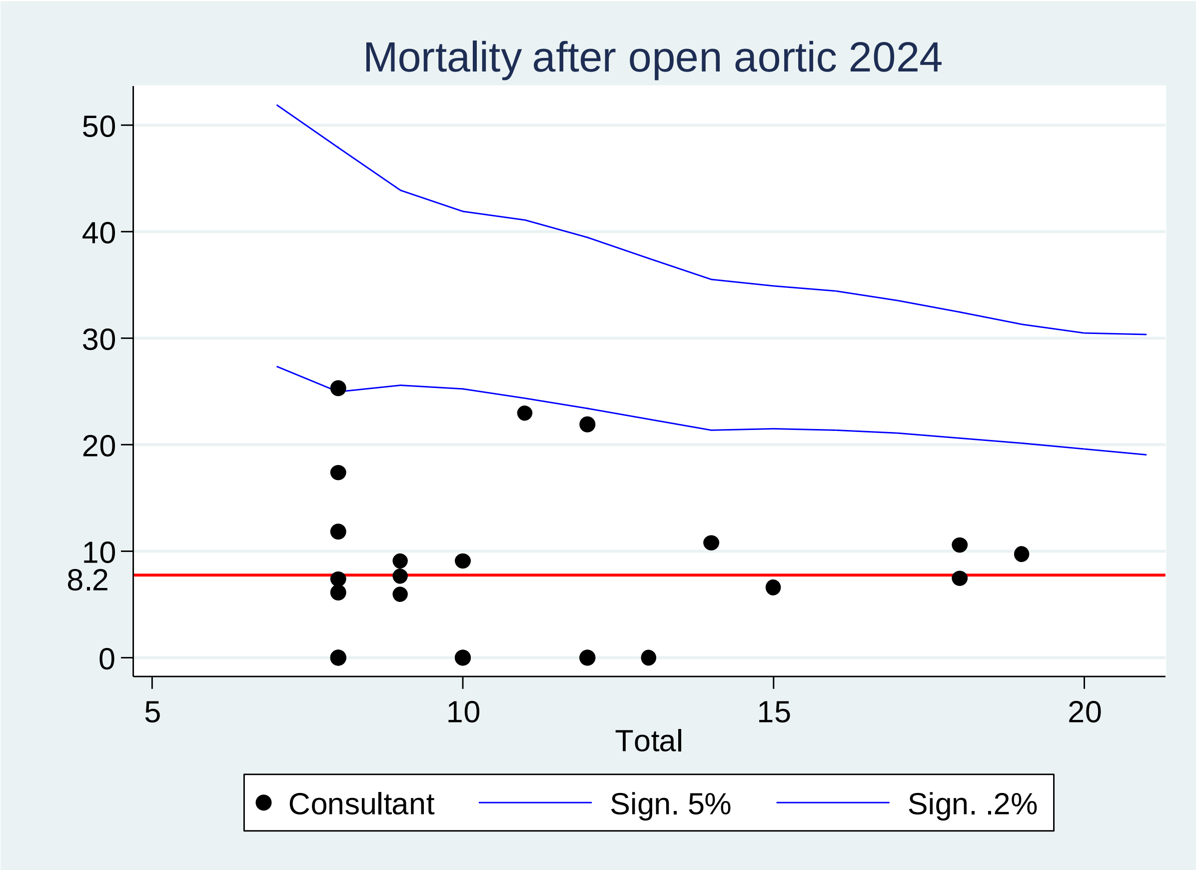
Table 3 shows the significant variables used in the model for all open aortic surgery 2024.

Parameter	Coefficient	Standard Error	Z Value	P(>|Z|)
Age80	0.957575	0.41476	2.308744	P = 0.021
Creatinine	1.183564	0.478879	2.47153	P = 0.0135
ASA 5	0.908593	0.446652	2.034229	P = 0.0419
Rupture AAA	2.161491	0.348351	6.204931	P < 0.0001

Once a predictive model is obtained, probabilities of mortality are obtained from the model and used to display risk-adjusted mortality based upon an expected mortality rate for each patient.

Funnel plots have been constructed and were plotted by including 25 consultants where 8 or more cases were performed during 2024. This plot shows the adjusted standardized mortality rate on the Y-axis against total cases done on the X-axis. 95% and 99% Poisson confidence intervals of the expected mortality for each surgeon are superimposed. This produces an easy-to-read graph showing any outliers.

Fig 7. Risk-adjusted funnel plot for open aortic surgery for consultants with 8 or more cases (25)



Outliers

No outlier was identified.

Open AAA

169 surgeons operated upon 477 patients with a mean of 3 and a range from 1-11 cases. This dataset was restricted to patients with abdominal aneurysm repair, excluding thoraco-abdominal aneurysms. This allowed comparison of postoperative complications between 379 intact (elective, mycotic, painful, occluded) aneurysms and 98 ruptured AAA (Table 4). Mean aneurysm diameter was 64mm. Crude mortality was 10.7%.

Table 4. Complications after intact and ruptured AAA repair

Complication	Intact AAA (379)	Ruptured AAA (98)
AMI	4(1.1%)	2(2%)
Gut ischaemia	8(2.1%)	6(6.1%)
Renal failure/impairment	10(2.6%)	11(11.2%)

Outcomes

Predictive variables for the model are shown in table 5. Excellent discrimination was obtained with a c-statistic of 0.77.

Table 5. Significant variables in the Open AAA model 2024.

Parameter	Odds Ratio	95% Conf. Int.	Z Value	P (>|Z|)
AAA rupture no bypass)	23.389839	(7.566518 to 72.30335)	5.474543	P < 0.0001
Blood loss >4L	10.921665	(5.379774 to 22.172449)	6.617381	P < 0.0001

Fig 8. Risk adjusted funnel plot for open AAA repair where surgeons performed 7 or more cases (13)

Outliers: There were no outliers for open AAA surgery. 62 surgeons performed only 1 case in 2024 with a mean mortality of 18% in this cohort (n=11).

iii) Endoluminal abdominal aortic surgery

Abdominal aortic aneurysm

232 surgeons inserted 1,668 ELG for AAA repair during 2024, with a range of 1-26 and a mean of 7. 93% patients had percutaneous access with closure device. Mean aneurysm diameter was 57.8mm. There were 27 type 1, 25 type 2 and 2 type 3 endoleaks. There were 5 occluded limbs and 1 conversion to an open repair. There were 4 cases with device failure/malposition. GA was used in 90%. Mortality was 1.4%.

Table 6. Indications for EVAR 2024

Indication	Total
Aneurysm-elective	1432
Aneurysm-pain	124
Aneurysm-ruptured	78
Aneurysm-mycotic	27
Aneurysm-occluded	4
Aneurysm-false(non iatrogenic trauma)	2
Aneurysm-false(iatrogenic trauma)	1

Comparison of complications between intact and ruptured ELG insertion is shown in Table 7.

Table 7. Complications after intraabdominal ELG (n =1,668)

Complication	Intact Aorta (1,590)	Non-intact (78)
AMI	4(0.3%)	1(1.3%)
Gut ischaemia	1(0%)	2(2.6%)
Renal failure/impairment	3(0.2%)	4(5.1%)
Endoleak type 1	25(1.6%)	2(2.6%)
Endoleak type 2	25(1.6%)	0
Endoleak type 3	2(0.1%)	0

The type of devices used for ELG is shown in table 8.

Device	Total
Endurant	504
Excluder	347
Excluder conformable	204
Cook low profile	130
Zenith Fenestrated	128
Zenith Alpha	120
Zenith branched-Iliac	48
Cook with side branches	43
Other hybrid combination	31
Zenith Flex(non-fenestrated)	31
Cook low profile with spiral limb(s)	26
Bentley BeGraft Aortic	12
Jotec E-nside	12
Zenith t-Branch	10
Jotec E-xtra	5
Zenith body with Gore limb(s)	5
Zenith limb only	5
Jotec E-tegra	3
Talent	2
Anaconda(fenestrated)	1
Zenith body with Endurant limb(s)	1
Zenith body with Gore limb(s);Cook low profile	1

iv) Fenestrated and branched ELG

The configuration of all ELG is shown in Table 9. The subsets of branched and fenestrated grafts are evident; 198/1,668 (11.9 %) were fenestrated/BREVAR with 7 deaths (3.5%) vs non-fenestrated/BREVAR mortality of 16/1,470 (1.1%). Endoleaks occurred in 3.5% of fenestrated vs 3.2% in non-fenestrated ELG (p=0.77).

Table 9. Configuration of ELG 2024

Configuration	Total
Bifurcated	**1267**
Tube	92
Fenestrated Renal(s)-SMA-Coeliac	69
Fenestrated Renal(s)-SMA	61
Branched endograft R Iliac	34
Aorto-uni-iliac-no x-over	29
BREVAR Renal(s)-SMA-Coeliac	25
Branched endograft L Iliac	24
Aorto-uni-Iliac and Fem fem bypass	14
Fenestrated both Renals	14
Fenestrated + Branched endograft	10
Bifurcated-bifurcated(+/- IBD)	9
BREVAR Renal(s)-SMA	5
Fenestrated L Renal	3
Fenestrated Renal(s)-Coeliac	3
Fenestrated SMA-Coeliac	3
BREVAR both Renals	2
Fenestrated Renal(s)-SMA-Coeliac;Fenestrated Renal(s)-SMA-Coeliac	2
Bifurcated;Tube	1
BREVAR R Renal	1
BREVAR-SMA	1

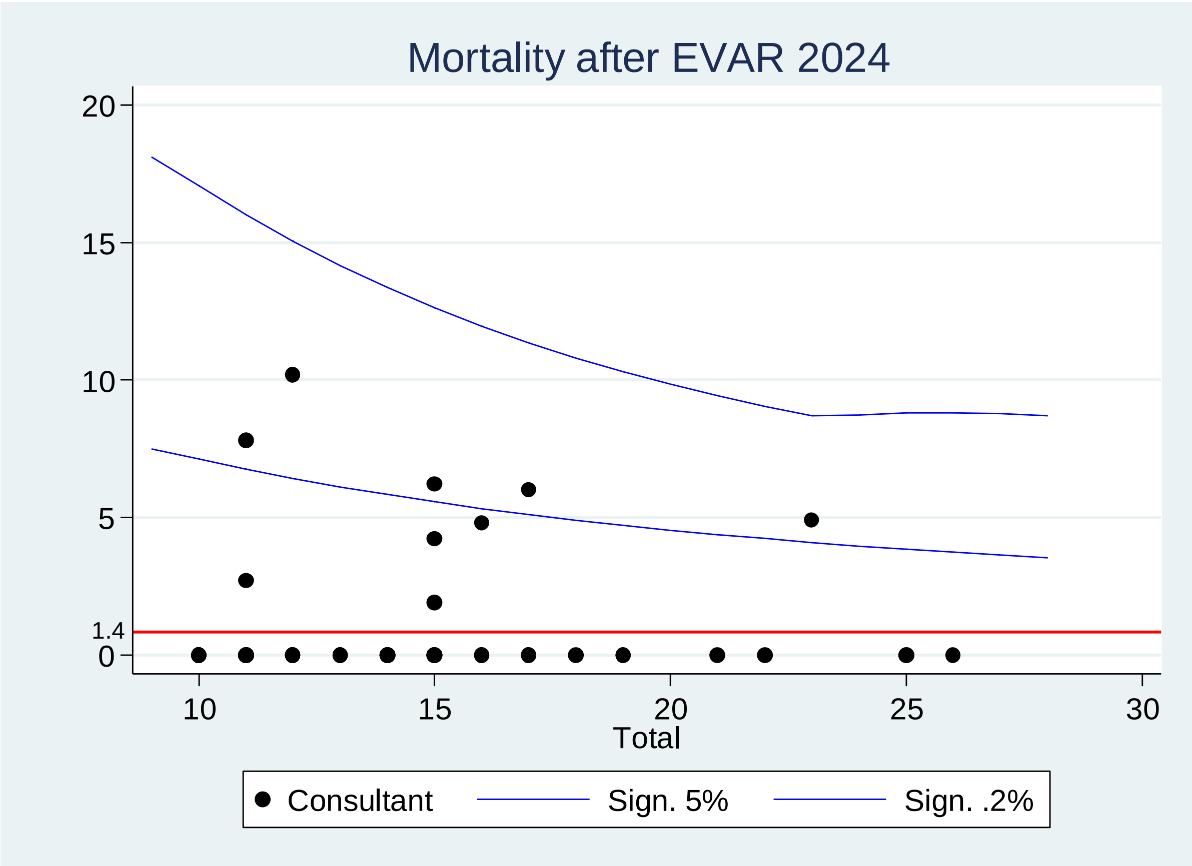
Outcomes

Significant variables in the model are shown in Table 10. The c-statistic was 0.84.

Table 10. Significant variables for mortality after EVAR for AAA 2024

Parameter	Coefficient	Standard Error	Z Value	P(>|Z|)
Ruptured	3.783364	0.514843	7.348581	P < 0.0001
FEVARBREVAR	2.249197	0.546303	4.117119	P < 0.0001

Fig. 10. Risk-adjusted Funnel plot of mortality after EVAR in 2024(10 or more cases for 62 surgeons).



Outliers

No outliers were identified.

iv) Thoracic and thoraco-abdominal procedures

Endoluminal. Pathology in thoracic and thoracoabdominal TEVAR (n=422) is shown in Table 11.

Table 11. Pathology for TEVAR 2024

Pathology	Total
Aneurysm(non-dissecting)	157
Dissection-acute	77
Aneurysm(dissecting)	60
Penetrating ulcer	57
Dissection-chronic	41
Traumatic tear	28
Fistula	2

139 surgeons inserted a mean of 3 ELG with a range from 1-28. 84 surgeons had performed < 3 cases in 2024. Configuration is shown in Table 12.

Table 12. TEVAR configuration

Configuration	Total
Overlapping Stent grafts	156
Single Stent graft	144
Fenestrated/branched-L SCA	67
Fenestrated/branched-Brachioceph	17
Stent graft(s) with distal bare stent	15
Fenestrated/branched-CCA	11
Fenestrated/branched-Brachioceph & CCA	9
Stent graft(s) with intra-abd fenestration(s)	3

Table 13. TEVAR devices inserted.

Device	Total
Gore C-TAG	**198**
Gore TBE	67
Zenith Alpha	64
Custom Cook (fenestrated/branched)	29
Zenith TX2	23
Medtronic	21
Gore C-TAG with Zenith Alpha extension	9
Excluder	5
Endospan Nexus	4
Jotec E-vita Thoracic 3G	2

In the 335 aneurysms and dissections, the proximal landing zones were; zone 0 in 33, zone 1 in 33, zone 2 in 100 and zone 3 in 169 patients. There were 4 patients with paraplegia (1.2%) and 5 strokes

(1.5%) following TEVAR. 3 patients had renal failure or impairment and none developed intestinal infarction. There were 1 type 1 and 1 type 3 endoleaks. One patient required conversion to open. Breakdown of complications by aetiology is shown in Table 14.

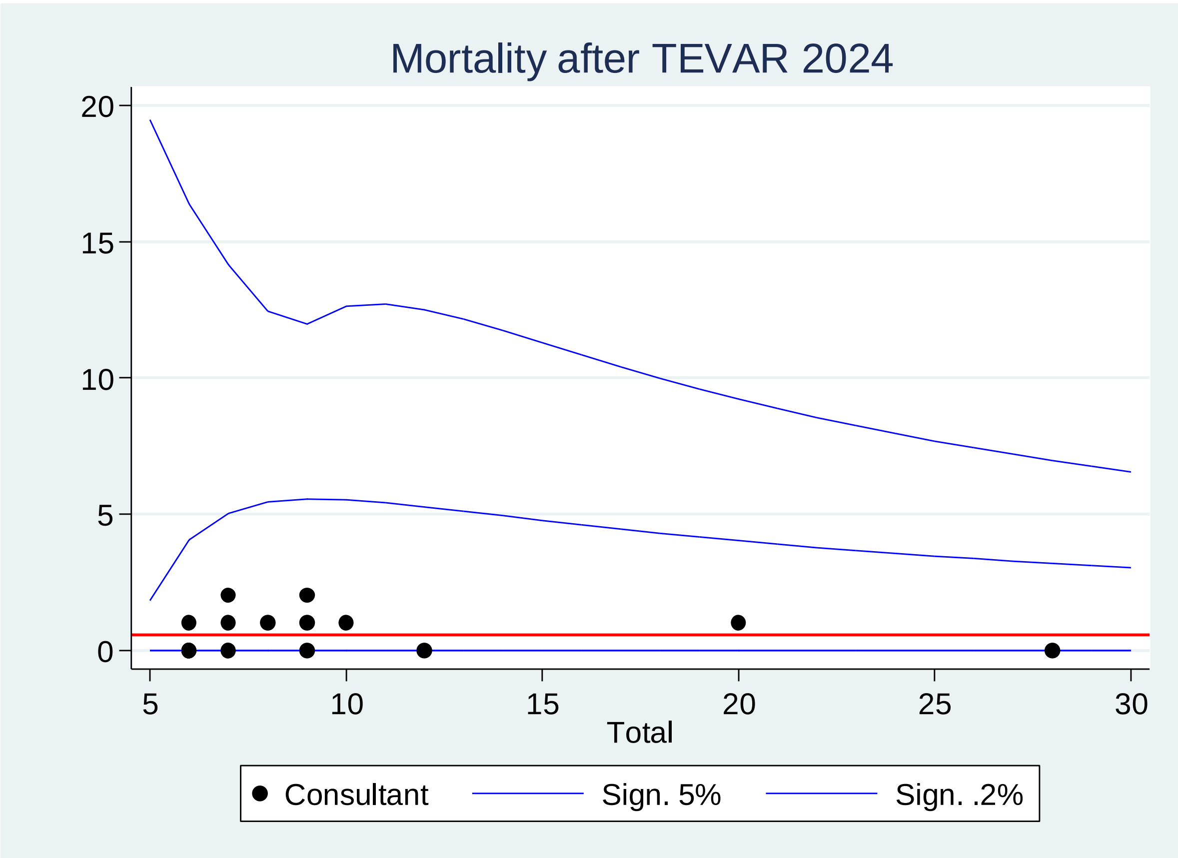
Table 14. Complications according to the main pathology types

Pathology	Total	Stroke	Paraplegia
Aneurysm(non-dissecting)	157	2	
Dissection-acute	77	3	3
Aneurysm(dissecting)	60		
Penetrating ulcer	57		
Dissection-chronic	41		1
Traumatic tear	28		
Fistula	2		

Outcomes

No predictive model was produced. 18 surgeons had performed 6 or more TEVAR in 2024 and 84 had performed < 3 cases. Mortality in this group was 8.3%. Raw mortality for the total cohort was 5.7%

Non-risk adjusted funnel plot showed no outliers for 2024 in surgeons with 5 or more cases (Fig. 11)



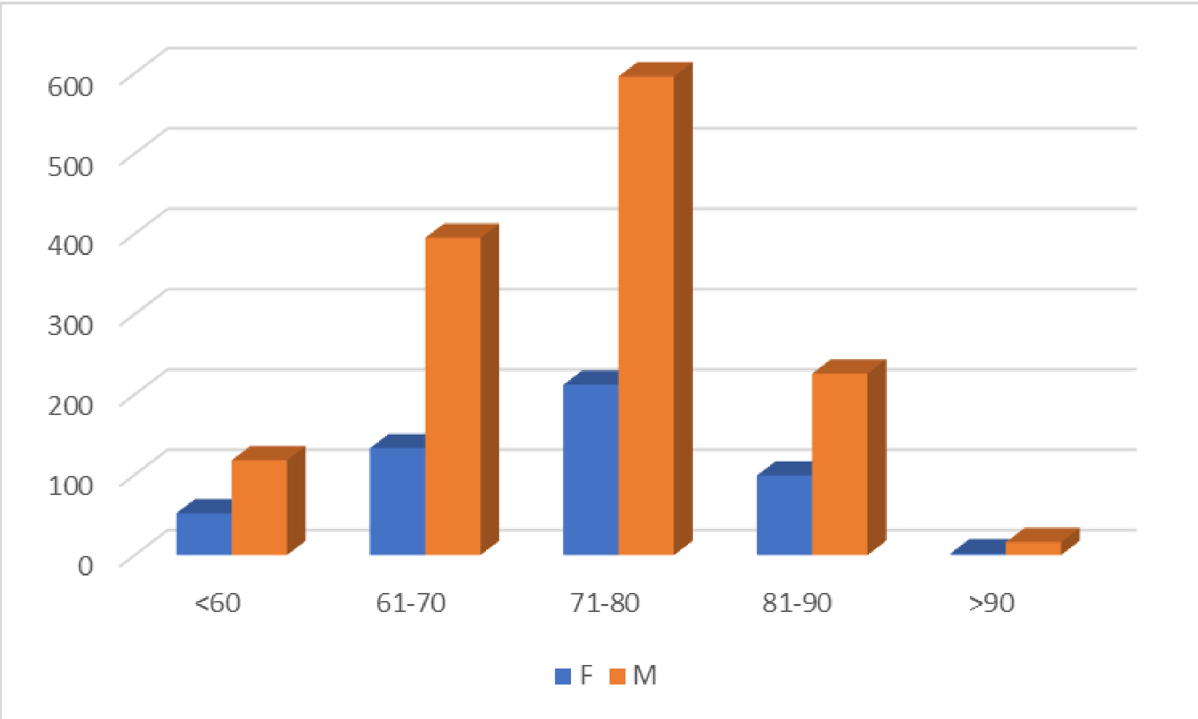
Open. There were 15 open thoracoabdominal procedures. They were performed by 11 surgeons and 4 surgeons had performed 2 procedures with the other 7 only performing a single procedure. There were 0 strokes or paraplegias. Average length of stay in this cohort was 23 days. Mean diameter of the aneurysms was 57mm.

Table 15. Indications for open thoracoabdominal bypasses 2024

Indication	Total
Aneurysm-elective	10
Aneurysm-mycotic	2
Aneurysm-ruptured	2
Dissection	1

Carotid Surgery

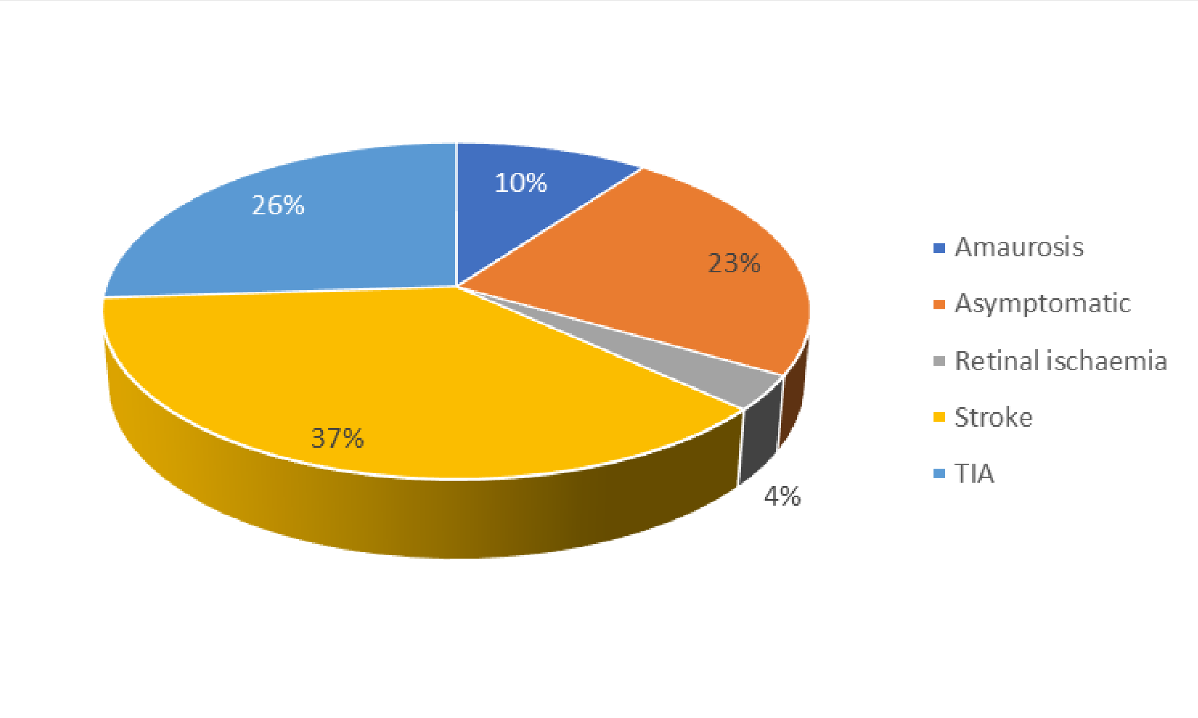
There were 1,850 carotid interventions, 1.711 carotid endarterectomies (CEA) and 139 carotid stents (CAS) in 2024. Age and gender are shown in Figure 12.



i) Carotid Endarterectomy

237 surgeons performed an average of 7 CEA with a range from 1-35. The indications for CEA are shown in Fig.13 with 23% having no symptoms. In the 2010 report 31% were asymptomatic.

Fig 13. Indication for CEA



The time from onset of symptoms to surgery in symptomatic patients (n=1,313) was < 48 hours in 1%, < 2 weeks in 66%, 2-4 weeks in 15% and > 4 weeks in 18%. NICE guidelines recommend that the goal should be to operate within 2 weeks from the onset of symptoms to have the lowest stroke incidence. General anaesthesia was used in 84% of the patients. Eversion endarterectomy was performed in 14% of patients and 41% were shunted. Patches were used in 90% of CEA (Table 16).

Table 16. Patches after CEA.

Patch	Total
Pericardium	1069
Polyurethane	315
Prosthetic (Other)	48
PTFE	46
Vein (Other)	17
Dacron	16
GSV-reversed	10
Neck vein	5
Peritoneum	5
Arm vein	1

Table 17. Complications after CEA (n=1,711)

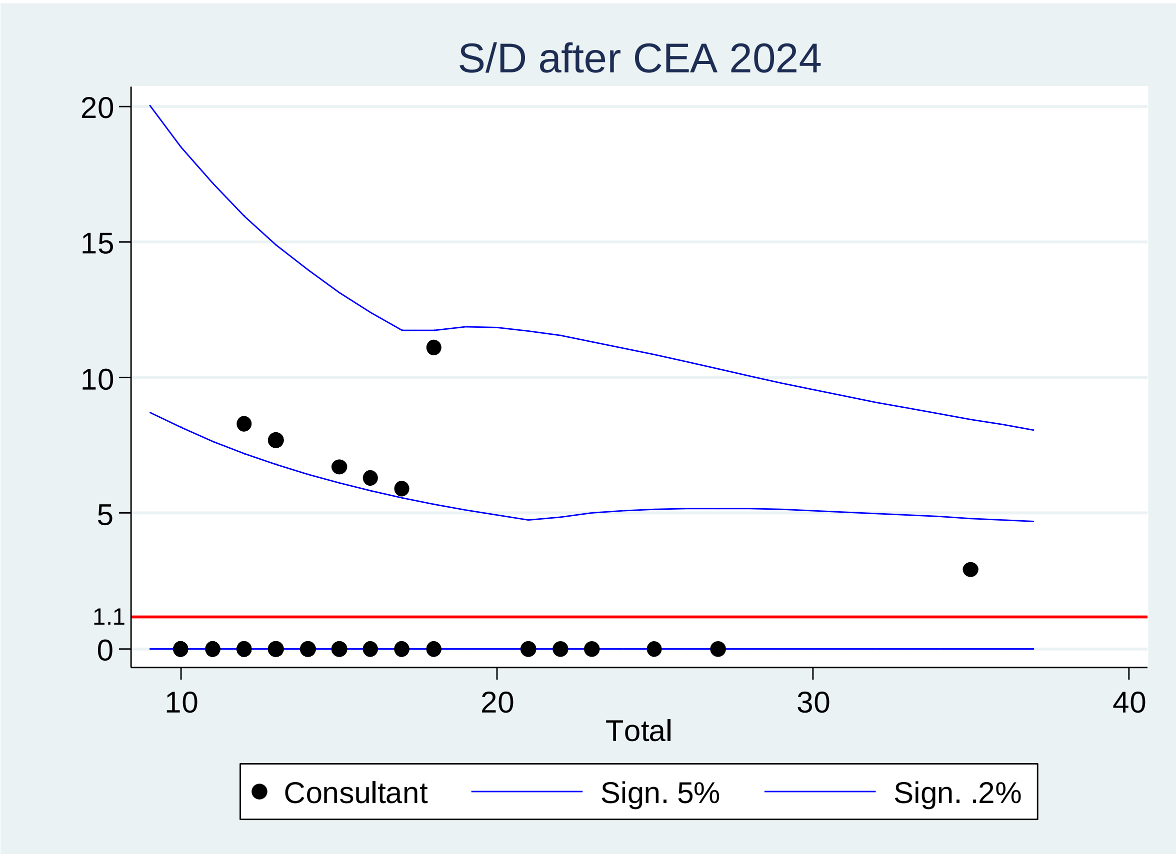
Complication	Percent
Haemorrhage requiring exploration	1.8
Cranial nerve trauma	0.3
Myocardial infarction	0.3
Major/minor stroke	0.8
TIA	.06
Hyperperfusion	0.2
Death	0.3
Stroke or death	1.1

Outcomes

No predictive model was obtained.

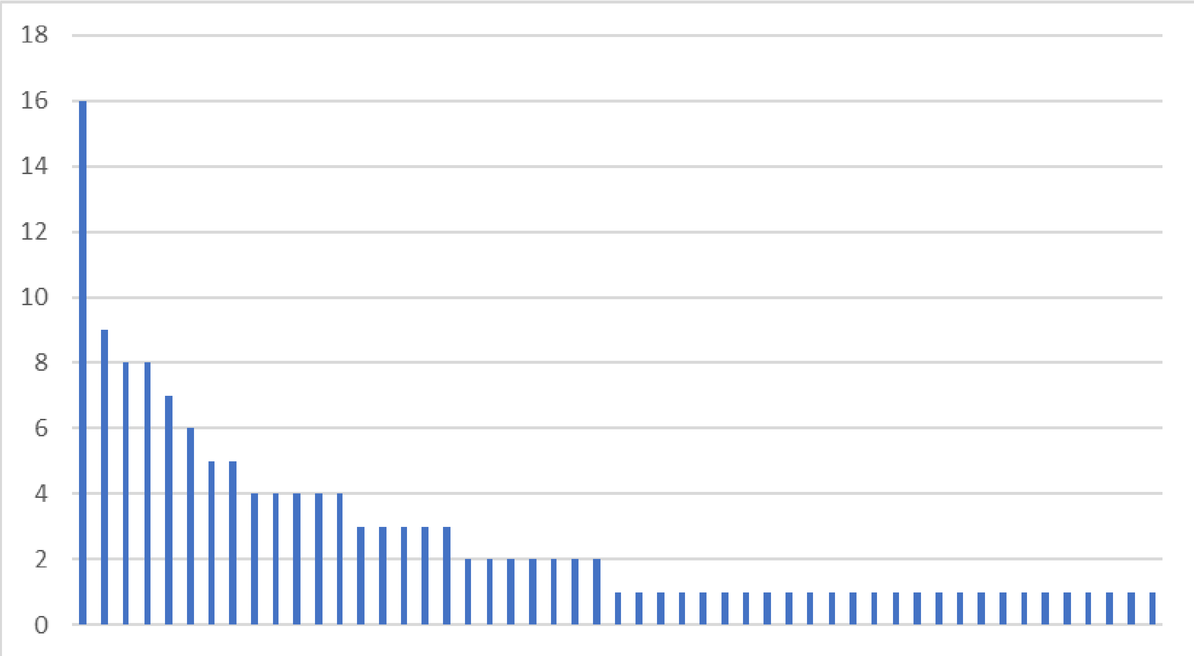
Only those surgeons (62) who performed 10 or more CEA were assessed by a non-risk adjusted funnel plot. The mean stroke/death (S/D) rate in this cohort was 1.1% and no outliers were detected as shown in Figure 14. Symptomatic S/D rate was 1.3% and Asymptomatic S/D was 0.3%. Postop S/D rate for stroke as the indication for operation was 1.3%.

Fig 14. Non-risk adjusted Funnel plot for stroke and death after CEA 2024

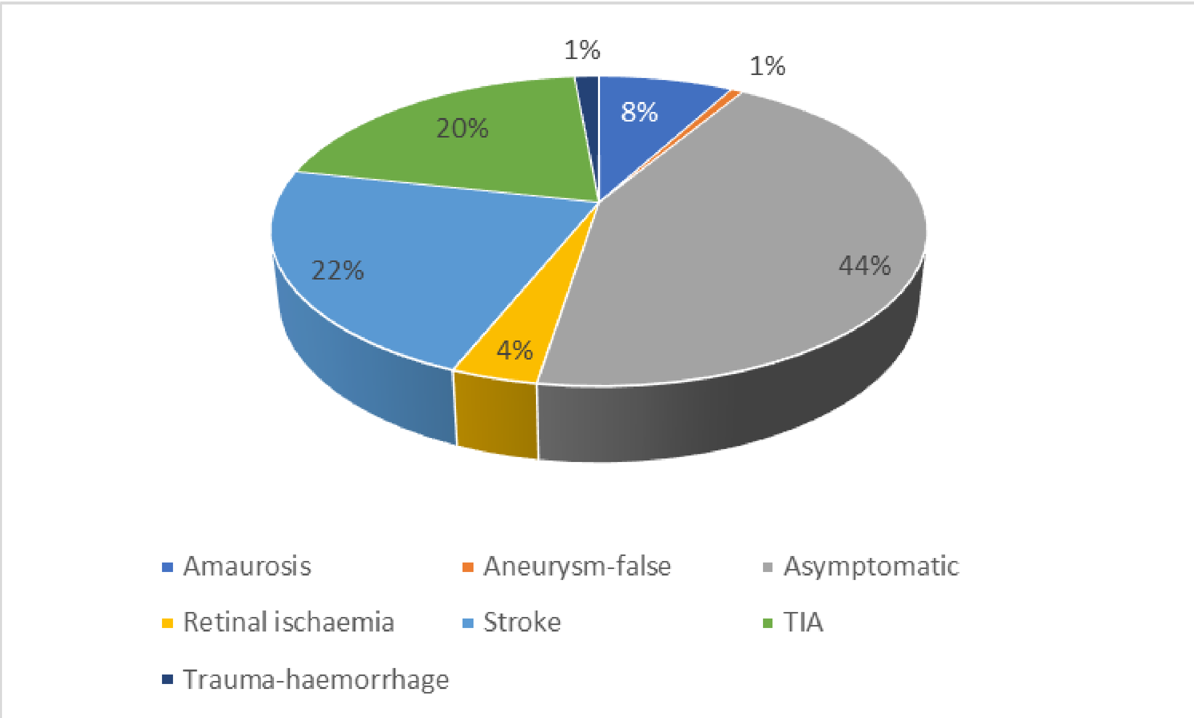


ii) Carotid Stents

51 surgeons placed 139 carotid stents in 2024, with a mean of 3 and a range from 1 – 16. Fig 15 shows the number of CAS per consultant.



Indications for CAS are shown in Fig 16, with the most frequent being asymptomatic, then stroke.



Technical details. n=139

Access was via a long sheath in 102 and via a short sheath with guiding catheter in 37. There was a type 1 arch in 87, type 2 in 46 and type 3 in 6 patients.

Cerebral protection devices used are shown in table 18. No protection device was employed in 12 patients. Post-dilatation was used in 105.

Filter	Total
Nav 6 Emboshield	96
SpiderFX	14
Filterwire EX	8
Angioguard	6
Flow Reversal	3

Stent types are shown in table 19.

Stent	Total
Xact	73
CGuard	19
Covered stent	13
Precise	9
Wallstent	9
Casper	5
Tapered	4
Xience	3
ProtegeRX	2
Acculink	1
Medtronic Cristallo	1

Outcomes

There were no strokes or deaths recorded. There were no AMIs or renal impairment in this cohort.

Infrainguinal bypass

229 surgeons performed 1,514 Infrainguinal bypasses (IIB) in 2024. The range was 1-32 with a mean of 6. The average age of patients was 67 with the M: F ratio of 4.6:1. General anaesthetic was used in 98%.

Indications for surgery are shown in Fig 17 with tissue loss being the most frequent.

Fig. 17 Indications for infrainguinal bypass 2024

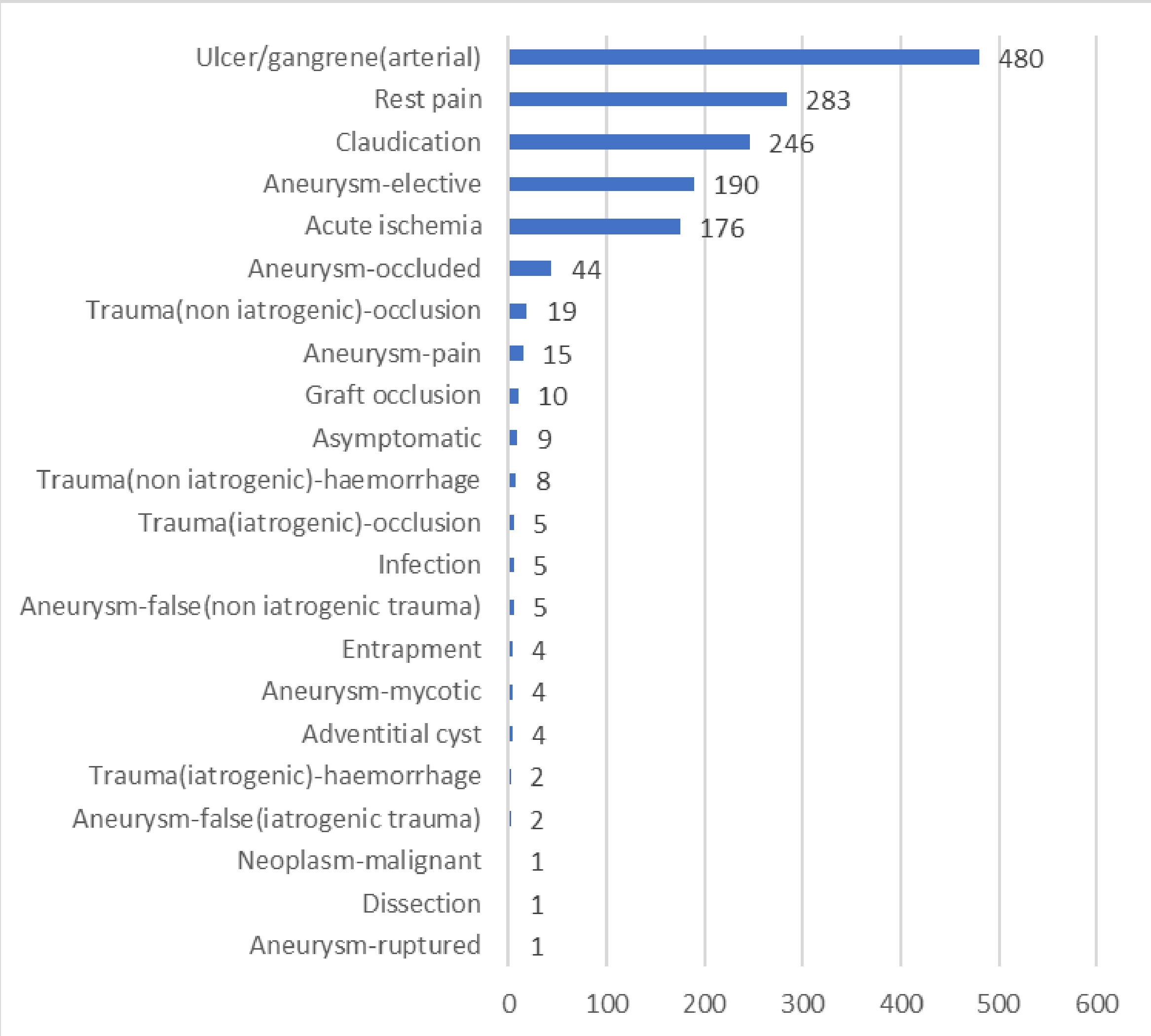
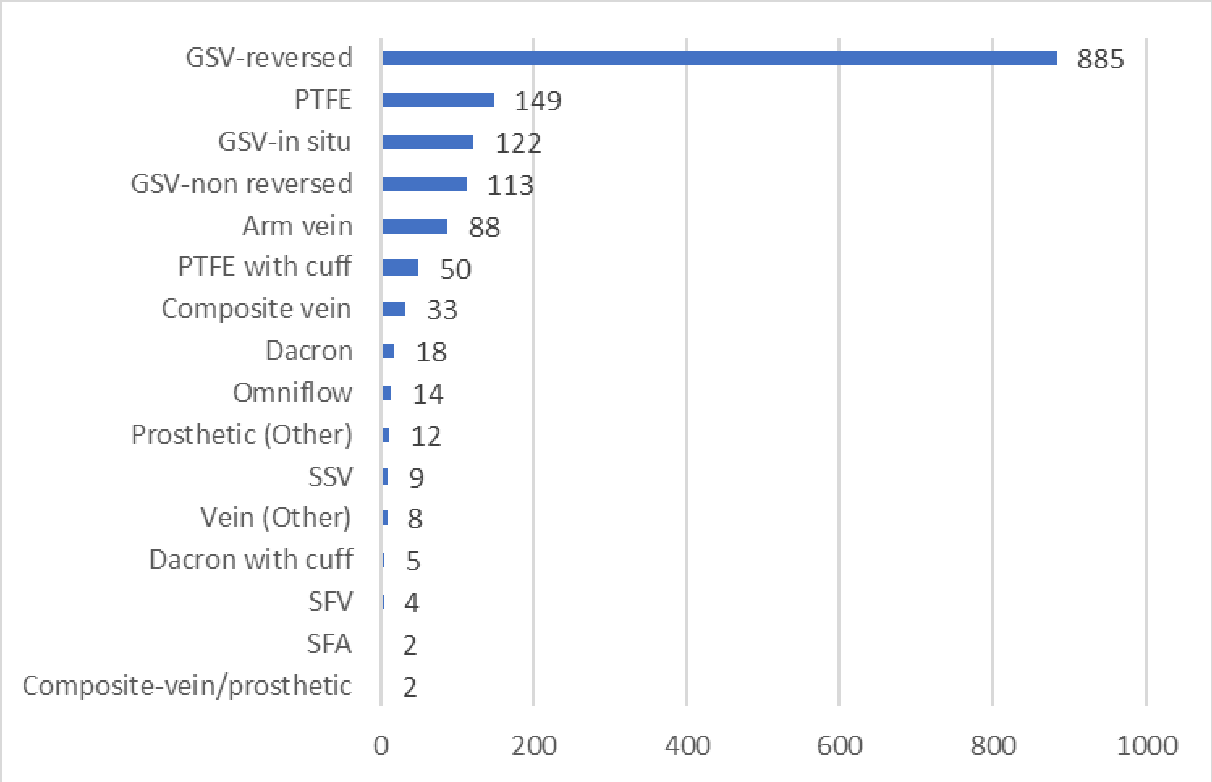
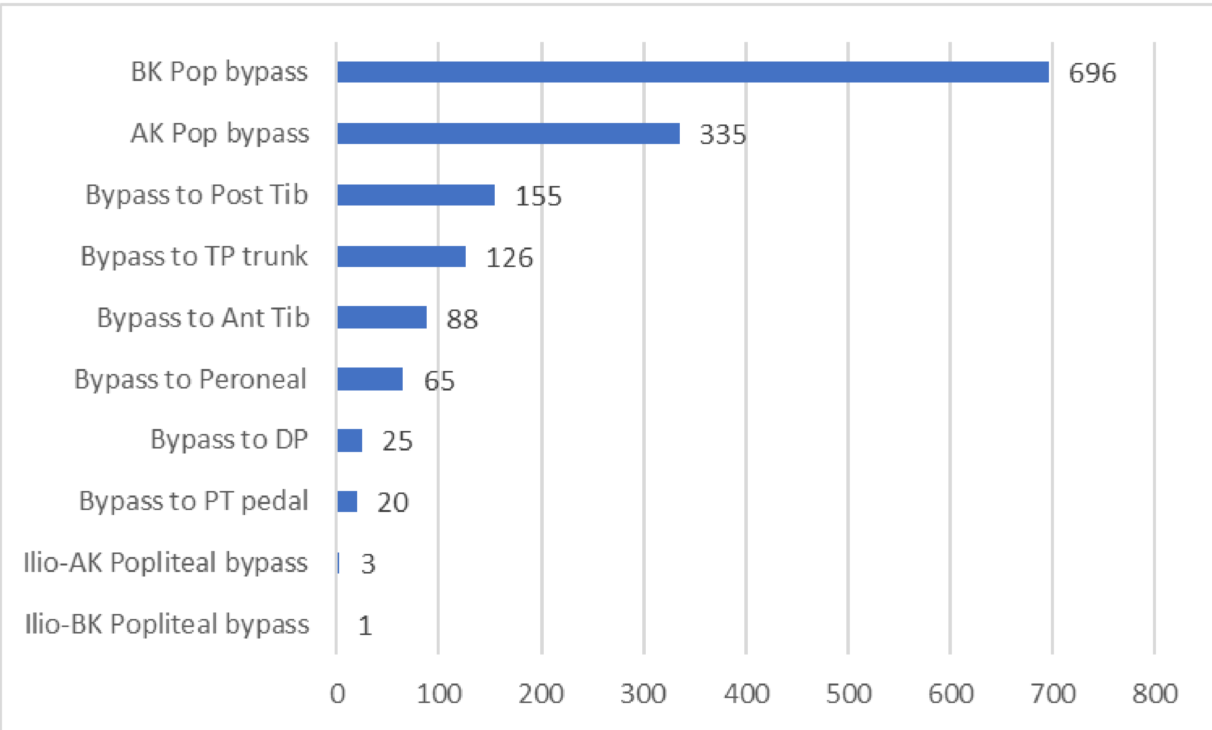


Fig. 18 Conduits for infrainguinal bypass 2024



Bypass configuration is shown in Fig 19.



Post-operative complications are shown in table 20 (n = 1,514)

Complication	Percent
Myocardial infarction	0.3
Stroke	0.1
Renal impairment/ failure	0.1
Wound complications	1.5
Haemorrhage requiring reoperation	2.4
Graft occlusion	2.6
Amputation	0.6

Outcomes

i) Occlusion

No risk-adjusted model was obtained for 2024.

Occlusion rates were assessed using a non-risk adjusted funnel plot for those 49 consultants that performed 10 or more bypasses (Fig 20). The mean occlusion rate was 2.6%.

Popliteal Aneurysm: There were 254 bypasses for primary aneurysms (elective, occluded, pain, mycotic or rupture). There was 1 bypass occlusion with a single limb loss for an occluded aneurysm. In non-aneurysm patients the graft occlusion rate was 3.1% and the amputation rate was 0.6%. 74 patients had an endovascular stent graft placed as the primary treatment for popliteal aneurysm.

Claudicants *vs* tissue loss: In the 246 claudicants, the occlusion rate was 0.8.% and there were no amputations. In 480 patients with tissue loss the occlusion rate was 2.3% and the amputation rate was 0.4%.

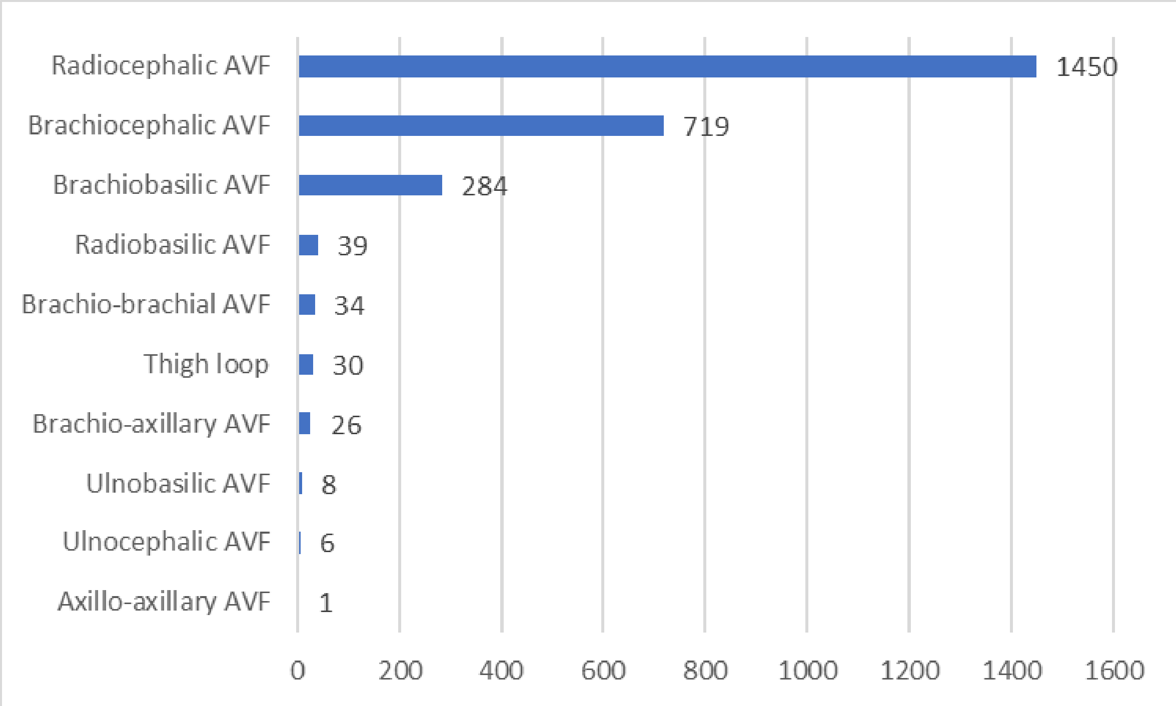
ii) Amputation

The limb salvage rate was 99.4%. 9 limbs were amputated and 3 of these occurred with a patent graft; none in this subgroup were diabetic.

Arteriovenous Fistulae

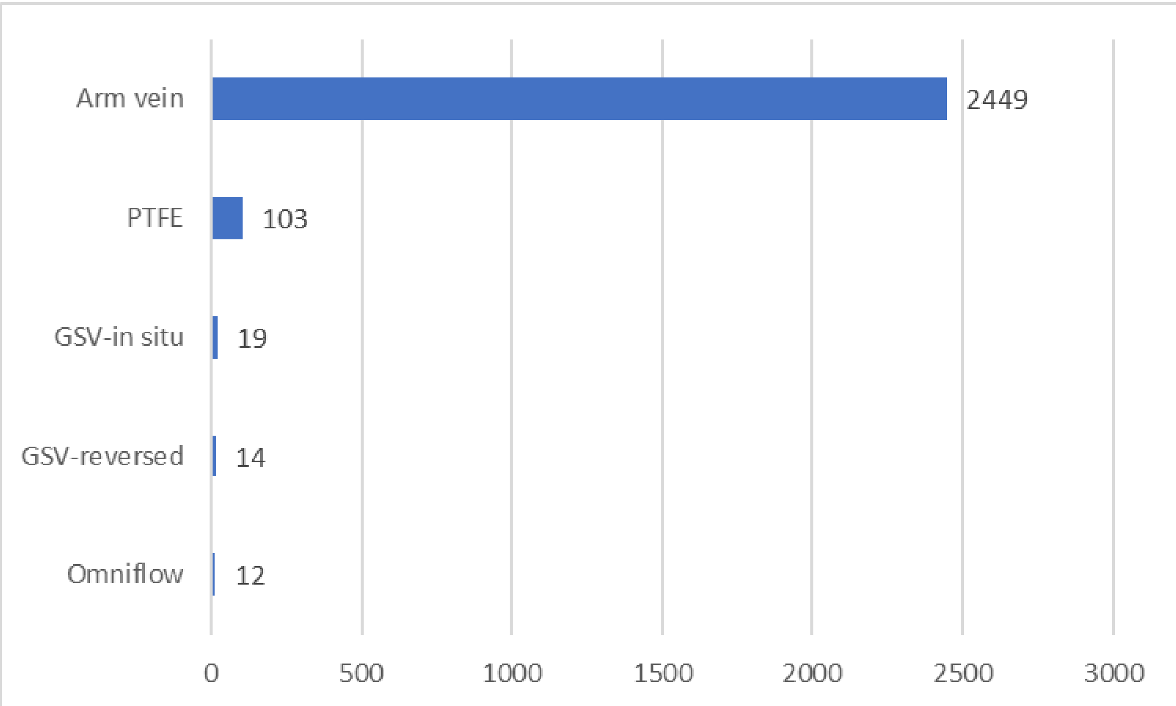
2,597 patients had an arteriovenous fistula (AVF) placed in 2024. 195 surgeons performed a range from 1-56 with a mean of 13. The locations of AVF are shown in Fig 21.

Fig 21. AVF configuration



The majority of AVF were autogenous (96%). The conduits used are shown in Fig 22.

Fig 22. Conduits used



Endovascular AVF

28 endovascular AVF were created in 2024; 18 WavelinQ and 10 Ellipsis devices. There were 15 radio-radial, 8 radio-perforator and 5 ulno-ulnar locations. There were no occlusions recorded.

Outcomes

There were 33 occlusions (1.3%). Autogenous fistulae occluded in 31/2,482 (1.2%) and prosthetic fistulae occluded in 2/115 (1.7%). 4 patients had a steal syndrome in a brachial level fistula

A model was obtained for occlusion after AV Fistula with a c-statistic of 0.72. Significant variables are shown in Table 22.

Table 21. Significant variables for occlusion after AVF construction 2024

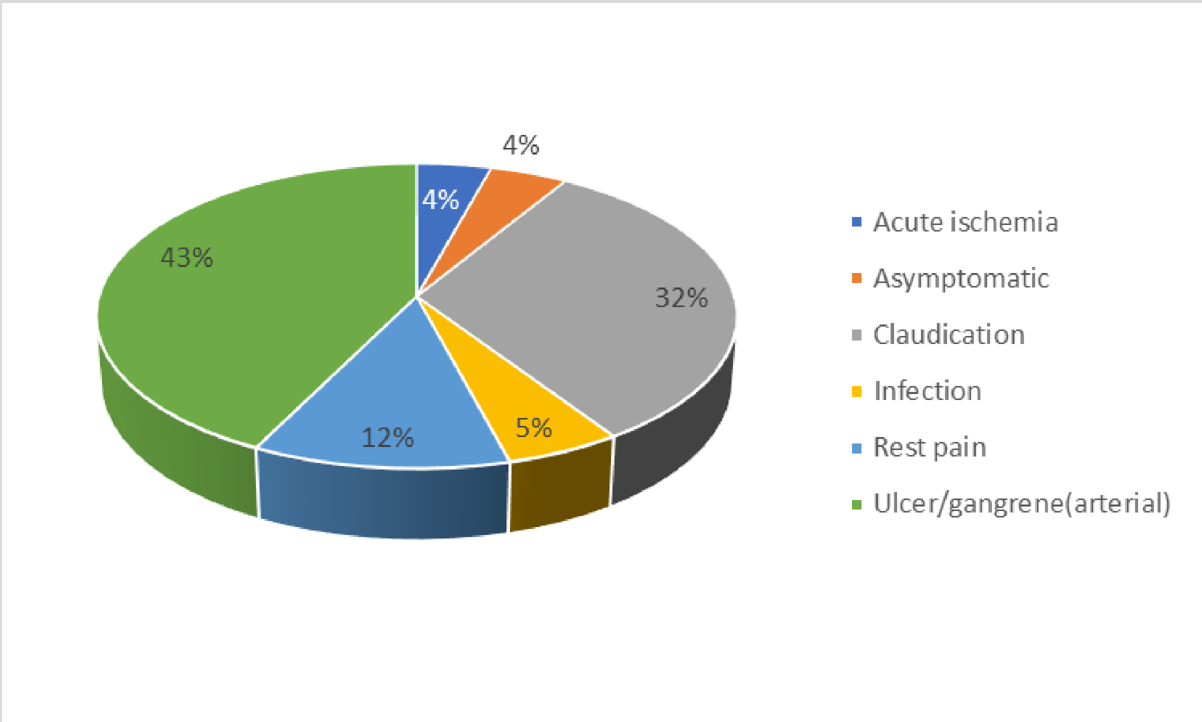
Parameter	Coefficient	Standard Error	Z Value	P(>|Z|)
Female	0.78431	0.355694	2.205015	P = 0.0275
Diabetes	-0.839912	0.353143	-2.37839	P = 0.0174
B-cephalic	-1.03518	0.536195	-1.930605	P = 0.0535

Endovascular treatment for PAD lower limb

Since 2020 this category has been added to the index procedures. There were 9,661 interventions performed by 234 surgeons, with a mean of 41 and a range from 1-211. Trauma, Hybrid bypass + endovascular procedures, aneurysmal disease and procedures performed by radiologists were excluded from this analysis. This group included procedures from the abdominal aorta to the ankle. There were 6,391 PTA and 3,270 stents.

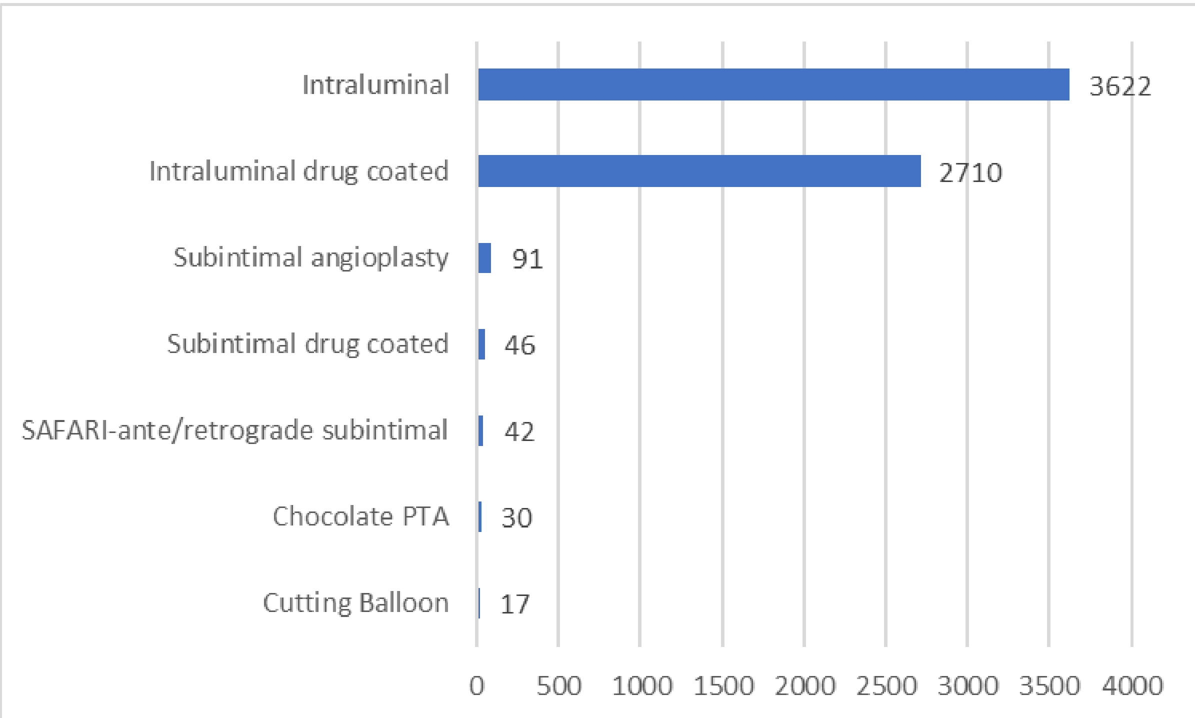
Indications for intervention are shown in Figure 24. Tissue loss was the most frequent, followed by claudication and rest pain.

Figure 24. Indications for endovascular treatment for PAD 2024. (Asymptomatic=stenosis graft)

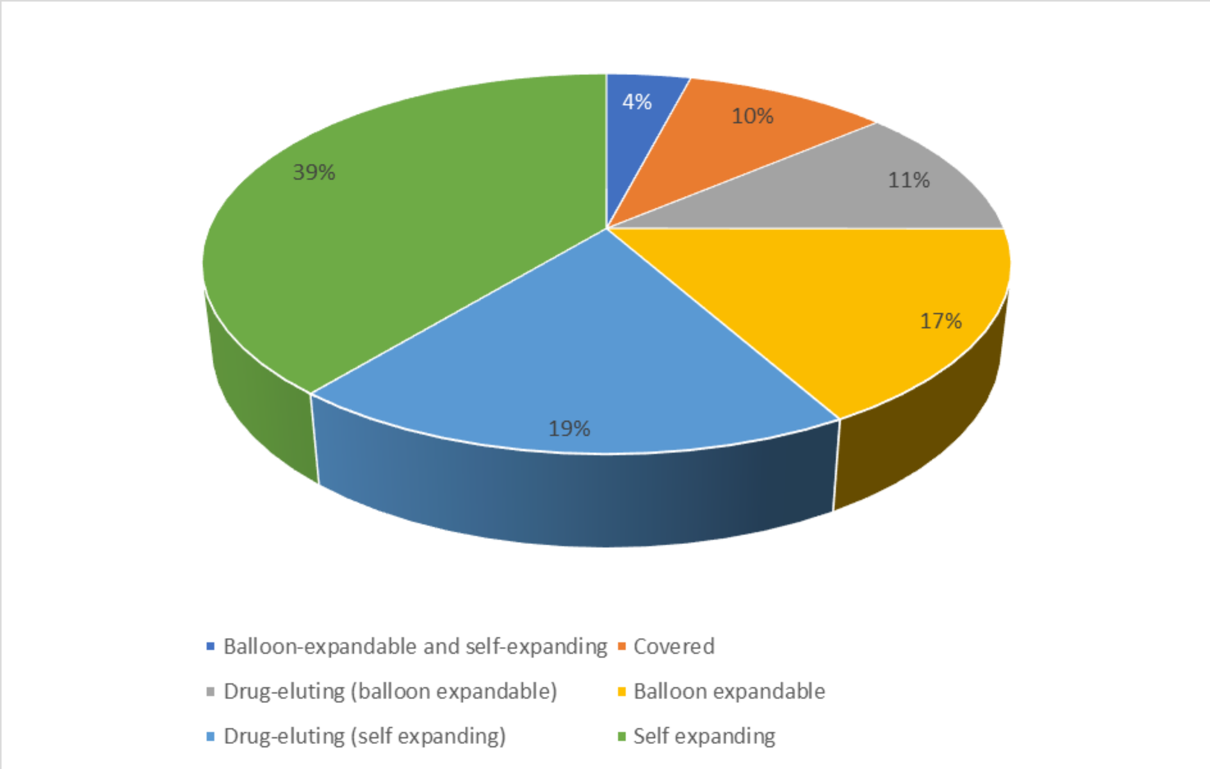


The type of PTA is shown in Figure 25. Most had an intraluminal angioplasty and 29% had an intraluminal drug coated balloon.

Figure 25. Type of angioplasty used in 2024.



30% of stents were drug eluting and 10% were covered stents as shown in Fig 26.



Endovascular complications are shown in Table 22.

Table 22. Endovascular complications 2024 (n=9,661)

Complication	Total
Thromboembolism	45
Dissection(with sequelae)	33
Occlusion	27
Perforation(with sequelae)	27
Haematoma	22
Pseudoaneurysm	21
Access failure	14
Device failure	7
Haemorrhage	5
Device malposition	2
Haemorrhage	1

Outcomes

65 patients died (0.7%) and there were 4 amputations. Combined complications, amputation in claudicants and death was 2.8% and complications included both endovascular (*excluding* dissections

without sequelae, perforations without sequelae, and access failure) and general (renal failure requiring dialysis, and re-exploration for haemorrhage) categories.

A predictive model was obtained with predictive variables shown in Table 23.

Table 23. Predictive variables for complications after Endovascular Rx for PAD.

Parameter	Odds Ratio	95% Conf. Int.	Z Value	P (>|Z|)
ASA4	2.728852	(1.934517 to 3.84935)	5.719292	P < 0.0001
Creatinine	1.446279	(1.057658 to 1.977694)	2.311055	P = 0.0208
Female	1.333774	(1.037377 to 1.714858)	2.246143	P = 0.0247
Hypertension	0.687527	(0.492199 to 0.960371)	-2.197088	P = 0.028
Emergency	1.66494	(1.17446 to 2.360256)	2.863102	P = 0.0042
Stent	1.566377	(1.22083 to 2.00973)	3.529058	P = 0.0004
AcuteIsch	2.104986	(1.345091 to 3.294177)	3.257402	P = 0.0011

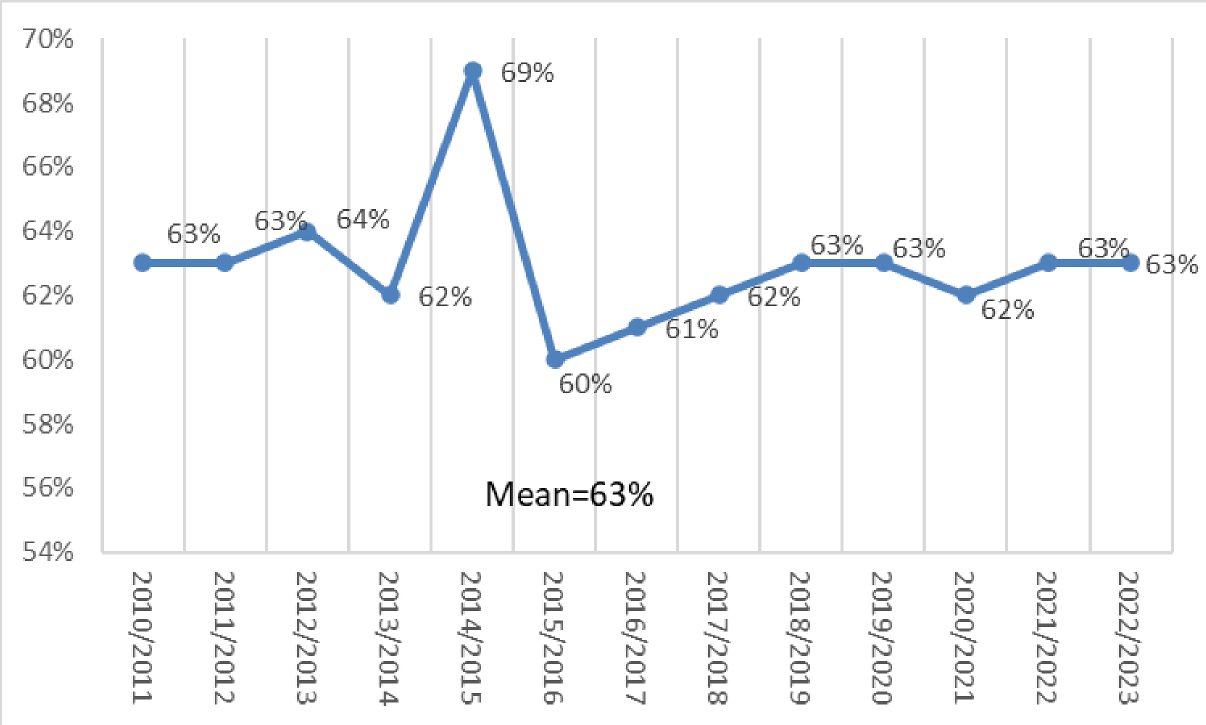
Endovenous obliteration of the Saphenous vein

4,487 cases were recorded with no post-procedural failures. Only 1 30-day outcome was entered with failure to obliterate the saphenous vein recorded.

Data validation and conclusions

This audit report has been the culmination of much hard work by the committee and the contributing membership. The most important conclusion is that the standard of Australasian vascular surgery remains high with excellent outcomes in all the selected areas of audit. The outcomes chosen for audit in these 6 procedures are the best method of assessing the clinical and technical skill of a vascular surgeon. The AMC found no concerning clinical issues with any of the outliers. The most important facet of an activity such as this remains the “audit of the audit”, and there are methods that were established during the inaugural year for both external and internal validation of this activity. External validation for Australian data has compared data capture between the AIHW database and the AVA (by financial year for the preceding years as data becomes available). Overall capture in the AVA for all Australian private and public hospital operations in the 4 index procedures has been shown to be 63% compared to AIHW data up to the 2022/2023 financial year (Fig 28).

Fig 28. AVA capture compared with AIHW data



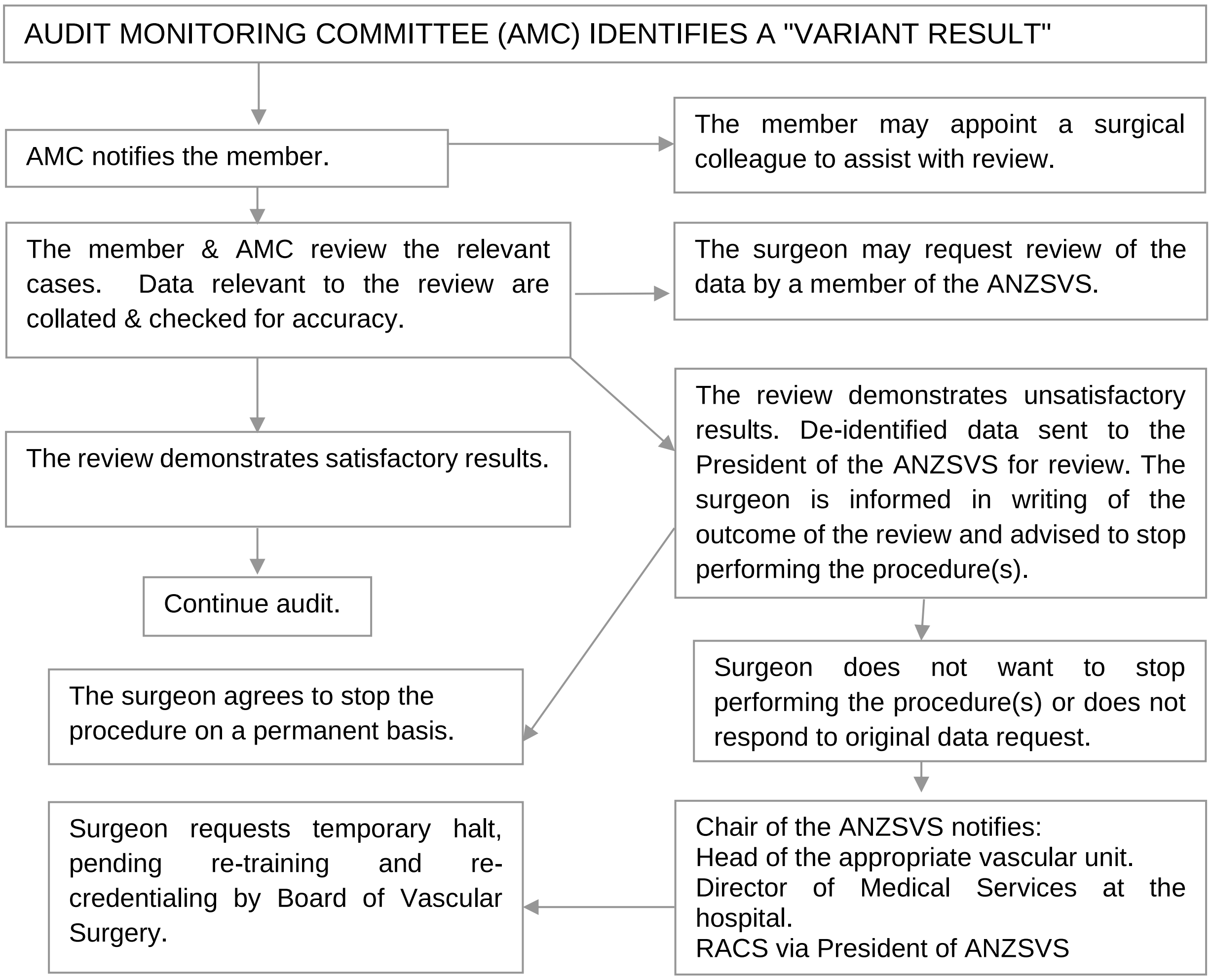
This data was compared with AVA data over the same period after exclusion of public and VA patients. This shows that there is poor entry of private data, and is at its lowest rate ever of 41%. Further measures are required to increase this percentage, which is unacceptable low. Private audit is generally not as robust as the M and M meetings in public teaching hospitals, and half of the workload in this sector is not being subjected to AVA methodology.

Internal validation was performed in 2023 comparing a 5% sample of patients with the actual case notes by nominated members at each hospital for 2022 data. This showed that data entry was of high quality with only 2.1% having incorrect field data entered out of a total of 2,894 fields studied. 2 outcome field were incorrect. This study is repeated every 3 years. Performance of vascular surgery in Australasia is at a high standard and our Society is enhanced by the existence of the AVA, especially with its unique audit loop. Members can continue to participate in the knowledge that it is a completely confidential activity, monitored by a committee that has a dual role of scrutiny of outcomes together with a genuine concern for the natural justice of members.

C Barry Beiles, Administrator

Appendix 1

Algorithm for audit



Note 1. The members of the ANZSVS Audit Monitoring Committee (AMC) are responsible for determining the thresholds for complications warranting review, after discussion and agreement by the members. Where appropriate, the thresholds used by the ACHS may be the limit chosen.

Note 2. If it is not possible for the independent reviewer chosen by the member and the AMC to reach consensus, the issue will be referred to the Board of Vascular Surgery for a final determination of satisfactory or unsatisfactory performance or other recommendation.

Note 3. The algorithm does not envisage advice to stop all operating unless audit showed unsatisfactory results in all types of operations performed. Thus the surgeon would only cease performing that particular operation that gave unsatisfactory results. Referral to the Medical Board may result in the suspension of all operating rights.

If there are continuing issues with the surgeon performing operations at an unsafe level then notification of the concerns of the AMC may be made to the Medical Board after discussion in writing with the president of the ANZSVS.

Appendix 2

Statistical methods

When performing institutional or individual comparisons for outcomes of health data, it is important to recognise that this has been fraught with difficulties in the past. The now discredited league tables are misleading and have been replaced with funnel plots, which are easy to interpret at a glance. The league table approach has been used to rank institutions based on performance, and this has led to "gaming", whereby institutions tackling the more complicated high-risk cases have avoided these procedures in order to improve their position in the table. There is also a 5% risk that a hospital or surgeon will be at the bottom of the table by chance, as these tables use 95% confidence intervals. It should also be recognised that it is a statistical certainty that an institution or surgeon can have a run of bad luck, and while they might reside at the bottom of the table in 1 year, this may be an isolated phenomenon.

Whichever method is used in assessing performance, some method of risk-adjustment is important, so that those hospitals or surgeons undertaking the high-risk cases will not be disadvantaged. It is recognised that methods of obtaining risk-adjustment are not an exact science, but the most widely utilised technique applied to outcomes that are 'binary' (where the outcome is one of 2 choices, ie. death or survival; patency or occlusion), is multilevel logistic regression analysis. Multilevel analysis determines the effect of the hospital on patients treated by the same surgeon at different locations. The outcome variable is called the dependent variable, and the variables that significantly affect the outcome are called the independent variables. These variables are accepted if the P value is < 0.05. An acceptable model is then produced that aims to provide good predictive qualities (called "discrimination") and this predictive ability should persist for cases with both low and high risk of an adverse outcome (called "calibration"). We have been able to produce good models for mortality following open aortic, open aneurysm, EVAR, occlusion after AVF creation and complications after endovascular treatment of PAD. The link test was run after each logistic regression to confirm that the model was correctly specified.

Once a model has been established, it will provide an expected risk of an adverse outcome for each patient in the population studied, based on the presence or absence of the statistically significant variables identified by the logistic regression procedure. This is then applied in the methods chosen to display the data. Statistical analysis was performed using Stata version 13.1 (Statacorp. 4905 Lakeway Drive College Station, Texas 77845 USA) and StatsDirect statistical software (England: StatsDirect Ltd. 2008)

Data display

Funnel plots have been adapted from a technique used to establish publication bias in meta-analyses. The adverse event rate is plotted on the Y axis, with the total number of cases on the X axis and Poisson 95% and 99% confidence intervals using the pooled adverse event rate for the whole group superimposed on the scatter plot. The data is risk adjusted (where a robust predictive model has been obtained) by plotting the adverse event rate as a standardised mortality/event ratio

(Observed/ Expected rate x overall event rate expressed as a percentage). The expected rate for each patient is derived from the logistic regression analysis. Non- risk adjusted funnel plots are displayed using the percent adverse event on the Y-axis and using a binomial distribution. These plots were obtained by using the funnelcompar module in Stata. The graph is easily interpreted because any consultant falling outside the upper 95% confidence interval that remains a statistical outlier after data accuracy bis confirmed is scrutinised to see if there is a problem in processes, using careful clinical appraisal. Conversely, consultants falling below the lower 95% confidence interval are performing much better than the majority.

Appendix 3

Features of the AVA application

This is a web-based database in SQL residing on a secure server (Microsoft Azure) within Australia and is compatible with all browser platforms. Data capture is exclusively via the web portal. A mobile-friendly modification has recently been designed.

1. Security and performance:

a) Uptime – Application and database up-time is greater than 99%

b) Backup Services - Daily database and application backup

c) Security services - Enterprise Firewalls, Intrusion Prevention Systems, and Anti-Virus Protection

d) Disaster recovery - Daily backups featuring file recovery, data de-duplication, redundant block elimination, over the wire encryption and offsite storage of backup data

e) Logon is only permitted by Surgeon code and password

f) The ability to view reports is determined by the status of the user. Members of the ANZSVS have the ability to view all reports, and there is the ability to view the user's outcomes in the 5 categories of audit in real time compared to the peer group. There is also a category of data manager for a unit or hospital (e.g. vascular trainee) that is granted access to enter data for the surgeons who work in their unit. They have no access to the private patient data for those surgeons.

2. Scalability:

The application is capable of handling 200 simultaneous users

3. Role based data updates:

Modification of data entered in the discharge/complication form fields after user logoff is only allowed by the administrator. Addition of data is allowed by all users. Deletion of records is only allowed by the administrator.

4. Privacy and confidentiality:

Compliance with privacy legislation is current and patient identifiers are encrypted and the database is securely stored on the server. Confidentiality of patient details is thus assured. Ethics committee approval has been obtained for this activity by the RACS ethics committee until 2016, after which it was determined that this was not required to be renewed annually as it was deemed a "low risk" activity according to the new NHMRC guidelines. Confidentiality of member's identity is assured by the storage of the surgeon code with legal representatives of the ANZSVS. The only situation where the identity of a surgeon would be allowed is in the event of the examination of the member by the AMC after possible underperformance has been identified by the statistical analysis. Commonwealth legislation identifying the AVA as a privileged quality assurance activity has been obtained in both Australia and New Zealand. Any identification of participating members outside of the strict algorithm of the audit process is punishable by a significant financial penalty and a maximum 2-year custodial sentence. In Australia in 2022, QP renewal was rejected but a new application is expected to be successful in 2023 for a 5-year period. An important feature of the AVA is the independence provided by total ownership of the data. This has been possible because the ANZSVS has self-funded the establishment and maintenance costs.

5. Data reliability:

Strict data validation criteria prevent erroneous data entry and there is no ability for free text data entry, except for 2 “comment” boxes in the operation and discharge forms. Drop down menus allow choices to appear that are based upon selections made in previous fields. This diminishes the ability to enter incorrect data.

6. Flexibility:

The application has been designed to allow alterations to the menu choices by the administrator. This has ensured that unusual operations can be entered. The application captures all endovascular procedures and the vascular surgical trainees extract data from the AVA to submit their logbooks to the Board of Vascular Surgery.

7. Benefits for the user:

The ability to compare real time outcomes by surgeon and /or hospital with the membership as a whole is very attractive. Also, there is the ability to conduct unit or personal audit using the reports specifically designed for this purpose. There is the ability to export data extracts, which represent a spreadsheet containing every field for each patient. This allows filtering to manipulate data in any form the user requires for any purpose. Logbook reports are also available for trainees and members. Participation in the AVA has been approved as a recognised audit activity by the Royal Australasian College of Surgeons for the purpose of re-accreditation. Participation also allows the user access to de-identified data for the purpose of research or in the event of an inquiry into one’s performance by a hospital or medico legal proceeding. A certificate of participation is issued annually upon application. This certificate is mandatory for retention of membership of the Society since 2019.

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