National Vascular Registry Report 2023: Summary for Anaesthetists

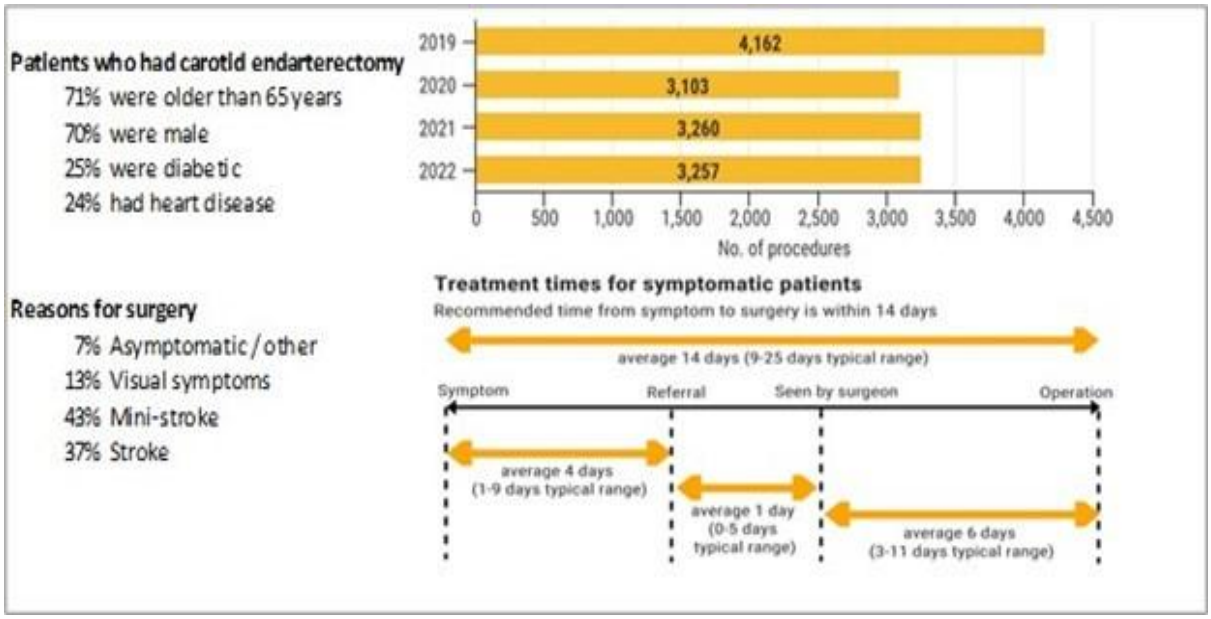
The NVR is commissioned by the Healthcare Quality Improvement Partnership (HQIP) as part of the National Clinical Audit and Patient Outcomes Programme and is designed to promote quality improvement within NHS hospitals performing vascular surgery by providing information on their performance.

In this summary we present data with direct relevance to vascular anaesthetists. The full report is available at 2023 NVR State of the Nation Report | VSQIP

Carotid Endarterectomy

In 2022, a total of 3,257 carotid endarterectomies were performed in the UK, compared to 3,171 in 2021. This number remains significantly reduced compared to 2019, when 4,162 procedures were performed.

A summary of patient characteristics is shown below.



Anaesthetic Type and Operative Details

Operative details of unilateral carotid endarterectomies performed during 2022:

- 64.4% were performed under general anaesthesia (GA) alone
- 6.9% were performed under local anaesthetic (LA) alone
- 11.9% combined GA/LA or block was used
- 16.8% were performed under block or regional
- 64.9% of procedures involved the use of a shunt

Table 7.4 shows the operative details of unilateral carotid endarterectomies performed during 2022, 2021 and 2020.

Table 7.4: Operative details of carotid endarterectomies performed from 2020 to 2022

Operation details		Procedures (n=3,257)	2022 %	2021 %	2020 %
Anaesthetic	General	2,097	64.4	63.7	64.5
	GA + block	387	11.9	10.6	8.8
	Block or regional	547	16.8	17.7	17.9
	Local	226	6.9	8.0	8.8
Type of endarterectomy	Standard	240	7.4	8.6	7.5
	Standard + patch	2,829	86.9	86.6	87.5
	Eversion	188	5.8	4.8	5.0
Carotid shunt used		2,115	64.9	64.0	61.8
Ipsilateral patency check		2,233	70.0	67.5	70.4

In 2022, the most common source of referral was the stroke physician (86.6%), vascular surgeons (2.8%), followed by neurologists (2.5%), and ophthalmologist (1.9%).

There were 3,083 patients (94.7%) with symptomatic disease.

- TIA was the most common symptom (45.0%), followed by stroke (39.1%).
- Over 70% of patients had at least 70% stenosis in their ipsilateral carotid artery at the time of operation.
- Only 0.7% of patients had a previous ipsilateral treatment

Medication for cardiovascular conditions was common among patients prior to surgery. Overall:

- 91.7% were on antiplatelet medication
    - 51.8% on single and
    - 48.2% on dual therapy,
- 82.4% were taking statins

Treatment Pathways

The median time from symptom onset to surgery for symptomatic patients in 2022 was 14 days (IQR 9-25 days). The median time delays were:

- 4 days (IQR 1-9) from symptom to first medical referral
- 1 day (IQR 0-5) from first medical referral to being seen by the vascular team, and
- 6 days (IQR 3-11) from being seen by the vascular team to undergoing CEA

There was considerable variation among NHS trusts in the median time to surgery during 2022:

- 36 of the 65 NHS organisations have a median time of 14 days or less
- The median exceeded 20 days for 8 vascular centres, which is an increase from 4 in 2021

- 27 trusts had less than half of their patients operated on within 14 days

Outcomes After Carotid Endarterectomy

The complication rates for the 3,257 procedures performed in NHS hospitals in 2022 are summarised in Table 7.5. The rates of the different complications tended to be around 0.4-2.1% and have remained fairly consistent over the last few NVR Annual Reports.

Over this 12-month period:

- the median length of stay was 2 days (IQR: 1 to 4 days)
- the rate of return to theatre was 2.3% (95% CI 1.8 to 2.9), and
- the rate of readmission within 30 days was 4.5% (95% CI 3.8 to 5.2).

Table 7.5: Postoperative outcomes following carotid endarterectomy for 2022

Procedures	**3,257**
Complication	**Complication rate (%) 2022**
Death and/or stroke within 30 days	2.1 (1.6 – 2.6)
Stroke within 30 days	1.9 (1.4 – 2.4)
Death within 30 days	0.4 (0.2 – 0.7)
Bleeding within admission	1.8 (1.4 – 2.4)
Myocardial infarct within admission	1.1 (0.7 – 1.5)
Cranial nerve injury within admission	1.9 (1.4 – 2.4)

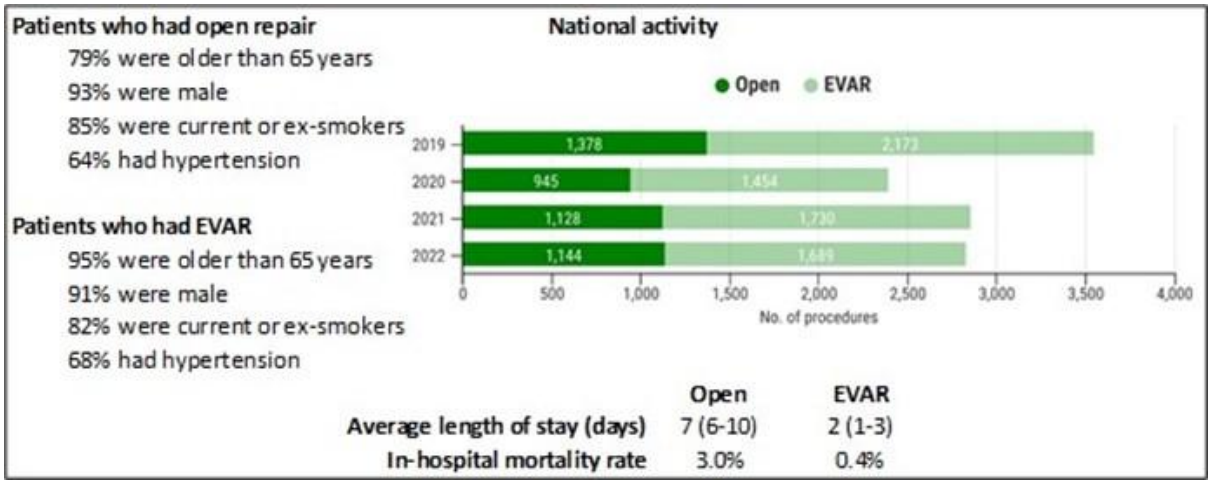
The NICE target time from symptom to operation is 14 days in order to minimise the chance of a high-risk patient developing a stroke. The median time from symptom to surgery for patients who had CEA in 2022 was 14 days and 52% were treated within 14 days. This is slightly worse than in 2021, when the median time was 13 days and 58% of patients were treated within 14 days. There is still variation in the waiting time for CEA between NHS organisations. The median time exceeded 20 days at eight NHS organisations, which is more than in 2021, although this is a half of the number of NHS organisations in 2016.

Recommendations:

- Ensure timely referral and expedited surgery for patients with symptomatic carotid disease with measures to reduce waiting times to carotid endarterectomy.
- The target time from symptom to operation is 14 days in order to minimise the chance of a high-risk patient developing a stroke.

Elective Infra-renal AAA

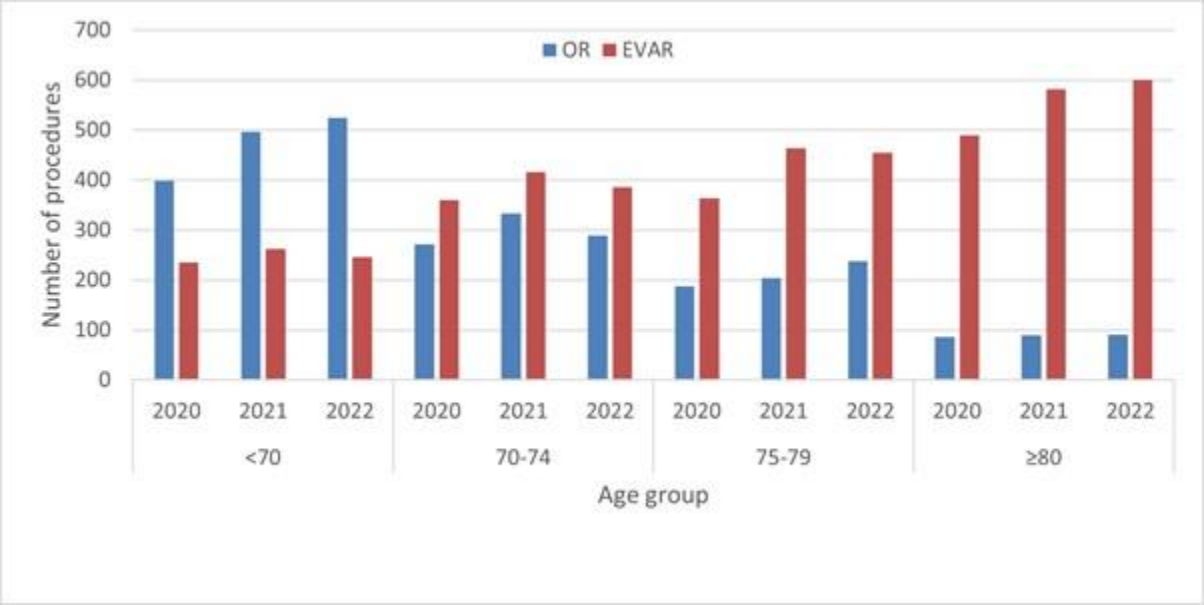
The organisation of vascular services undertaking AAA repair continues to evolve. The number of NHS vascular units performing any AAA repairs decreased from 72 in 2020 to 69 in 2022.



The NVR received information on 2,833 patients who had an elective repair of an infra-renal AAA in 2022. Overall, 60% of procedures were endovascular repair (EVAR) and 40% were open repair, but this split varied across NHS organisations.

Table 4.3: Split of open and endovascular elective infra-renal AAA procedures by year

Year	Open	EVAR	Total	% EVAR
2020	945	1,454	2,399	60.6
2021	1,128	1,730	2,858	60.5
2022	1,144	1,689	2,833	59.6
Total	3,217	4,873	8,090	60.2



Outcomes Following Elective Infra-renal AAA Repair

Table 4.6 describes various aspects of postoperative care for 2022.

- For EVAR, over 65% of patients went to a standard ward after surgery, and the median length of postoperative stay was 2 days.

- For patients undergoing open repair, over 95% of patients were admitted to a level 2 or level 3 critical care unit after surgery. Patients typically remained in critical care for 3 days and the median total postoperative stay was 7 days.

NHS vascular units achieved good outcomes after elective infra-renal AAA repair in 2022. The in-hospital postoperative mortality was 3.0% after open repair and 0.4% after EVAR. Rates of readmission within 30 days were 5.2% for open repair and 5.6% for EVAR. Between Jan 2020 to Dec 2022, the risk adjusted in-hospital mortality rates for all 67 NHS vascular units were within the expected range of the national average of 1.4%

The in-hospital mortality rate for open repair in 2022 was 3.0% (95% CI 2.1 to 4.1), comparable to 2.9% (95% CI 2.0 to 4.1) observed in 2021. The in-hospital mortality rate for EVAR was 0.4%.

Patients undergoing open repair were more susceptible to cardiac, renal and respiratory complications, and the rate of return to theatre was also higher.

For open repair, the rate of respiratory complications was 9.2% (95% CI 7.6 to 11.0) in 2022, a slight fall from 12.1% (95% CI 10.1 to 14.3) observed in 2020. For EVARs, respiratory complications decreased from 1.4% (95% CI 0.9 to 2.2) to 1.2% (95% CI 0.8 to 1.9) between 2020 and 2021. However, it increased to 1.4% (95% 0.9 to 2.0) in 2022.

Table 4.6: Postoperative details of elective infra-renal repairs undertaken in 2022

		Open repair (n=1,144)		**EVAR (n=1,689)**	
Admitted to	Ward	2.7%		68.0%	
	Level 2	60.8%		29.7%	
	Level 3	36.4%		2.2%	
	Died in theatre	0.2%		0.1%	
		Median	***IQR***	***Median***	***IQR***
Days in critical care: Level 2		3	2 to 4	1	0 to 1
Level 3		3	2 to 4	1	1 to 2
Post-op length of stay (days)		7	6 to 10	2	1 to 3
		Rate	***95% CI***	***Rate***	***95% CI***
In-hospital postoperative mortality		3.0	2.1 to 4.1	0.4	0.2 to 0.9
Defined complications					
	Cardiac	5.1	3.9 to 6.5	0.7	0.3 to 1.2
	Respiratory	9.2	7.6 to 11.0	1.4	0.9 to 2.0
	Haemorrhage	1.9	1.2 to 2.9	1.1	0.6 to 1.7
	Limb ischaemia	3.0	2.1 to 4.1	0.2	0.0 to 0.5
	Renal failure	4.9	3.7 to 6.3	0.5	0.2 to 0.9
	Other	10.1	8.4 to 12.0	3.9	3.0 to 4.9
	None of the above	70.3	67.6 to 73.0	92.4	91.0 to 93.6
Return to theatre		7.3	5.8 to 8.9	1.2	0.8 to 1.9
Readmission within 30 days		5.2	4.0 to 6.7	5.6	4.5 to 6.8

The Vascular Society AAA Quality Improvement Framework (QIF) established several standards for preoperative assessment of patients undergoing AAA repair. In 2022, most patients treated in NHS vascular units received care consistent with the standard (see Table 4.5)

Table 4.5: Overall compliance with standards related to the VSGBI elective AAA care pathway

	Percentage of patients meeting standard		
	2022	2021	2020
Elective patients were discussed at MDT meetings	2,490/2,833 (87.9%)	86.0%	85.2%
Patients with an AAA diameter ≥5.5cm deemed suitable for repair had a preoperative CT/MR angiography assessment	2,395/2,560 (93.6%)	91.8%	90.9%
Patients underwent a formal anaesthetic review	2,749/2,833 (97.0%)	97.1%	97.2%
Patients whose anaesthetic review was done by a consultant vascular anaesthetist	2,529/2,748 (92.0%)	92.2%	92.1%
Patients who had their fitness measured	2,352/2,831 (83.1%)	83.0%	80.4%
Most common assessment methods:			
CPET	1,344/2,352 (57.1%)	51.4%	51.9%
Echocardiogram	1,086/2,352 (46.2%)	46.2%	42.2%

Anaesthetic Type

The table below demonstrates the anaesthetic types undertaken for elective infra-renal AAA repair in 2022.

Type	Open	EVAR	Total	Open%	EVAR%
GA Only	609	1,064	1,673	53%	63%
LA only	0	128	128	0%	8%
GA + LA	21	161	182	2%	10%
LA + Plexus/Compartment	0	8	8	0%	0%
LA + Plexus/Compartment + Spinal/Epidural	0	1	1	0%	0%
GA + LA + Plexus/Compartment + Spinal/Epidural	1	0	1	0%	0%
LA + Spinal/Epidural	0	58	58	0%	3%
GA + LA + Spinal/Epidural	12	3	15	1%	0%
Plexus/Compartment only	1	10	11	0%	1%
GA + Plexus/Compartment	37	5	42	3%	0%
Plexus/Compartment + Spinal/Epidural	1	0	1	0%	0%
GA + Plexus/Compartment + Spinal/Epidural	3	0	3	0%	0%
Spinal/Epidural only	3	232	235	0%	14%
GA + Spinal/Epidural	455	18	473	40%	1%
TOTALS	1,143	1,688	2,831		

Other Elective Repair of Aortic Conditions

Aneurysms can occur at various locations along the aorta. In addition to infra-renal aneurysms, a distinction is made between two other types:

- Juxta-renal (that occur near to the renal arteries)
- Supra-renal (that occur above the renal arteries), and

The two most common procedures are Fenestrated EVAR (FEVAR), performed when aneurysms are close to the renal arteries, and branched EVAR (BEVAR), performed when other arteries branching from the aorta are involved. For the period 2020-2022, 84% of the elective procedures were FEVARs and 13% were BEVARs.

In 2020-22, there were 1,266 endovascular procedures, which included 1,065 FEVAR and 161 BEVAR. There were 228 complex open repair procedures in 2020-2022.

Other elective procedures		Open	%	Endovascular	%	Total
Total procedures		228		1,266		1,494
Age group (years)	Under 66	63	27.6	118	9.4	181
	66 to 75	118	51.8	577	45.8	695
	76 to 85	46	20.2	535	42.5	581
	86 and over	1	0.4	30	2.4	31
Male		196	86.0	1,103	87.1	1,299
Female		32	14.0	163	12.9	195
Current smoker		90	39.5	300	23.9	390
ASA fitness grade	1,2	48	21.1	178	14.1	226
	3	166	72.8	1,002	79.1	1,168
	4,5	14	6.1	86	6.8	100
Comorbidities	Hypertension	158	69.3	938	74.1	1,096
	Ischemic heart disease	50	21.9	478	37.8	528
	Chronic heart failure	1	0.4	77	6.1	78
	Stroke	18	7.9	111	8.8	129
	Diabetes	35	15.4	204	16.1	239
	Chronic renal failure	24	10.5	211	16.7	235
	Chronic lung disease	63	27.6	444	35.1	507

Rates of postoperative mortality after complex endovascular repairs were lower than after complex open repairs. In 2020-22, in-hospital postoperative mortality rates were:

- 1.7% for endovascular procedures, being 1.6% for FEVAR, and for 1.2% BEVAR.
- 10.1% for open repairs.

Rates of readmission within 30 days were 5.0% for open procedures and 7.7% for endovascular procedures (see Table 5.2).

Table 5.2: Postoperative details of other elective repairs undertaken between January 2020 and December 2022

Other elective procedures		**Open repair (n=228)**		**EVAR (n=1,266)**	
Admitted to	Ward	2.2%		21.3%	
	Level 2	39.9%		63.1%	
	Level 3	57.5%		15.5%	
	Died in theatre	0.4%		0.1%	
		Median	***IQR***	***Median***	***IQR***
Days in critical care:	Level 2	3	2 to 4	2	1 to 2
	Level 3	3	2 to 7	2	1 to 3
Post-op length of stay (days)		9	6 to 15	4	2 to 7
		Rate	***95% CI***	***Rate***	***95% CI***
In-hospital postoperative mortality		10.1	6.5 to 14.8	1.7	1.0 to 2.5
Return to theatre		11.5	7.6 to 16.3	5.9	4.7 to 7.4
Readmission within 30 days		5.0	2.4 to 9.0	7.7	6.2 to 9.3

Repair of Thoracic Aortic Conditions

Patients who suffer from a thoracic aortic aneurysm or aortic dissection are increasingly treated using a thoracic endovascular aortic repair (TEVAR). This procedure is performed in either a cardiothoracic unit or specialist vascular unit. Of the thoracic repairs, non-elective patients were younger and more likely to smoke. ASA fitness was higher for non-electives. Elective cases had more comorbidities.

In 2020-22, there were 405 emergency and 394 elective TEVAR procedures performed by 38 UK vascular units.

TEVARS		Elective	%	Non-elective	%	Total
Total procedures		394		405		799
Age group (years)	Under 66	107	27.2	186	46.2	293
	66 to 75	158	40.2	108	26.8	266
	76 to 85	119	30.3	93	23.1	212
	86 and over	9	2.3	16	4	25
Male		258	65.5	274	67.7	532
Female		136	34.5	131	32.3	267
Current smoker		70	17.8	108	27.1	178
AAA diameter (cm)	Under 5.5	110	27.9	251	62.0	361
	5.5 to 6.9	197	50.0	66	16.3	263
	7.0 and over	79	20.1	65	16.0	144
ASA fitness grade	1,2	47	11.9	42	10.4	89
	3	298	75.6	150	37.3	448
	4,5	49	12.4	210	52.2	259
Comorbidities	Hypertension	302	76.6	264	65.2	566
	Ischemic heart disease	102	25.9	69	17.0	171
	Chronic heart failure	27	6.9	18	4.4	45
	Stroke	27	6.9	26	6.4	53
	Diabetes	47	11.9	33	8.1	80
	Chronic renal failure	57	14.5	39	9.6	96
	Chronic lung disease	96	24.4	82	20.2	178

In 2020-22, in-hospital postoperative mortality rates after TEVAR were: 11.6% for emergency and 2.0% for elective procedures performed by UK vascular units. Rates of readmission within 30 days were 8.5% for elective procedures and 8.5% for emergency procedures (see Table 5.4).

Table 5.4: Postoperative details of TEVARs undertaken between January 2020 and December 2022

TEVARS		Elective (n=394)		Non-elective (n=405)	
Admitted to	Ward	25.9%		10.7%	
	Level 2	53.6%		41.4%	
	Level 3	20.6%		46.9%	
	Died in theatre	0.0%		1.0%	
		Median	***IQR***	***Median***	***IQR***
Days in critical care:	Level 2	2	1 to 3	2	1 to 4
	Level 3	2	1 to 3	4	2 to 9
Post-op length of stay (days)		4	2 to 6	9	5 to 19
		Rate	***95% CI***	***Rate***	***95% CI***
In-hospital postoperative mortality		2.0	0.9 to 4.0	11.6	8.7 to 15.1
Return to theatre		3.8	2.2 to 6.2	16.5	13.0 to 20.5
Readmission within 30 days		8.5	5.9 to 11.9	8.5	5.8 to 11.9

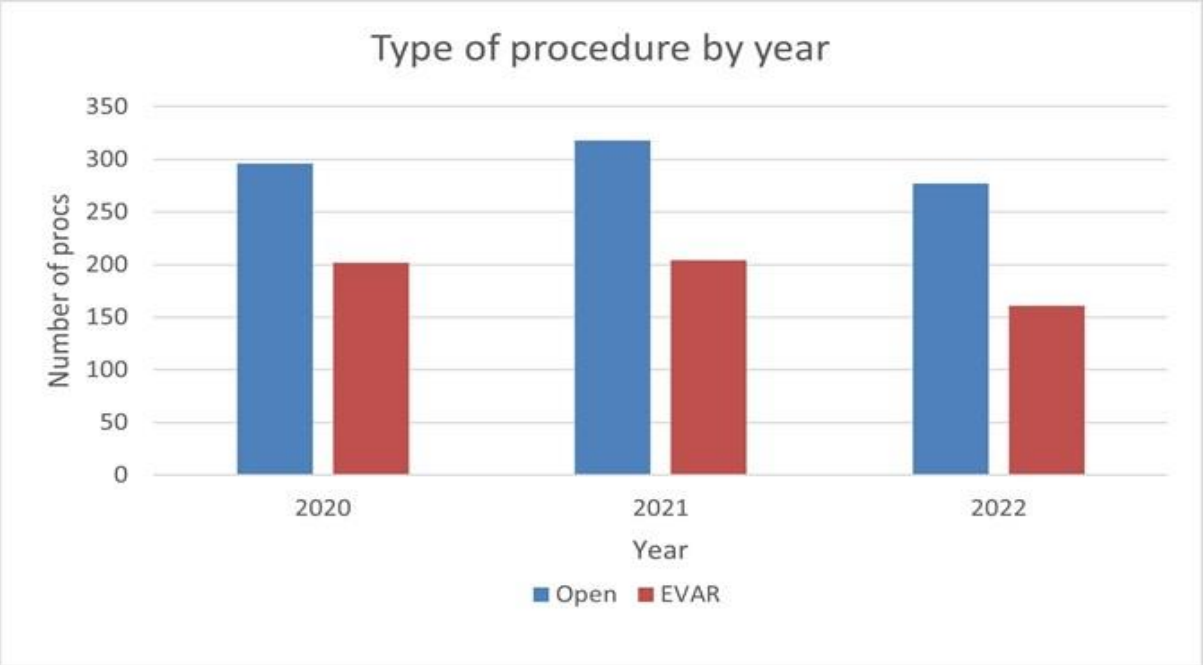
For elective cases, over 50% were admitted to level 2 care where they stayed for 2 days. Nearly half of non-electives procedures were admitted to level 3 care with a median length of stay of 4 days. Median postoperative length of stay was 4 days for elective TEVARs in the last three years compared with 9 days for non-elective patients. Non-elective mortality was six times more than elective cases. However, 30-day readmissions were similar for both admission modes.

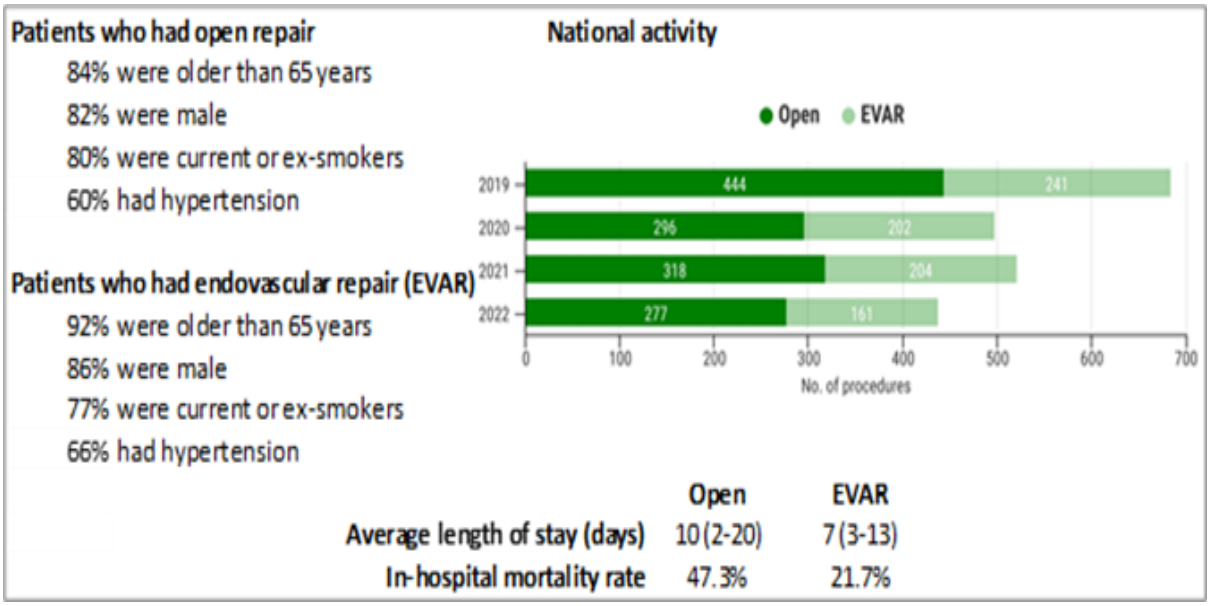
Ruptured AAA

The NVR recorded 1,458 emergency repairs of a ruptured abdominal aneurysm between January 2020 and December 2022, with a slight fall from year to year. Estimated case ascertainment in 2020-2022 was 87%.

In 2018, around 30% of patients with ruptured AAA had an EVAR procedure. In 2022, this had increased to 37% of patients. Between 2020 and 2022, there were 13 units who performed more EVARs than open repairs for ruptured AAA.

Table 6.2: Number of open repairs and EVARs for ruptured AAAs between January 2020 and December 2022.





Outcomes Following Ruptured AAA

The in-hospital postoperative mortality rates for EVAR and open repair were 21.7% and 47.3%, respectively, in 2020-2022. We caution against comparing the figures for EVAR and open repair because patients who have open procedures may represent the more complex cases that are unsuitable for endovascular repair. Rates of readmission within 30 days were 8.3% for open repair and 9.0% for EVAR. During the three-year period 2020-2022, all 61 NHS organisations had in-hospital postoperative mortality rates within the expected range after repair for ruptured AAA, given the number of procedures performed at the vascular units. The overall national average for this period was 37.3%.

Table 6.2: Postoperative details of emergency repairs for ruptured AAAs undertaken between January 2020 and December 2022

2020-2022		Open repair (n=891)		EVAR (n=567)	
Admitted to	Ward	0.3%		16.6%	
	Level 2	9.6%		37.5%	
	Level 3	82.4%		42.6%	
	Died in theatre	7.8%		3.4%	
		Median	***IQR***	***Median***	***IQR***
Days in critical care: Level 2		4	2 to 6	2	1 to 3
Level 3		4	2 to 9	2	1 to 5
Post-op length of stay (days)		10	2 to 20	7	3 to 13
Post-op length of stay for patients discharged alive (days)		16	10 to 27	8	4 to 14
		Rate	***95% CI***	***Rate***	***95% CI***
In-hospital postoperative mortality		47.3	43.9 to 50.6	21.7	18.4 to 25.3
Defined complications					
	Cardiac	20.0	17.3 to 22.8	11.0	8.5 to 13.9
	Respiratory	33.1	29.9 to 36.4	17.2	14.1 to 20.6
	Stroke	2.2	1.3 to 3.4	1.3	0.5 to 2.6
	Haemorrhage	4.4	3.1 to 6.0	2.6	1.4 to 4.3
	Limb ischaemia	13.0	10.8 to 15.5	3.3	2.0 to 5.2
	Renal failure	27.1	24.1 to 30.3	10.1	7.7 to 12.9
	Ischaemic bowel	11.4	9.3 to 13.8	3.3	2.0 to 5.2
	None of predefined	28.8	25.8 to 32.1	56.3	52.0 to 60.5
Return to theatre		21.7	18.9 to 24.6	11.1	8.6 to 14.1
Readmission within 30 days		8.3	6.0 to 11.2	9.0	6.5 to 12.1

For NHS organisations undertaking repair of a ruptured AAA between 1 January 2020 and 31 December 2022, the risk-adjusted postoperative mortality rates are shown in Figure 6.3. The in-hospital postoperative mortality rates for the years 2020, 2021 and 2022 for open procedures were 50.3%, 45.0% and 46.6% respectively. For EVARs, the corresponding rates were 19.8%, 23.5% and 21.7%.

Anaesthetic Type

The following table summarises the anaesthetic types for rAAA from 2020-2022.

Type	Open	EVAR	Total	Open%	EVAR%
GA only	285	765	1,050	93%	67%
GA + Plexus/Compartment	2	1	3	1%	0%
LA only	1	284	285	0%	25%
GA + LA	3	69	72	1%	6%
GA + LA + Plexus/Compartment	1	1	2	0%	0%
LA + Spinal/Epidural	0	5	5	0%	0%
Spinal/Epidural only	1	13	14	0%	1%
GA + Spinal/Epidural	13	11	24	4%	1%
TOTALS	**306**	**1,149**	**1,455**		

Recommendations:

Vascular units should evaluate how access to endovascular repair can be improved for emergency repair of ruptured aneurysms. This may require:

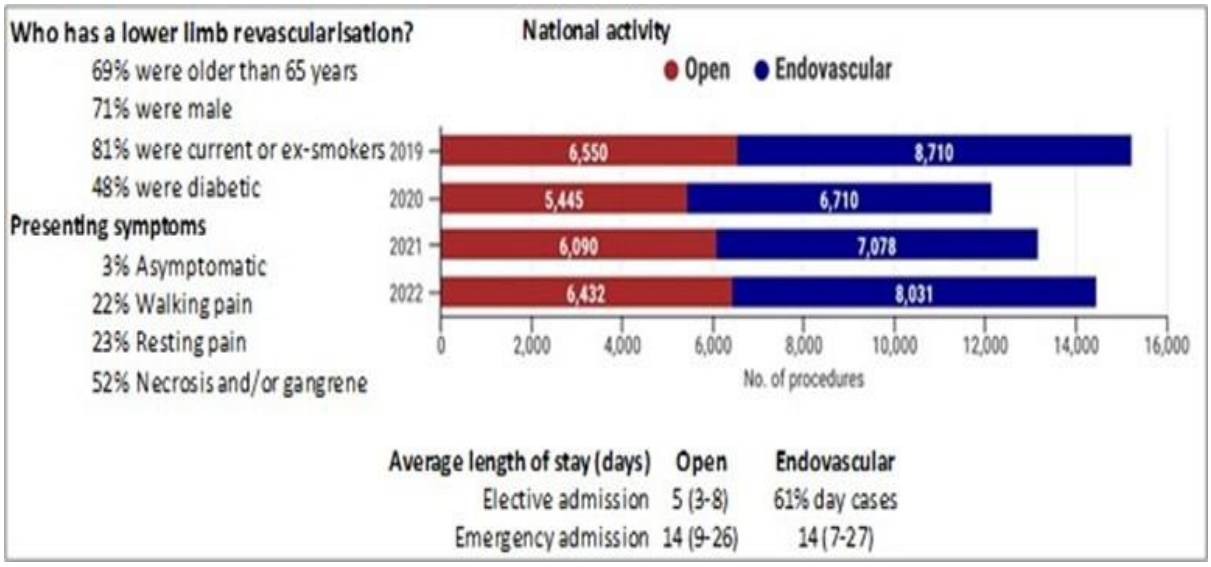
- Network pathways for vascular surgery working in collaboration with interventional radiology and vascular anaesthesia.
- 24/7 access to hybrid operating theatres.
- Developing teams with the required expertise qualified to deliver in and out of hours care including nursing staff and radiographers addressing workforce for both vascular surgery and interventional radiology.

Lower Limb Revascularisation

In 2022, over 14,000 revascularisation procedures for chronic limb threatening ischemia (CLTI) (endovascular, hybrid and open bypass) were performed, compared to 13,065 in 2021. During 2022, there were:

- 6,432 bypass or open procedures (3,565 elective and 2,867 non-elective).
- 8,031 endovascular procedures (5,265 elective and 2,766 non-elective).

Estimated case ascertainment rates in 2022 were 89% for bypass and 54% for angioplasty. A summary of patient characteristics is shown below.



Most patients for open surgical procedures were over the age of 70 years presenting for elective and non-elective procedures, 34.6% and 35.4% respectively. Most had comorbidities, the commonest being hypertension (69.5% elective, 64.3% non-elective), followed by diabetes (35.6% elective, 43.9% non-elective) and then ischaemic heart disease (32.6% elective, 35% non-elective). A small proportion of patients had no comorbid disease (11.2% elective, 11.1% non-elective).

With regards to anti-platelet therapy, 84.9% of elective patients and 76.1% of non-elective patients were recorded as being on one anti-platelet agent, and 82.3% of elective patients and 75.2% of non-elective patients were recorded as being on a statin.

The following table summarises the patient characteristics for those undergoing lower limb revascularisation in 2022.

Table 2.3: Characteristics of patients undergoing lower limb revascularisation in 2022

	Elective				Non-elective			
	Endovascular		Open surgical		Endovascular		Open surgical	
	No.	%	No.	%	No.	%	No.	%
Total procedures	5,265	65.6	3,565	55.4	2,766	34.4	2,867	44.6
Age group (years)								
Under 60	806	15.4	650	18.3	439	15.9	508	17.8
60 to 69	1,496	28.5	1,196	33.7	699	25.4	839	29.4
70 to 79	1,782	34.0	1,229	34.6	851	30.9	1,013	35.4
80 and over	1,163	22.2	474	13.4	766	27.8	498	17.4
Men	3,626	68.9	2,660	74.6	1,907	68.9	2,035	71.0
Women	1,639	31.1	905	25.4	859	31.1	832	29.0
Smoking status								
Current smoker	1,291	24.7	1,187	33.4	668	24.4	1,199	42.0
Ex-smoker	2,733	52.3	2,013	56.6	1,293	47.1	1,319	46.2
Never smoked	1,206	23.1	356	10.0	782	28.5	338	11.8
Comorbidities								
None	635	12.1	400	11.2	201	7.3	319	11.1
Diabetes	2,564	48.9	1,269	35.6	1,853	67.2	1,257	43.9
Hypertension	3,242	61.9	2,477	69.5	1,714	62.2	1,841	64.3
Chronic lung disease	947	18.1	910	25.5	497	18.0	745	26.0
Ischaemic heart disease	1,423	27.2	1,160	32.6	814	29.5	1,001	35.0
Chronic heart failure	430	8.2	206	5.8	389	14.1	271	9.5
Chronic renal disease	778	14.8	363	10.2	695	25.2	344	12.0
Stroke	433	8.3	293	8.2	268	9.7	253	8.8
Medication								
None	217	4.1	10	0.3	98	3.6	8	0.3
Antiplatelet	4,017	76.6	3,027	84.9	1,925	69.7	2,181	76.1
Statin	3,527	67.2	2,934	82.3	1,821	65.9	2,154	75.2
Beta blocker	1,350	25.7	965	27.1	895	32.4	783	27.3
ACE inhibitor	1,631	31.1	1,359	38.1	924	33.4	1,006	35.1

Most endovascular procedures in 2022 (91.4%) were performed under local anaesthetic, with 1.7% under regional and 6.9% under general anaesthetic. For open procedures in 2022, 85.4% were performed under general anaesthetic, 12.1% under regional and 2.5% under local.

The following table (2.6) shows the characteristics of lower limb revascularisation procedures undertaken in 2022.

Table 2.6: Characteristics of lower limb revascularisation procedures undertaken in 2022

	Elective		Non-elective	
	Endovascular	**Open**	**Endovascular**	**Open**
Chronic limb ischaemia				
Asymptomatic	278 (5.3%)	31 (0.9%)	31 (1.1%)	18 (0.6%)
Intermittent claudication	1,781 (33.8%)	927 (26%)	88 (3.2%)	43 (1.5%)
Nocturnal/resting pain	942 (17.9%)	1,193 (33.5%)	280 (10.1%)	516 (18%)
Necrosis/gangrene	2,047 (38.9%)	923 (25.9%)	2,128 (77%)	1,563 (54.5%)
Acute limb ischaemia	144 (2.7%)	150 (4.2%)	204 (7.4%)	584 (20.4%)
Trauma	8 (0.2%)	9 (0.3%)	13 (0.5%)	35 (1.2%)
Aneurysm	64 (1.2%)	331 (9.3%)	21 (0.8%)	108 (3.8%)

During 2022, there were 4,487 patients with chronic limb threatening ischaemia (CLTI) who were admitted non-electively. Of these, the median time (IQR) from admission to intervention was 5 (3-9) days.

The proportion of patients revascularised within 5 days was 51% in 2022. Among the 59 NHS organisations that performed 10 or more procedures for non-elective CLTI:

- 23 units had at least 50% of their patients wait more than 5 days
- 12 vascular units had at least 25% of their patients wait more than 10 days

There was an 8% increase in open surgical procedures for CLTI in 2022 (n=3,565) compared to 2021 (n=3,307), and of 23% in 2020 (n=2,889). There was a small increase in non-elective procedures, with 2,867 performed in 2022, compared to 2,873 in 2021 and 2,554 in 2020.

In 2022, 92.7% (n=5856) of open procedures (elective 97.7% and non-elective 86.4%) were performed between 8am and 6pm on a weekday. The percentage of open surgical procedures performed on planned lists was at least 75% for all but three NHS trusts that submitted 10 or more procedures in the NVR in 2022 (63 out of 666 NHS trusts, 95.5%).

The proportion of patients revascularized within 5 days from admission was 51% in 2022 (the PAD QIF standard). This is lower than in 2021 (54%) and 58.4% in 2020, but higher than in 2019 (47%). The timing to revascularisation for CLTI was:

- Median wait from admission to intervention was 5 days (IQR 3-9 days) in 2022, 5 days (IQR:2-9 days) in 2021 compared to 4 days (IQR 2-8 days) in 2020

The overall length of stay for open procedures was 5 days (IQR 3-8) for elective procedures and 14 days (IQR 9-26) for non-elective procedures.

85% of elective cases and 71.6% of non- elective cases had no complications. However, those undergoing non-elective procedures had a generally higher complications rate and re-intervention rates than those undergoing elective procedures, with limb ischaemia (8% non-elective , 2.5% elective), and respiratory (5.1% non-elective and 2.5% elective) complications being the highest.

The re-intervention rate (angioplasty/stent, bypass, minor and major amputation, 30-day amputation) was 7.5% for elective procedures and 28% for non-elective procedures.

The in-hospital postoperative mortality rate was 3.9% for elective patients and 4.8% for non-elective patients. The report highlighted that all NHS trusts had a risk adjusted in-hospital mortality following lower limb bypass that deck within the expected range of the overall national average of 1.9% (95% CI: 1.7 to 2.1) in this cycle

Table 2.7: Postoperative outcomes after lower limb revascularisation for 2022 by procedure type

	Elective		Non-elective	
	Endovascular	**Open**	**Endovascular**	**Open**
Total procedures	5,265	3,565	2,766	2,867
Post-op destination	**n (%)**	**n (%)**	**n (%)**	**n (%)**
Ward	2,280 (43.4%)	2,637 (74.0%)	2,625 (95.1%)	2,081 (72.6%)
Level 2 (HDU/PACU)	43 (0.8%)	742 (20.8%)	52 (1.9%)	599 (20.9%)
Level 3 (ICU)	9 (0.2%)	158 (4.4%)	17 (0.6%)	185 (6.5%)
Died in theatre	0 (0.0%)	0 (0.0%)	0 (0.0%)	<5 (0.0%)
Day-case unit	2,919 (55.6%)	27 (0.8%)	66 (2.4%)	<5 (0.0%)
Complications	**Rate**	**Rate**	**Rate**	**Rate**
None	94.5	85.0	84.7	71.6
Cardiac	0.3	2.0	1.6	3.9
Respiratory	0.3	2.5	2.5	5.1
Limb ischaemia	0.4	3.1	3.7	8.0
Renal failure	0.2	0.8	0.9	2.0
Further procedures				
None	95.0	92.8	78.6	79.9
Angioplasty/stent	1.9	1.4	7.2	3.4
Bypass	1.0	1.9	3.2	3.6
Minor amputation	1.2	1.5	10.3	4.4
Major amputation	0.7	1.1	6.0	7.5
30-day major amputation	1.3	1.6	9.1	9.1
In-hospital mortality	0.6	1.4	4.2	4.6
Re-admission to higher level care	0.7	1.7	2.7	3.2
Re-admission within 30 days	7.7	10.0	16.8	13.6
	Median (IQR)	**Median (IQR)**	**Median (IQR)**	**Median (IQR)**
Overall LOS (days)	0 (0 - 1)	5 (3 - 8)	14 (7 - 27)	14 (9 - 26)
Admission-to-procedure (days)	0 (0 - 0)	0 (0 - 0)	5 (2 - 9)	4 (1 - 7)
Post-op LOS (days)	0 (0 - 1)	4 (3 - 7)	6 (2 - 17)	9 (5 - 19)

Recommendations:

- Patients admitted non-electively with chronic limb ischaemia should have a revascularisation procedure within 5 days.

- Improved data entry for this group especially for those who require a second unplanned procedure during the same admission.
- Trusts should aim to perform at least 75% of lower limb revascularisation on planned operating lists.

Lower Limb Amputation

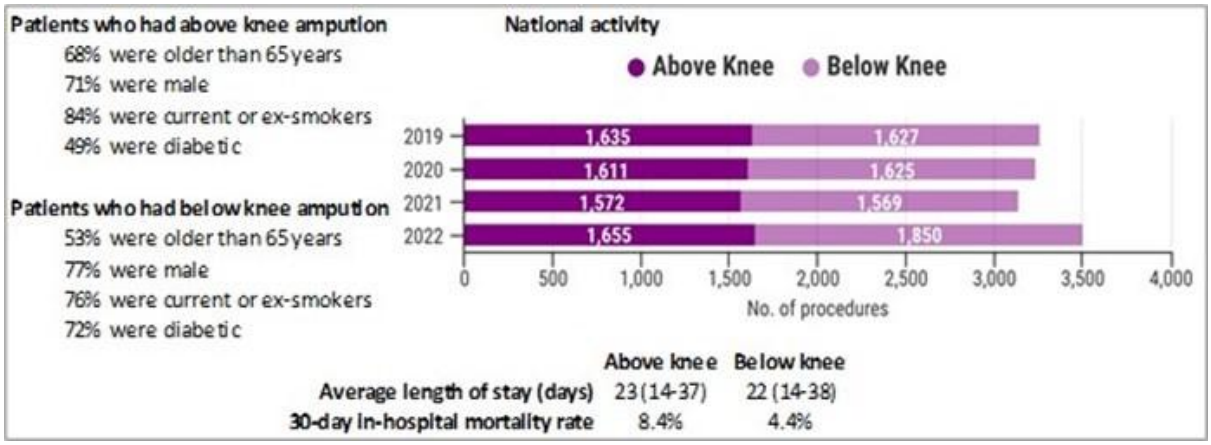
This chapter describes the patterns of care and outcomes for patients undergoing unilateral major lower limb amputations due to vascular disease during the audit period from January 2022 to December 2022.

During this period, 3,505 primary major unilateral amputations were recorded in the NVR, which consisted of 1,850 (52.8%) below the knee amputations (BKAs) and 1,655 (47.2%) above the knee amputations (AKAs). Through knee amputations (TKAs) have been analysed as part of the BKA group. TKAs accounted for 3.7% of all major amputations recorded on the NVR during the 1-year audit period. The case ascertainment rate was 88%, which exceeds the recommended 85% target by GIRFT vascular surgery report 2018.

In addition, NHS hospitals submitted information on 913 minor amputations, and other types of major amputation (58 bilateral, 30 due to trauma and 534 that were performed within 30 days of a lower limb revascularisation procedure). This chapter focuses on major unilateral lower limb amputations that were primary procedures, and these other types of procedure were not included in the analysis.

During the pandemic, there was a slight reduction in the number of unilateral major amputations undertaken within the NHS in 2020 and 2021, compared to 2019 (3,703 procedures). However, an increase of more than 300 major amputations were performed in 2022 than in 2019, which could be an indirect impact from COVID 19.

A summary of patient characteristics is shown below.



BKA's were more common in those under the age of 60 (31.7%), while AKA were more common in those over the age of 80 (19.4%). Most patients in both groups were mainly men, and were either current or ex-smokers.

Most patients had one or more comorbidities. The majority of patients requiring a BKA were diabetic (72.1%), compared to the majority being hypertensive (62.8%) in those requiring an AKA. It was common for patients to be on multiple medications, antiplatelet agents, statins,

antibiotic and DVT prophylaxis being the commonest. Oral anticoagulants were taken by 20-25% of patients.

Prophylactic antibiotics was recorded in 90.9% of BKAs and 89.7% of AKAs, and and DVT prophylaxis was recorded in 69.2% of BKAs and 68.6% of AKAs.

Table 3.3 shows the characteristics of patients undergoing lower limb amputation in 2022, and table 3.4 shows the pre-operative risk factors among patients undergoing lower limb amputation in 2022.

Table 3.3: Characteristics of patients undergoing major unilateral lower limb amputation in 2022

	Below knee	%	Above knee	%
Total procedures	1,850		1,655	
Age group (years)				
Under 60	584	31.7	299	18.1
60 to 64	286	15.5	224	13.6
65 to 69	290	15.7	265	16.1
70 to 74	243	13.2	285	17.3
75 to 79	239	13.0	257	15.6
80 and over	203	11.0	320	19.4
Sex				
Men	1,425	77.0	1,171	70.8
Women	425	23.0	484	29.2
Smoking				
Current smoker	533	29.4	645	39.3
Ex-smoker	848	46.7	734	44.7
Never smoked	435	24.0	263	16.0
Presenting problem				
Acute limb ischemia	167	9.0	329	19.9
Chronic limb ischemia	528	28.6	460	27.8
Neuropathy	24	1.3	12	0.7
Tissue loss	663	35.9	582	35.2
Uncontrolled infection	466	25.2	255	15.4
Aneurysm	1	0.1	15	0.9
Previous ipsilateral limb procedure	1,019	61.2	745	50.9
Type of previous ipsilateral limb procedure				
Minor amputation only	183	18.2	34	4.6
Angioplasty/stent	458	45.7	209	28.6
Surgical revascularisation	310	30.9	309	42.2
Major amputation	52	5.2	180	24.6

Table 3.4: Preoperative risk factors among patients undergoing lower limb amputation in 2022

	Below knee	%	Above knee	%
Total procedures	1,850		1,655	
Pre-op ASA grade				
Normal	8	0.4	5	0.3
Mild disease	126	6.8	48	2.9
Severe, not life-threatening disease	1,329	71.8	966	58.4
Severe, life-threatening disease, or moribund patient	387	20.9	635	38.4
Comorbidities				
None	133	7.2	148	8.9
Diabetes	1,334	72.1	813	49.1
Hypertension	1,108	59.9	1,039	62.8
Chronic lung disease	345	18.6	456	27.6
Ischaemic heart disease	608	32.9	591	35.7
Chronic heart failure	211	11.4	252	15.2
Chronic renal disease	433	23.4	301	18.2
Stroke	145	7.8	229	13.8
Active/managed cancer	112	6.1	135	8.2
Medication				
None	14	0.8	11	0.7
Anti-platelet	1,259	68.1	1,055	63.7
Statin	1,305	70.5	1,131	68.3
Beta-blocker	532	28.8	541	32.7
ACE inhibitor/ARB	641	34.6	528	31.9
Antibiotic prophylaxis	1,682	90.9	1,485	89.7
DVT prophylaxis	1,281	69.2	1,135	68.6
Oral anticoagulant	393	21.2	408	24.7

In 2022, there were 1,655 above knee and 1,850 below knee amputations, giving an overall AKA:BKA ratio of 0.89. Most NHS organisations had a ratio of less than one, but six organisations had a ratio above two.

Overall, in 2022:

- 91% of major amputations occurred during daytime hours (8am-6pm)
- a consultant surgeon was present in 74% of the procedures

The median time from vascular assessment to amputation in 2022 was:

- 8 days (IQR: 3 to 20 days) for non-elective patients
- 37 days (IQR: 14 to 102 days) for elective patients, and
- 10 days (IQR: 3 to 29 days) for all patients

Outcomes After Major Amputation

Patient outcomes immediately following a major lower limb amputation is summarised in table 3.6.

Overall, 27.8% of patients suffered one or more complication following major limb amputation; these were commonly respiratory (5.9% BKA, 9.6% AKA), cardiac (3.5% BKA, 5.6% AKA) complications and surgical site infections (4.9% BKA, 4.4% AKA), which were similar to the rates in 2021: respiratory (6.5% BKA, 8.9% AKA), cardiac (3.3% BKA, 4.4% AKA) complications and surgical site infections (4.8% BKA, 3.8% AKA). 8.8 % of BKA and 6.3% AKA had a return to theatre during their admission.

Most patients returned to the ward following an amputation, while 9.8% of BKA and 18=6.8% of AKA patients were admitted to critical care (level 2 or 3)

The overall median length of hospital stay for major lower limb amputation was 22 days (IQR: 14 to 38 days)

The overall rate of 30-day in-hospital death for major lower limb amputations in 2022 was 6.3%. As expected, it was higher for AKA (8.4%) than BKA (4.4%). Rates of readmission within 30 days were 9.5% for AKAs and 9.8% for BKAs.

Table 3.6: Patient outcomes following major lower limb amputations undertaken in 2022

	Below knee		**Above knee**	
Procedures	1,850		1,655	
Post-op destination				
Ward	1,666	90.2%	1,374	83.2%
Level 2 (HDU/PACU)	125	6.8%	157	9.5%
Level 3 (ICU)	55	3.0%	121	7.3%
	Median	**IQR**	**Median**	**IQR**
Days in level 2 critical care	2	1 to 4	3	1 to 5
Days in level 3 critical care	3	2 to 6	5	2 to 8
Overall length of stay (days)	22	14 to 38	23	14 to 37
Postoperative length of stay (days)	15	9 to 27	16	10 to 27
	Rate	**95% CI**	**Rate**	**95% CI**
Overall in-hospital mortality	5.9	4.8 to 7.0	10.0	8.6 to 11.6
30-day in-hospital mortality	4.4	3.5 to 5.5	8.4	7.1 to 9.9
Procedure complications				
Respiratory	5.9	4.9 to 7.1	9.6	8.2 to 11.1
Cardiac	3.5	2.7 to 4.4	5.6	4.6 to 6.8
Limb ischaemia	3.4	2.6 to 4.3	2.7	1.9 to 3.6
Renal failure	1.8	1.2 to 2.5	3.1	2.3 to 4.0
Surgical site infection	4.9	4.0 to 6.0	4.4	3.4 to 5.4
Postoperative confusion	2.5	1.8 to 3.3	2.4	1.7 to 3.3
Haemorrhage	0.2	0.1 to 0.5	0.5	0.2 to 1.0
Cerebral	0.4	0.2 to 0.8	0.5	0.2 to 1.0
No defined complications	74.2	72.1 to 76.1	70.1	67.8 to 72.3
Return to theatre	8.8	7.5 to 10.1	6.3	5.2 to 7.6
Re-admission to higher level care	2.3	1.7 to 3.1	2.4	1.7 to 3.2

Anaesthetic Type

Anaesthetic data showed 49.11% of procedures were done under GA alone, 17% were combined GA with LA/RA and 34.4% were under LA/RA alone.

The following table summarises the anaesthetic types for major amputations undertaken in 2022.

Type	N	%
GA only	1,726	49.1%
LA only	16	0.5%
GA + LA	149	4.2%
LA + Plexus/Compartment	10	0.3%
GA + LA + Plexus/Compartment	15	0.4%
LA + Plexus/Compartment + Spinal/Epidural	15	0.4%
LA + Spinal/Epidural	136	3.9%
GA + LA + Spinal/Epidural	7	0.2%
Plexus/Compartment only	70	2.0%
GA + Plexus/Compartment	287	8.2%
Plexus/Compartment + Spinal/Epidural	160	4.6%
GA + Plexus/Compartment + Spinal/Epidural	3	0.1%
Spinal/Epidural only	782	22.3%
GA + Spinal/Epidural	138	3.9%
TOTALS	**3,514**	

Recommendations:

- All patients undergoing elective major lower limb amputation should be admitted in a timely fashion to a recognised arterial centre with agreed protocols and timeframes for transfer from spoke sites and non-vascular units.
- Below knee amputations should be undertaken whenever appropriate.
- Vascular units should aim to have an above knee amputation to below knee amputation ratio below one.
- Major amputations should be undertaken on a planned operating list during normal working hours.
- A consultant surgeon should operate or at least be present in the theatre to supervise a senior trainee (ST4 or above) undertaking the amputation.
- The patient should have routine antibiotic and DVT prophylaxis according to local policy.

Commentary

This is the first National Vascular Registry State of the Nation report and aims to provide a summary of the care received by patients who had a major vascular procedure during 2022.

The report highlights several important aspects of vascular care within the UK.

Firstly, levels of activity continue to recover from the detrimental effect of the COVID-19 pandemic, with elective activity approaching the levels delivered in 2019. The excellent short-term outcomes after vascular procedures were also maintained. The times from vascular assessment to treatment have increased slightly for carotid endarterectomy and the elective repair of infra-renal AAA, although the picture is not uniform across the country.

A national focus for quality improvement over the last few years has been the 5-day target for revascularisation for emergency admissions with chronic limb threatening ischaemia (CLTI). Just over half of these patients underwent lower limb bypass or angioplasty within 5-days of admission in 2022, which is slightly down from the 55% achieved in 2021.

The rise in major lower limb amputations from 3,260 in 2019 to 3,430 in 2022 is of concern given the impact the loss of a limb has on patient well-being. It is unclear whether this is temporary or the start of a trend and requires further investigation to understand whether it reflects changes in the prevalence of disease or in clinical practice, including access to revascularisation.

The drop in the numbers of repairs for ruptured AAA is more encouraging. The postoperative mortality rate after open repair remains high, and there might be opportunities for greater use of endovascular repair. Its use is dependent upon patient stability and suitability but NICE [1] notes “EVAR provides more benefit than open surgical repair for most people, especially men over 70 and women of any age”.

The next year will see an evolution in the collection of NVR data as the NVR data collection system becomes integrated with the NHS England system for collecting data on implanted medical devices.