

National Vascular Registry

State of the Nation Report 2023

Results for patients who had vascular procedures during 2022 in NHS hospitals in England, Wales, Scotland and Northern Ireland



November 2023



Commissioned by:



1. Introduction

The National Vascular Registry (NVR) was established in 2013 to measure the quality and outcomes of care for adult patients who undergo major vascular procedures in NHS hospitals, and to support vascular services to improve the quality of care for these patients.

This State of the Nation report for 2023 publishes information on emergency (non-elective) and elective procedures for the following patient groups:

1. patients with peripheral arterial disease (PAD) who undergo either (a) lower limb angioplasty/stent, (b) lower limb bypass surgery, or (c) lower limb amputation
2. patients who have a repair procedure for abdominal aortic aneurysm (AAA)
3. patients who undergo carotid endarterectomy or carotid stenting.

It contains key findings of vascular procedures carried out in 2022 (some outcome measures use data from 2020-2022). The volumes of procedures undertaken in 2019 are included to show activity before the COVID-19 pandemic.

National guidelines underpin the management of patients with vascular conditions, and the NVR evaluates patterns of care against their recommendations. An

overall framework for vascular services is described by the “Provision of Services for People with Vascular Disease” published by the Vascular Society of Great Britain & Ireland. Additional standards originate from documents published by the National Institute for Health and Clinical Excellence (NICE), national screening guidance, and government documents.

The NVR uses a set of indicators derived from these documents and encourages vascular specialists to review the findings of this report and to understand why unwarranted differences exist.

There are additional supplementary materials that accompany this report available on the NVR website at: www.vsqip.org.uk. These include data tables containing individual NHS trust/health board results of the key NVR metrics, and a description of the audit methods. They also break the results down by UK country. The website also provides access to:

- links to resources that support local services’ quality improvement initiatives
- links to other sources of information about vascular conditions

How to read this report

Results are typically presented as totals and/or percentages, medians and interquartile ranges (IQR). In a few instances, the percentages do not add up exactly to 100%, which is due to the rounding up or down of the individual values. Unless otherwise stated, results are presented for all four UK nations. For clarity of presentation, the terms NHS trust or trusts and units have been used to describe both NHS trusts and Health Boards. A list of NHS vascular units for which results are published is available on the [VSQIP website](http://www.vsqip.org.uk), together with more details of the [audit methods](#). We have provided an [online glossary](#) to explain some of the more technical or medical terms used in this report. This report includes layers that work best in Adobe Reader. The default PDF readers for some internet browsers do not support these features, so please download the file and open in Adobe.

Recommendations

| NVR Key Recommendations for Quality Improvement | Audience | Results in 2022 | NVR benchmarking standard |
|---|---|--|--|
| <p>1) Ensure that patients with chronic limb threatening Ischaemia (CLTI) receive care as recommended in the VSGBI Quality Improvement Frameworks (QIF) for peripheral arterial disease and are treated with sufficient urgency:</p> <ul style="list-style-type: none"> aim for 60% of non-elective admitted patients to have a revascularisation procedure within 5 days, in keeping with the 2022-23 CQUIN (rising to 65% in the 2023-24 CQUIN). Please note that the CQUIN only applies in England. | NHS trusts / health boards and vascular specialists | <p>Median time: 5 days.</p> <p>51% of patients revascularised within 5 days.</p> | <p>Five days from admission to revascularisation procedure.</p> <p>NHS England CQUIN sets benchmark standards of 40% and 60% of patients to meet the 5 day target (rising to 45% and 65% in 2023-24) for patients in England.</p> |
| <p>2) Ensure that patients who have major lower limb amputation receive care as recommended in the VSGBI Quality Improvement Framework (QIF), and avoid long delays to surgery after vascular assessment. Below knee amputation should be performed whenever appropriate.</p> | NHS trusts / health boards and vascular specialists | <p>Median time from assessment to procedure for non-elective admissions was 8 days (IQR 3 to 20 days). Overall AKA:BKA ratio was 0.90. Six NHS trusts had a ratio above 2.</p> | <p>All patients undergoing major 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.</p> <p>Units should aim to have an above knee amputation to below knee amputation (AKA:BKA) ratio below one.</p> |
| <p>3) Ensure that pathways for patients with aortic aneurysms avoid undue delays, and make efforts to meet the recommended 8 week standard for elective repair of abdominal aortic aneurysms (AAA)</p> | NHS trusts / health boards and vascular specialists | <p>Median time: 87 days.</p> <p>Just 32% of patients treated within 8 weeks.</p> | <p>80% of patients to meet the 8 weeks (56 days) from assessment to elective AAA repair.</p> |
| <p>4) Commissioning of vascular units to perform FEVAR / BEVAR aortic procedures should be conditional on the unit submitting data on all such cases to the NVR so that activities and outcomes can be monitored. Vascular units should enter data on all TEVAR procedures on the NVR to support regional delivery of the Acute Aortic Dissection Toolkit.</p> | NHS England Specialist commissioning and NHS Wales | <p>In 2020-22, 40 trusts did FEVAR / BEVAR.</p> <p>38 trusts performed TEVAR.</p> | <p>All trusts should enter and submit their FEVAR / BEVAR aortic procedures and TEVAR procedures on the NVR, as there is no other source of data on these procedures.</p> |
| <p>5) Ensure timely referral and expedited surgery for patients with symptomatic carotid disease with measures to reduce waiting times to carotid endarterectomy (CEA)</p> | NHS trusts / health boards and vascular specialists | <p>Median time: 14 days. 52% of patients treated within 14 days.</p> | <p>Time from symptom to CEA should be within 14 days.</p> |

2. Lower limb revascularisation for peripheral arterial disease

Peripheral arterial disease (PAD) of the lower limbs causes a range of symptoms extending from lifestyle restrictions due to intermittent claudication, to potential limb loss because of limited blood flow in the lower limb arteries.

In 2022, NHS organisations submitted data to the NVR on over 14,000 revascularisation procedures of the lower limbs, 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 the patient characteristics is shown overleaf (Fig 2.1)

Chronic limb threatening ischaemia

Chronic limb-threatening ischaemia (CLTI) is the severest form of PAD, with patients often admitted in an emergency with either resting pain or necrosis / gangrene. The VSGBI Quality Improvement Framework (QIF) outlines key aspects of its management.

VSGBI: PAD QIF

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

During 2022, there were 4,487 patients with 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

This metric is also being reported by NHS England as part of a [vascular CQUIN](#).

Outcomes after revascularisation

For bypass / open procedures, the in-hospital postoperative mortality rates in 2022 were 1.4% for elective admissions and 4.6% for non-elective admissions. Over 75% of patients had no reported complications, and rates of readmission within 30-days were 10.0% for elective and 13.6% for non-elective patients.

All 69 NHS organisations had an adjusted postoperative in-hospital mortality rate that fell within the expected range given the volume of cases (3.0% for 3 years from 2020 to 2022).

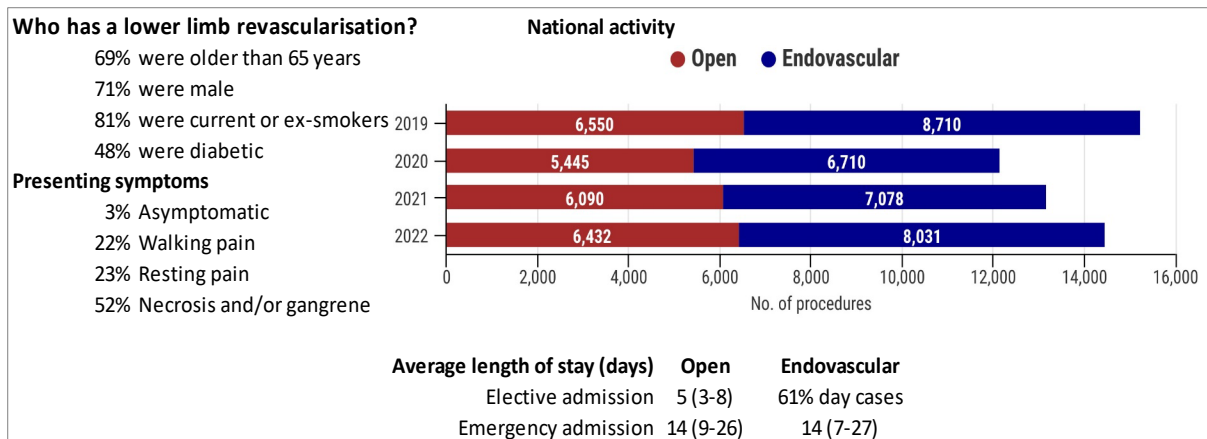
Outcomes after lower limb angioplasty / stents were good. In 2022, the in-hospital postoperative mortality rate was 0.6% for elective admissions and 4.2% for non-elective admissions. Rates of readmission within 30 days were 7.7% for elective and 16.8% for non-elective patients.

All 80 NHS organisations had an adjusted rate of postoperative in-hospital death that fell within the expected range of the national average (1.9% for 3 years from 2020 to 2022). The case ascertainment for angioplasty is rising. However the mortality rates for units that have low volumes should be interpreted with caution.

Click here for:
Fig 2.1: Patient details and
outcomes of care

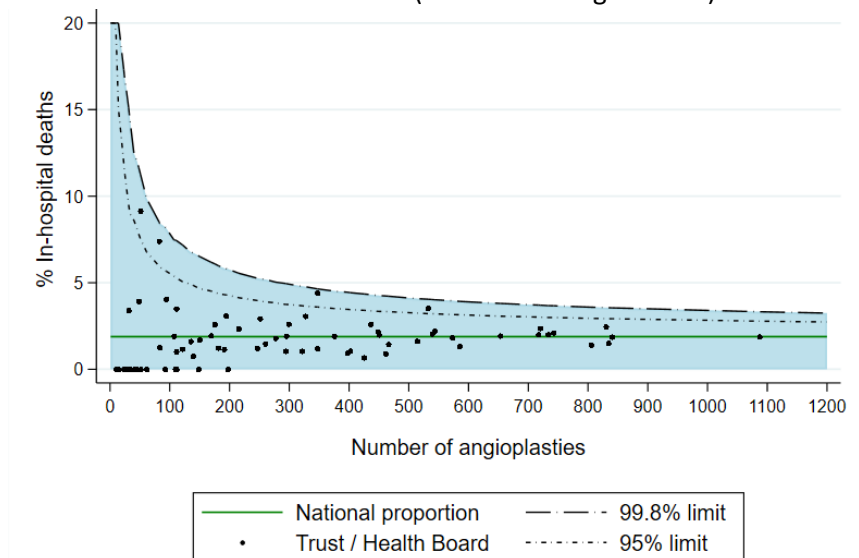
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Fig 2.2: Time from admission
to intervention

Figure: 2.1 Details of patients undergoing lower limb revascularisation procedures

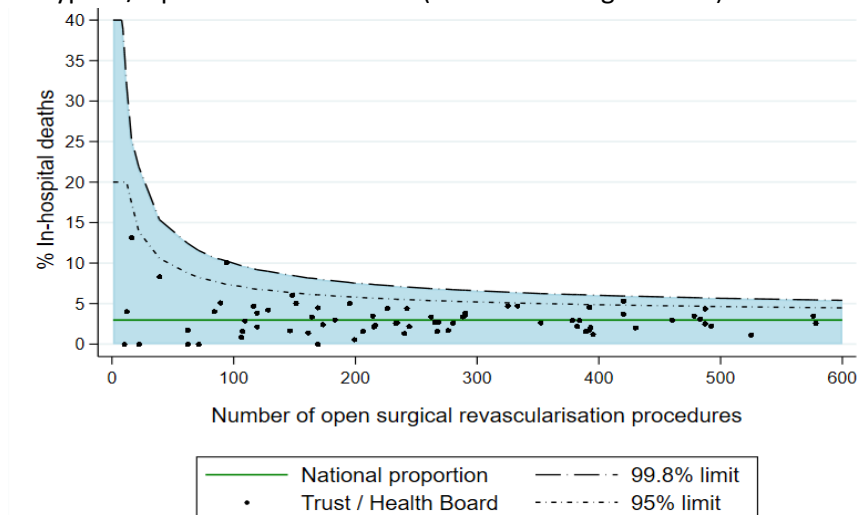


Risk-adjusted in-hospital deaths after lower limb revascularisation for NHS organisations from January 2020 to December 2022

A: Endovascular revascularisation (national average = 1.9%)



B: Bypass / open revascularisation (national average = 3.0%)



3. Major lower limb amputation

PAD can become sufficiently severe to mean that an operation to improve the blood flow is no longer possible and patients will require an amputation of a leg, either above or below the knee. People with diabetes even without PAD may require an amputation due to tissue damage with or without infection. This section focuses on major (above the level of the ankle) unilateral (one leg only) lower limb amputations that were primary procedures (first procedure in a hospital admission). We exclude bilateral amputations (amputations on both legs), amputation for trauma and amputations performed within 30 days of a lower limb revascularisation.

Through knee amputations (TKAs) only accounted for 3.7% of procedures, and as a result, they have been analysed as part of the BKA group.

During 2022, the NVR received details of 3,505 major lower limb amputations, giving a case ascertainment rate of 88%. The majority of patients who had a major amputation were admitted non-electively (84% non-elective vs 16% elective). There appears to be an increase in major amputation procedures in 2022 compared to previous years (Fig 3.1, overleaf). This will be monitored in future NVR reports.

VSGBI: Amputation QIF

All patients undergoing elective major lower limb amputation should be admitted in a timely fashion.

The overall median time from vascular assessment to major lower limb amputation was 10 days (IQR: 3 to 29 days). The time differed for patients who had amputations as elective procedures (median=37 days; IQR: 14 to 102) compared with patients who had the procedure following a non-elective admission (median=8 days; IQR: 3 to 20). Among patients admitted non-electively, there were 14 NHS organisations where a quarter of patients had a waited longer than 30 days.

VSGBI: Amputation QIF

Vascular units should aim to have an above knee amputation (AKA) to below knee amputation (BKA) ratio below one.

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.

VSGBI: Amputation QIF

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.

Overall, in 2022:

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

Outcomes after major amputation

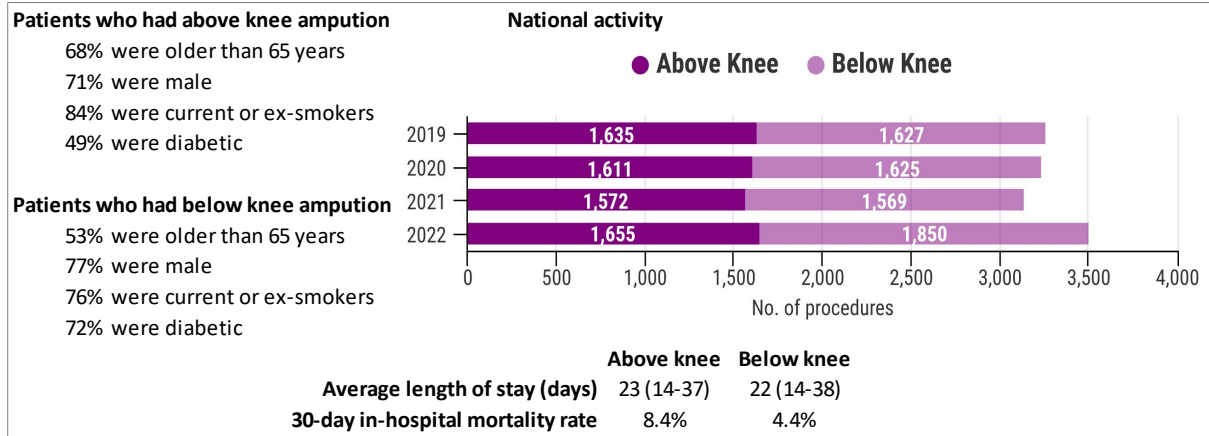
The overall rate of 30-day in-hospital death for major lower limb amputations in 2022 was 6.3%. As expected, it was higher for AKA (8.4%) than BKA (4.4%). Rates of readmission within 30 days were 9.5% for AKAs and 9.8% for BKAs.

All 68 NHS organisations had an adjusted 30-day in-hospital mortality rate that fell within the expected range of the overall 30-day in hospital mortality rate (6.5% for 3 years from 2020 to 2022).

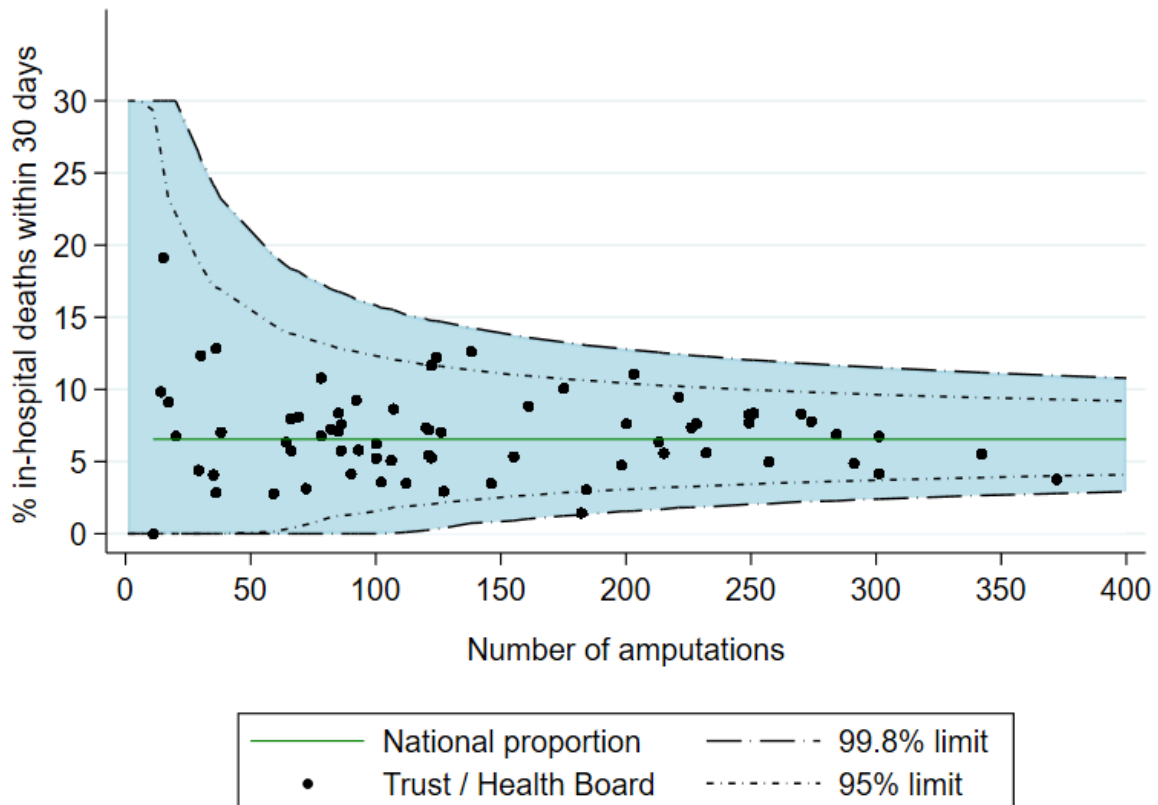
Click here for:
Fig 3.1: Patient details and
outcomes of care

Click here for:
Fig 3.2: AKA:BKA ratio by
NHS organisation

Fig 3.1: Summary of patients undergoing a major lower limb amputation



Risk-adjusted 30-day in-hospital death rate following major amputation for procedures undertaken during January 2020 and December 2022. National average for 3 years from 2020 to 2022 was 6.5%



4. Abdominal aortic aneurysms (AAA)

1) *Elective infra-renal AAA*

Aneurysms can develop in the aorta, most frequently below the arteries to the kidneys. These are known as infra-renal AAAs. 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 (Fig 4.2).

We now include endovascular iliac branched procedures in this infra-renal repair chapter. Consequently, the numbers are greater than stated in previous NVR Annual reports. Estimated case ascertainment in 2022 was 90%.

VSGBI: AAA QIF

All elective procedures should be reviewed preoperatively in an MDT that includes surgeon(s) and interventional radiologist(s) as a minimum.

All patients should undergo comprehensive preoperative assessment and risk scoring, as well as CT angiography to determine their suitability for EVAR.

All patients should be seen in pre-assessment by an anaesthetist with experience in elective vascular anaesthesia.

The Vascular Society AAA Quality Improvement Framework established a number of standards for preoperative assessment of patients undergoing AAA repair. In 2022, most patients treated in NHS vascular units received care consistent with the standards:

- 88% were discussed at MDT meetings
- 94% had preoperative CT/MR angiography
- 83% had documented formal fitness assessment tests.
- 97% had a formal anaesthetic review
 - 92% of these had review by consultant vascular anaesthetist.

VSGBI: AAA QIF

The National AAA Screening Programme (NAAASP) recommends a target of 8 weeks from the date of referral from the NAAASP to the date of repair. The Screening Programme states that NHS organisations should meet this standard for 80% of patients.

Across the 59 NHS vascular units performing elective repairs for infra-renal AAAs in 2022, the median time from assessment to procedure was 87 days, which is much longer than the 69 days in 2019. At three vascular units, a quarter of patients waited more than 240 days for their procedure in 2022. Overall, 32% of patients underwent repair within the recommended 8 weeks.

Outcomes after elective infra-renal AAA repair

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.

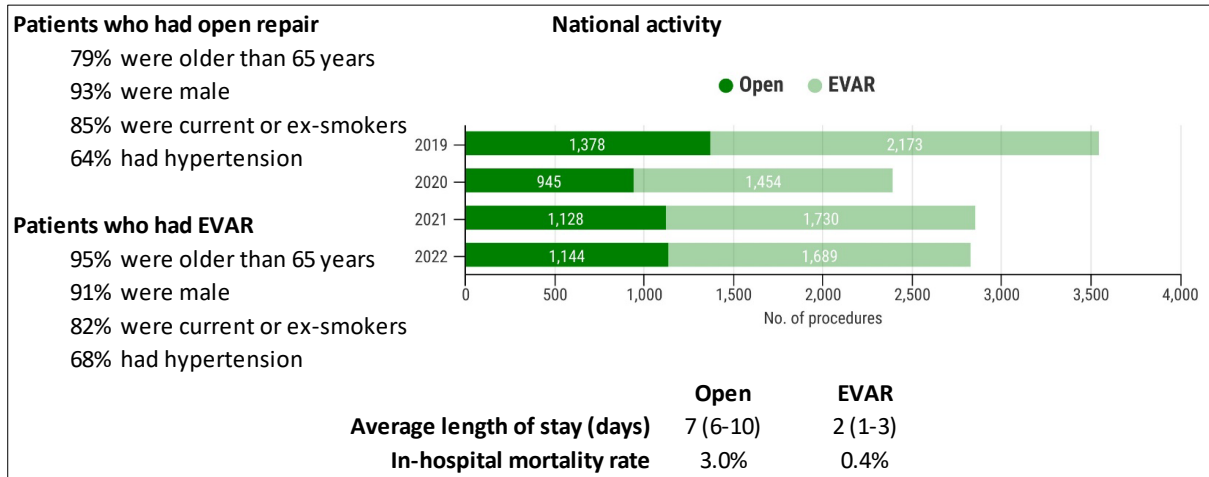
Between Jan 2020 to Dec 2022, the risk-adjusted in-hospital mortality rates for all 67 NHS vascular units were within the expected range of the national average of 1.4%.

Click here for:
 Fig 4.1: Summary and mortality after AAA repair

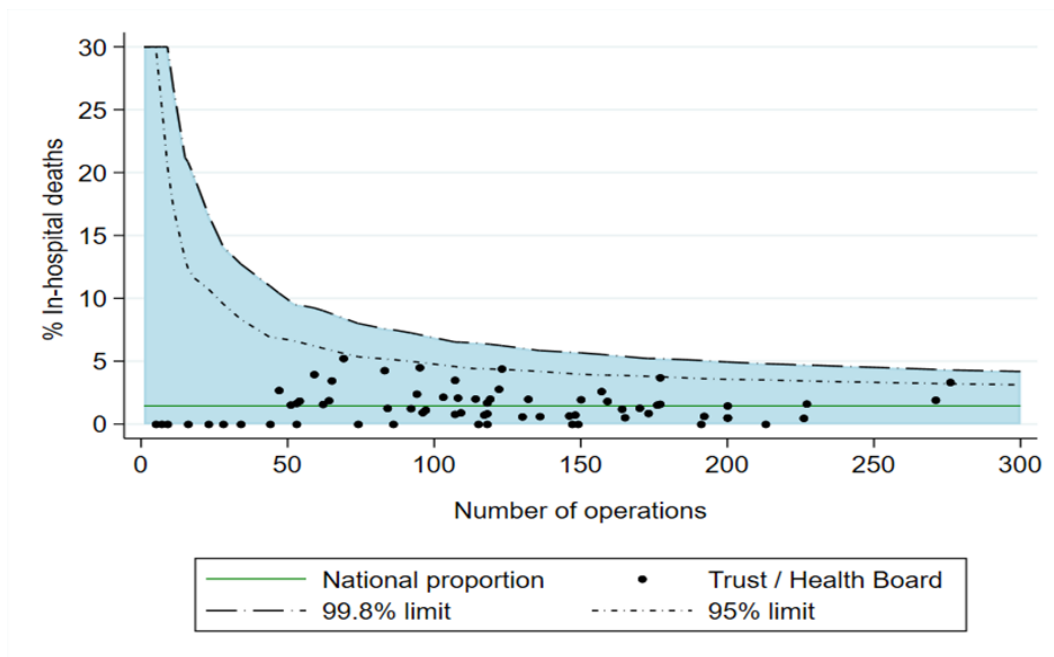
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 Fig 4.2: %EVAR by NHS organisation

Click here for:
 Fig 4.3 Time from assessment to intervention

Fig 4.1: Summary of patients undergoing elective infra-renal AAA repair



Risk-adjusted in-hospital mortality rates after elective infra-renal AAA repair among NHS vascular units (January 2020 - December 2022). Overall in-hospital mortality rate was 1.4%



2) Other elective repair of aortic conditions

A person can suffer from aortic aneurysms that occur above or around the arteries to the kidneys. It is now common to repair the aorta in these situations using endovascular procedures, although open repairs are still indicated in some situations. 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.

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 (Fig 4.4).

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.

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. Patients may present as an emergency admission and have a TEVAR with minimal delay; the condition may be less severe in some patients and be safely treated electively.

In 2020-22, there were 405 emergency and 394 elective TEVAR procedures performed by 38 UK vascular units (Fig 4.5).

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.

4) Repair of 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 (Fig 4.6). 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.

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%.

Fig 4.4: Summary of patients undergoing procedures for other elective aortic conditions

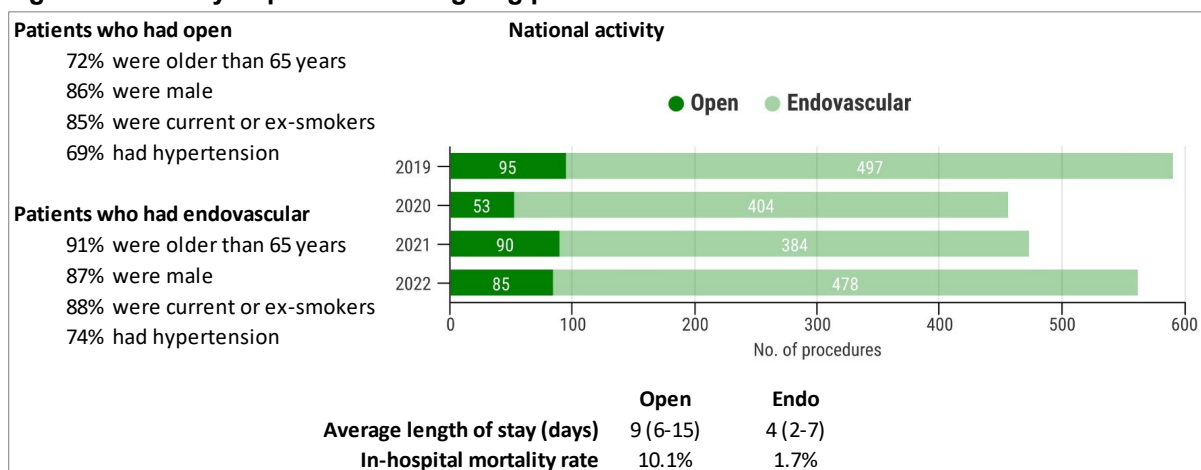


Fig 4.5 Summary of patients undergoing a repair of thoracic aortic conditions

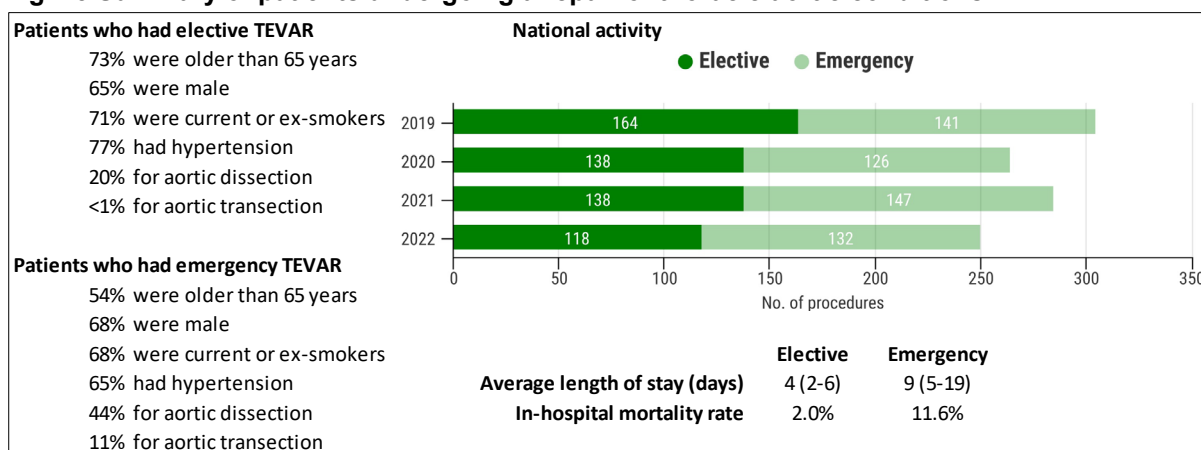
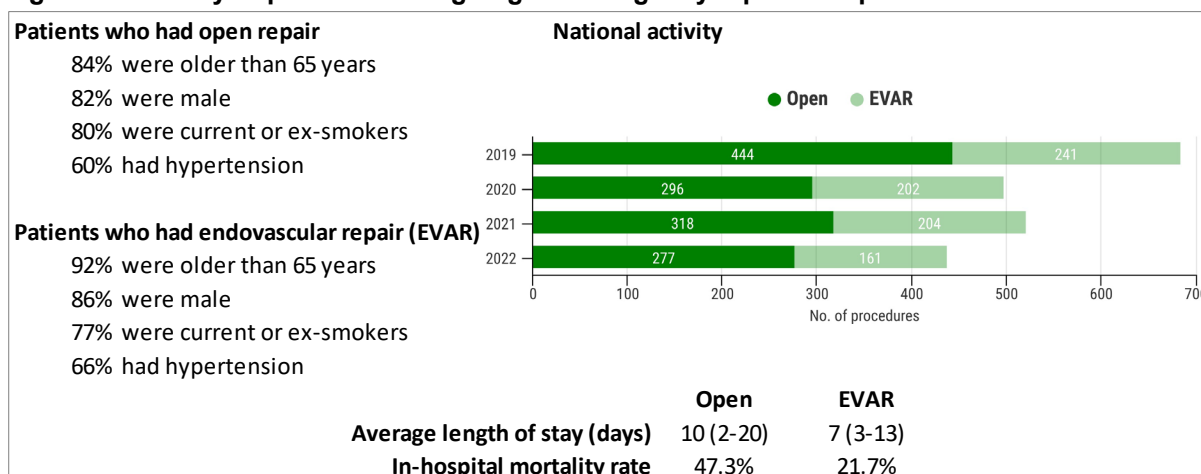


Fig 4.6: Summary of patients undergoing an emergency repair of ruptured AAA



5. Carotid endarterectomy

In the UK, around 3,000-3,500 patients undergo a carotid endarterectomy (CEA) each year to remove plaque that has built up within the carotid arteries (the main vessels that supply blood to the brain, head and neck).

In 2022, a total of 3,257 carotid endarterectomies (CEAs) were entered onto the NVR. The number of CEAs has decreased

markedly since 2011 when nearly 6,000 procedures were performed. A few vascular units also perform carotid stenting but this equates to only around 250 procedures annually. This section therefore focuses on carotid endarterectomies.

Estimated case ascertainment in 2022 was 92%.

NICE guideline NG128

The time from symptom to carotid surgery is recommended to be within 14 days to reduce the risk of patients developing a stroke.

Carotid endarterectomy aims to reduce the risk of stroke, and can be performed in patients who have recently experienced symptoms. It can also be performed in patients with no symptoms although the carotid arteries are partially blocked, but procedures for this circumstance have become less common in the UK. Symptomatic patients made up 95% of the CEAs performed in 2022.

For the three distinct phases from symptom to procedure, the median times in 2022 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.

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 (Fig 5.2). 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.

Outcomes after carotid endarterectomy

Among the 3,257 patients undergoing carotid endarterectomy in 2022, complication rates during the hospital admission remained low:

- 2.1% of patients died and/or had a stroke within 30 days (95% CI 1.6-2.6)
- 1.9% of patients had a cranial nerve injury during their admission (95% CI 1.4-2.4).

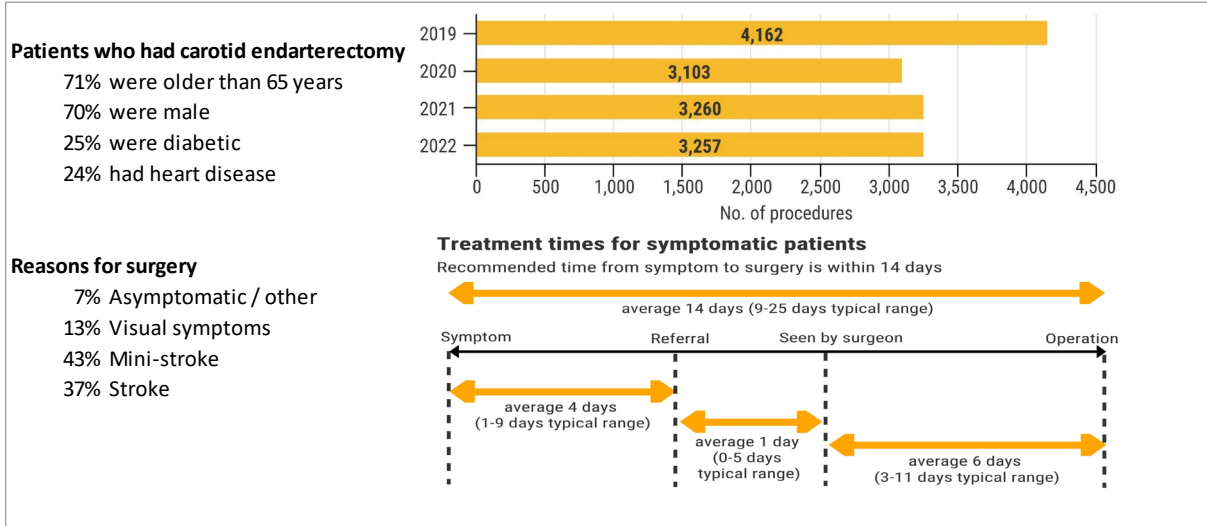
The rate of readmission within 30 days was 4.5%. The average length of stay was 2 days (IQR: 1-4 days).

For procedures performed between 2020 and 2022, all 67 NHS organisations had an adjusted 30-day mortality / stroke rate after surgery within the expected range of the national average (2.2%), given the number of procedures performed at that organisation (Fig 5.1).

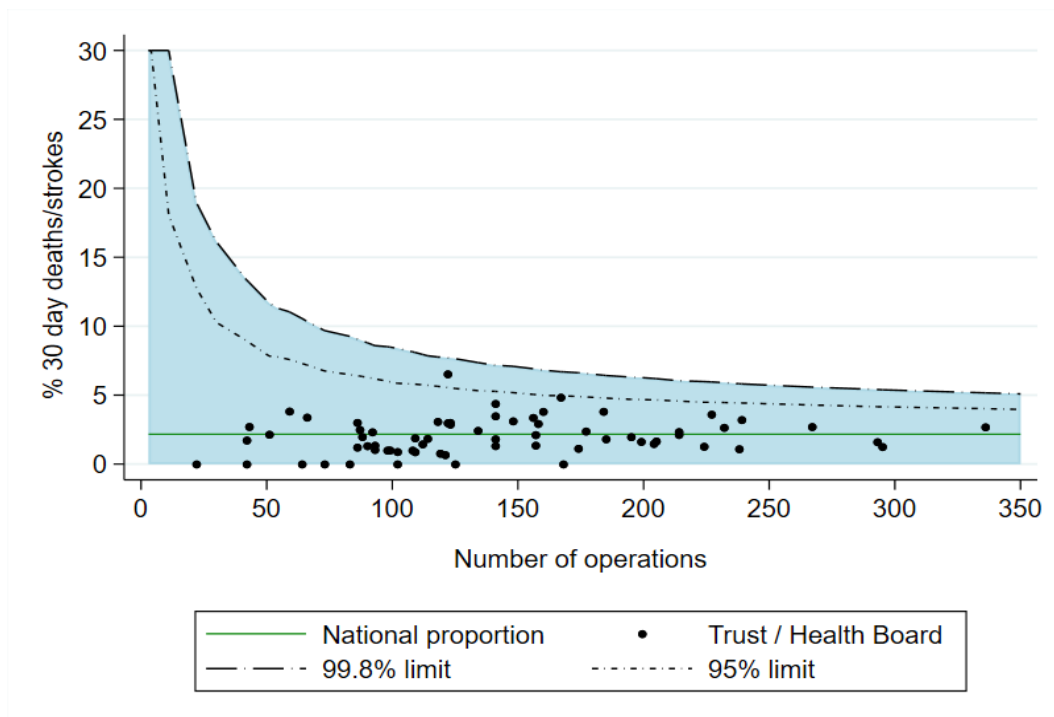
Click here for:
 Fig 5.1: Summary and 30-day stroke / mortality after CEA

Click here for:
 Fig 5.2: Time from symptom to intervention

Fig 5.1: Summary of patients undergoing carotid endarterectomy



Funnel plot of risk-adjusted rates of stroke/death within 30 days for NHS organisations, for carotid endarterectomies between January 2020 and December 2022. The national average for this period was 2.2%



6. Commentary

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

The report highlights a number of 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. This is a tribute to colleagues and vascular services. The excellent short-term outcomes after vascular procedures were also maintained. The effects have not all dissipated, however. 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. The reasons for this are likely to differ between NHS vascular units, especially with all hospitals experiencing service pressures and NHS waiting lists at a record high.

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. In England, this target became a CQUIN measure for 2022-2023 (which was adopted again for 2023-24). We expect performance on the “5-day target” to improve in response to this and the continued work by the VSGBI and BSIR to implement the PAD Quality Improvement Framework (PAD-QIF). We are encouraged by the greater numbers of angioplasty procedures entered on the NVR in 2022.

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. The NVR initiated the collection of data on devices implanted during AAA repair procedures and we expect this facility will be extended to other procedures in the coming year. The collection of device information is simplified by hospital operating theatres / IR procedure rooms having facilities for scanning the barcodes of medical devices into the computer system. To maintain the excellent levels of case-ascertainment, and high-quality of completion of data items, we encourage vascular units to ensure bar code scanners are available in operating suites. We also encourage NHS organisations to review the quality of data entered on ‘Hybrid’ lower limb revascularisation procedures and the repair of (complex) aortic aneurysms and aortic dissection.

[1] NICE. Abdominal aortic aneurysm: diagnosis and management. NICE guideline [NG156]; 19 March 2020. <https://www.nice.org.uk/guidance/ng156/chapter/recommendations>

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The RCSEng managed the publication of the 2023 State of the Nation Report.



The Vascular Society of Great Britain and Ireland is the specialist society that represents vascular surgeons. It is one of the key partners leading the audit. Registered charity no: 1102769



The British Society of Interventional Radiology is the specialist society that represents interventional radiologists. It is again, one of the key partners leading the audit. Registered charity no: 1084852

Commissioned by



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