

National Kidney Care Audit Vascular Access Report 2010



Prepared in partnership with:



The Healthcare Quality Improvement Partnership (HQIP) promotes quality in healthcare. HQIP holds commissioning and funding responsibility for the National Kidney Care Audit and other national clinical audits.



The NHS Information Centre for Health and Social Care (The NHS IC) is England's central authoritative source of essential data and statistical information for frontline decision makers in health and social care. The NHS IC managed the publication of the 2010 Report.



The UK Renal Registry (UKRR) was established by the Renal Association with support from the Department of Health, the British Association of Paediatric Nephrologists, and the British Transplant Society as a resource for the development of patient care in renal disease. The Registry provides a focus for the collection and analysis of standardised data relating to the incidence, clinical management and outcome of renal disease.



The National Kidney Federation (NKF) is the only national kidney charity actually run by "Kidney Patients for Kidney Patients". The NKF has a major role in campaigning for improvements to renal provision and treatment, and national patient support services.

National Kidney Care Audit Vascular Access Report 2010

Reporting on the 2009
incident patients

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Foreword

Dr Donal O'Donoghue
National Clinical Director
for Kidney Care



Quality means different things to different people. In healthcare it means people and populations having the best possible experience of care and optimal individual outcomes. It also means efficiency and effectiveness because resources, be they people, money or time, are limited. *Equity and excellence: liberating the NHS*, the coalition Government's White Paper on health published in July 2010 puts quality centre stage: "quality is the only organising principle of the NHS".

What does this mean for people with kidney disease? Well for those with advanced chronic kidney disease it means good preparation and choice. For that the individual needs to be well informed, their views, values and aspirations need to shape the decisions. Patient choice is central to high quality care. Good outcomes need involved patients and well organised services as well as time for discussions to enable shared decision making. Decisions about dialysis must involve discussion about all options for dialysis, transplantation and conservative kidney care. Not everyone is suitable for transplantation but when people aren't or the risks are high, that needs to be explained and discussed with the patient. The reasons should be clearly written in the patient's record. Similarly, the conservative kidney care or "no dialysis option" needs to be available to everyone and a significant minority now choose this option.

When dialysis is chosen a whole range of other questions arise. Home or hospital? Peritoneal or haemo dialysis? When the patient's choice is haemodialysis, planning needs to begin and this includes type of access as well as regime and location of treatment. The simple most important modifiable variable for those starting haemodialysis is successful creation of arteriovenous fistula. A good fistula can literally mean the

difference between life and death, can be crucial for home haemodialysis and should ensure a smooth start to dialysis as an outpatient.

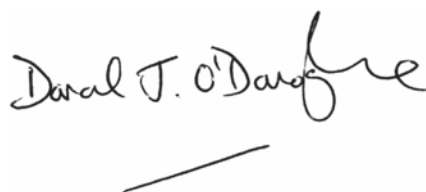
So for most people choosing haemodialysis the safe, timely and efficient creation of an effective Arteriovenous fistula is a key quality indicator. For those who start dialysis as an emergency we need accelerated procedures to ensure equity of counselling and support so they have the options and choice including type of access when haemodialysis is preferred.

Few people are totally unconcerned about needling, some are quite apprehensive and some have needle phobia. Peer support from other patients, encouragement from skilled staff and occasionally psychological therapies can help reduce this normal apprehension. Patient choice is very rarely a reason to provide dialysis through a central line. But there can be technical reasons why a fistula or even a graft is not possible. For people who need dialysis through a line a zero tolerance approach to infection is a must. MRSA and other blood stream infections in haemodialysis patients have fallen dramatically over the last few years. We need to remain vigilant about infection. Patients in whom successful fistula formation will not be achieved should not be subjected to futile operations. This requires clinical judgement and leadership. The reasons why fistula formation is not possible should be clearly explained to the patient and exception reported in the notes.

This audit has only been possible because of the hard work of the central team, the leadership of Dr Richard Fluck, the support of the Renal Registry and the importance individual clinical units place on vascular access as a marker of high quality care. It shows significant variance – that should cause local teams to pause and consider how they can do better. Resources are limited, they need to be used well, and in some units they may need augmenting. Ambition should not be limited.

I see this audit as a start, in time we will need to collect different things. We know that experience and outcomes are dependent on team working, unit culture and individual behaviours. The importance of preparation and choice is here to stay.

Vascular access is important in its own right but it is also a measure of preparation, patient engagement and can also be the driver for improvement in choice of renal replacement therapy or conservative kidney care.

A handwritten signature in black ink that reads "Donal J. O'Donoghue". Below the signature is a single horizontal line.

Dr Damian Fogarty

Consultant / Senior Lecturer Belfast Trust / QUB
Chairman, UK Renal Registry



On behalf of the UK Renal Registry and the centres whose data we handle I am pleased to add my support and comments to this report. All members of the renal team are aware of the importance of good vascular access so the following comments reflect on some operational aspects of this audit and its future vision.

First, the Registry would like to thank all the clinical and non-clinical staff in each of the 11 units who helped gather this information. We are well aware of the burden of gathering information, especially if duplication of medical record keeping has been required for this audit. Although we have tried to collect data from the existing renal information systems, this approach was not always easy or feasible. This is the first lesson we can all learn from this audit. Our long-standing commitment is to make registry data collection fit, as seamlessly as possible, with existing systems thus allowing staff time to focus on patients and quality improvement lessons. As we capture additional non-numeric data, we recognise that this will be more complex for centres, not least as the investment in electronic patient records did not materialize as anticipated 5-10 years ago. In the current

climate, we need to focus on linkage between existing systems and better data sharing – perhaps ‘record once and share’ should be our new audit mantra.

This vascular access audit has highlighted different AVF rates across renal centres in England, Wales and Northern Ireland. Understanding the basis of that variation is the next step but this will require new information based on what we call centre level data namely how vascular access processes are organised within a unit. Understanding the role of both patient case-mix and disparate centre processes will allow units to identify modifiable factors to help improve their local situation.

The new tariff for haemodialysis in England will preferentially reward AVF based therapy and data included in this report can ensure that the incentives are pitched appropriately and recognise centres with larger proportions of older and/or sicker patients who may not achieve the same AVF success rate as other patient groups. In acknowledging this, most colleagues would recognise the scope for improvement lies not in this but in the complex pathway that ‘moves’ a pre-dialysis patient from a medical clinic to a surgical clinic to the operating theatre and back to the renal unit and dialysis as required.

In the early years of the Registry, the numbers and demographics of RRT patients coupled with laboratory data formed the bulk of collected audit information. We need now to capture more information regarding differences between patients (diagnostic codes, ethnic and socio-economic factors, referral and timeline data etc) coupled with differences between centres (staffing, funding, processes etc). It has been proposed that in 2011 centre level data is collected about the vascular access systems spanning the patient care pathway. Further consultation and input is needed on this area and as ever your advice and support will be essential to the registry in helping you help our patients.

A handwritten signature in black ink that reads "Damian Fogarty". The signature is written in a cursive, flowing style.

Acknowledgements

Marion Higgins

Patient Representative



As a member of the National Kidney Care Audit Board I am delighted to comment on this exciting report.

My own fistula is now almost eleven years old and is my highly valued lifeline. When I started my life on dialysis it was on peritoneal dialysis (PD) and when this failed to be effective I had no choice but to turn to haemodialysis and because this was unplanned, it meant dialysing with lines. It was traumatic for me at first but it kept me alive. I was so relieved therefore, when, at a third attempt, my last fistula finally worked. After this the quality of dialysis improved considerably and with that, my quality of life.

For the first time, we have been able to capture the data surrounding vascular access and monitor where the failings lie, including the infections caused by long-term dialysis with lines.

This report will be a tool for the future to accelerate improvement leading to enhanced, quality patient care.

Marion Higgins

The National Kidney Care Audit is commissioned by the Healthcare Quality Improvement Partnership (HQIP). The Audit is managed by The NHS Information Centre for Health and Social Care (The NHS IC), who are working in partnership with the National Kidney Federation and the UK Renal Registry.

There are 2 distinct areas of audit; the provision of timely and appropriate surgery for permanent vascular access and patient transport for haemodialysis patients.

Throughout the development of the Audit we have had invaluable support from patients and their representatives, clinical staff and allied health professionals, IT and operational staff within renal units and The NHS IC. We acknowledge how vital their input has been into ensuring that the Audit has been successful.

In particular, we would like to express thanks to the early adopter units, the system suppliers, and the UK Renal Registry, who have made this aspect of the Audit possible through their support and hard work.

Our thanks also go to the vascular access clinical lead, Dr Richard Fluck, who has written this report.

Introduction

Background

For a patient requiring long-term haemodialysis (HD) for established renal failure, vascular access is a crucial aspect of the therapy. Vascular access (VA) is required to remove and return blood to the patient, passing the blood through an artificial kidney or filter. Most patients have their treatment three times a week for four hours or more.

Types of vascular access for haemodialysis

The ideal form of VA should be safe and efficient. It should be easy to use. It should provide effective therapy. It should minimise the risk of complications related to its use and presence. There are three broad categories of VA in use today.

1. Arteriovenous fistula (AVF) (Lawton and Gulesserian 1969): an artery and vein, usually in the arm above or below the elbow, are surgically joined, to create a fistula so that arterial pressure eventually enlarges the vein. The enlarged vein can then accommodate a cannula or large needle, so that blood may be removed and passed through an artificial kidney.

2. Arteriovenous graft (AVG) (Baker, Johnson et al. 1976): an artery and vein are joined surgically, using an artificial graft, usually Polytetrafluoroethylene (PTFE). The graft material itself is then used for the placement of cannulae or needles.
3. Venous catheters: a large plastic tube (catheter) is placed into a large vein, allowing a connection to be made to the dialysis circuit. The tube itself may be either passing directly from the vein through the skin to outside (non-tunnelled, NTC) or exit the vein, pass under the skin through a tunnel and then out (tunnelled, TC).

The risk related to access

Whilst none of these fully meet the desired criteria it is recognised that an arteriovenous fistula (AVF) offers the best form of VA. An AVF has a lower risk of infection due to the lack of non-biological material and the absence of an external device. An AVF also has a longer useable lifetime and requires fewer interventions. However, it does require prior planning, surgery and time for the fistula to develop.

Figure 1
An arteriovenous fistula

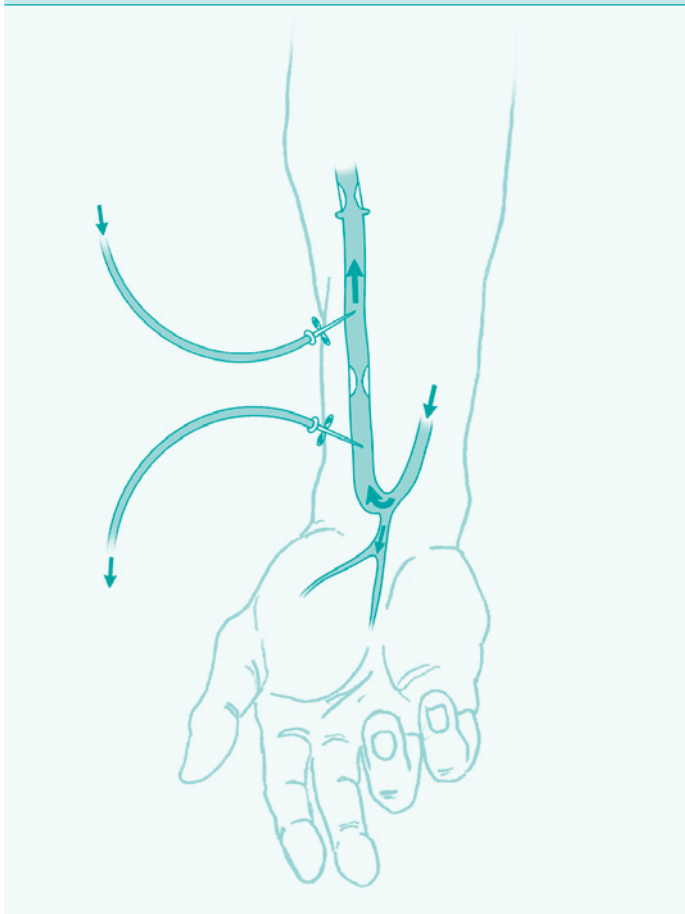
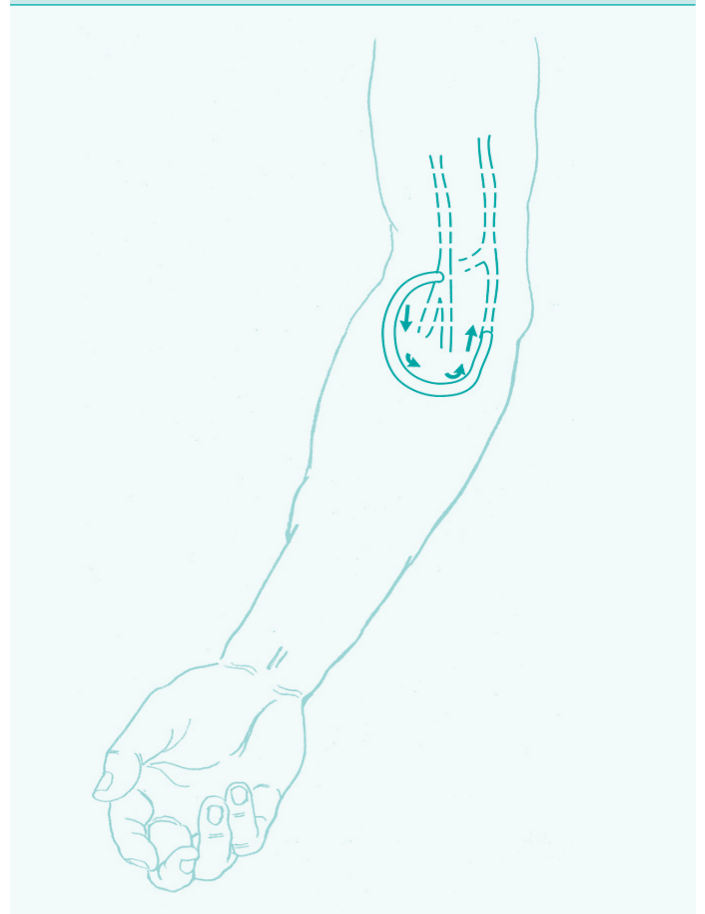


Figure 2
An arteriovenous graft



In some individuals, the blood vessels will not be suitable for the surgery. Consequently TC and NTC are often used when an AVF cannot be formed in time or when it is not possible. Both TC and NTC are a risk factor for infection, with considerably higher rates than an AVF (Rehman, Schmidt et al. 2009). Since infection is the second leading cause of death (Ansell, Roderick et al. 2009) and an important cause of morbidity for patients needing HD, it is critical to offer the best VA for all individuals who need long-term HD. Infection directly leads to death, but may also have a role in the excess of cardiovascular mortality seen in this patient population (Ishani, Collins et al. 2005).

Current UK situation

Within the United Kingdom, it is known that the proportion of patients with an AVF falls short of the Renal Association standards.

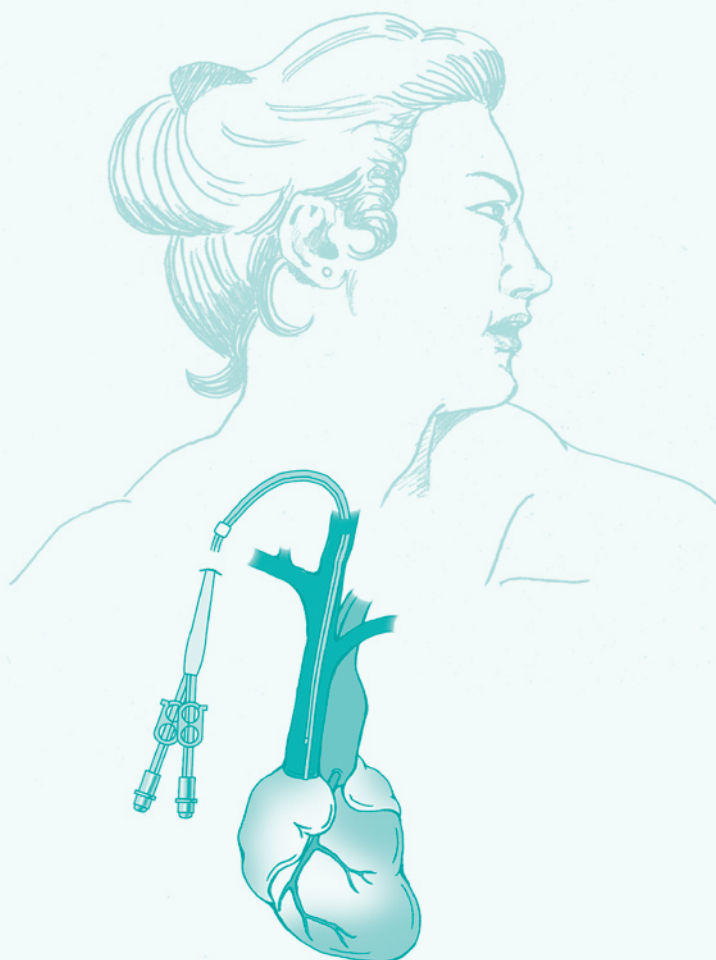
The Third Edition of the Renal Association (RA) guidelines (2002 available at www.renal.org) made the following four recommendations concerning VA:

- At least 67 per cent of patients presenting within three months of dialysis should start HD with a usable native arteriovenous fistula. (Good practice)
- At least 80 per cent of prevalent HD patients should be dialysed using a native arteriovenous fistula. (Good practice)
- No patient already requiring dialysis should wait more than four weeks for fistula construction including those who present late. (Good practice)
- All dialysis units should collect data on infections related to dialysis catheters and polytetrafluoroethylene (PTFE) grafts to allow internal audit. (Good practice)

The National Service Framework (National Service Framework for Renal Services: Part One – Dialysis and transplantation, 2004, DH (England) www.dh.gov.uk/renal) confirmed the importance of vascular access, stating in standard three the aim was:

“To improve the outcomes of permanent vascular or peritoneal dialysis access surgery, minimise complications and maximise the longevity of the access.”

Figure 3
A venous catheter



In the Eighth Annual Report from the Renal Registry (2005) data from the first vascular access survey was presented. In Chapter 6: The National Dialysis Access Survey – preliminary results, the overall provision of vascular access was shown to be below the Renal Association (RA) standard (67 per cent of all HD patients had either an AVF or AVG), with considerable variation between units (range 44–94 per cent). Of the 62 units that provided data, only 10 units achieved the RA standard.

For patients starting dialysis, the same survey found that only 31 per cent of those starting on HD did so with an AVF or AVG. Of those known to the renal units for a year or more, only half started HD with definitive access. For patients known to the renal units more than six months before starting Renal Replacement Therapy (RRT), only 13 per cent were not referred for access within six months of first RRT, suggesting planning or capacity issues for surgery. One year later, a repeat survey (Fluck, Rao et al. 2007) found that at one year 30 per cent of patients were still on dialysis with a TC.

Infection risk also remains high (Albers 1996; Butterly and Schwab 2000; Berman, Johnson et al. 2004) and remains an international concern in the treatment of end stage renal failure. Mandatory MRSA bacteraemia (MRSAB) reporting in England has been enhanced with additional reporting on dialysis related items. In 2007/8 188 episodes of MRSAB were reported in dialysis patients (Fluck, Wilson et al. 2009). This represented 4.2 per cent of all reported MRSAB, with dialysis patients having a 100 times higher risk compared to the general population. For an HD patient using a TC this risk was elevated 8 fold, to 800 times higher.

The overall picture is one of poor rates for patients starting haemodialysis, slow processes to provide an individual with the best available vascular access and a high risk of complications related to VA. Therefore the National Kidney Care Audit has been designed to measure and audit the provision of vascular access in the United Kingdom.

Data Flow

The Vascular Access element of the National Kidney Care Audit is run through partnership between The NHS Information Centre and the UK Renal Registry (UKRR). The UKRR has a longstanding history of collecting data from renal units, and has been one of the key partners in the development of the National Renal Dataset (NRD).

The NRD extends the existing data collections of the UK Renal Registry, UK Transplant and the British Association of Paediatric Nephrologists, and the data collection and submission of the NRD is being included within these existing collection mechanisms.

While the National Kidney Care Audit and the National Renal Dataset are separate projects, a number of the data items required for the Vascular Access audit are drawn from the NRD. As the UKRR is responsible for the collection of these elements of the NRD, this marks one of the distinct data flows present in the Audit.

These data items cover the basic demographic information about the patients, and a number of key facts about each patient's treatment. These include:

1. the date the patient was first seen by a renal physician
2. the date renal replacement therapy began
3. the date of the first haemodialysis session
4. the type of access used for the first dialysis session
5. details about each access construction, such as the date of referral for construction, the date the construction took place, and the type of access constructed.

In order to address the key audit measures, data also flows into The NHS IC from other sources.

Data about hospital episodes is required to investigate the number of operations and interventions patients undergo, and the amount of time spent in hospital. Each of the home countries maintains its own hospital episodes database, containing essentially the same data. Hospital episode records that match the patient details provided by the UKRR are being extracted from these databases.

The third data flow comes from the Health Protection Agency (HPA). The HPA routinely collects data on Healthcare Associated Infections (HCAIs). One of the aims of the Audit is to investigate the hospital-acquired infection rates amongst haemodialysis patients. To this end, data is being extracted from the HPA's databases that relates to the patients whose details have come from the UKRR. This data flow will be included in the 2011 report.

Permission

The processing and linking together of these separate data streams takes place at The NHS IC. A bespoke processing system and database has been developed to automate these tasks as each batch of data comes in during the rolling audit.

To be able to perform such linking, and associated activities such as validating or tracing NHS numbers, it is necessary to collect and hold patient identifiable information. The Ethics and Confidentiality Committee of the National Information Governance Board for Health and Social Care oversees and advises on matters relating to the processing of health or social care information. In particular it can grant approval, where warranted, for the collection of patient identifiable data in specific circumstances where anonymised data is not sufficient.

The National Kidney Care Audit has been granted approval under Section 251 of the NHS Act 2006 to collect and hold the required items for the purposes of the Audit.

Implementation

As mentioned above, the UKRR is responsible for the collection of a portion of the NRD, through augmenting its longstanding quarterly data collections. To this end the Registry have published a dataset specification that covers the relevant items in the NRD.

Renal units extract data from their clinical systems and submit data to the Registry on a quarterly basis. With the introduction of a new specification there is inevitably a lead time between publication and the clinical systems being compliant.

There are a number of different clinical systems in use in renal units in England, Northern Ireland and Wales:

- Proton
- eMed
- Clinical Vision
- RenalPlus
- VitalData
- CyberREN

There are also systems provided by Baxter and Fresenius, as well as bespoke systems and those maintained in-house.

The system suppliers each have their own development processes and timescales for becoming compliant with version 3.14 of the UKRR specification (the first to cover the NRD items). This naturally leads to a phased rollout, with different units being able to participate in the Audit as their clinical systems become capable of submitting the appropriate data to the Registry.

There is also an overhead for the staff at the renal units. Many renal units already collect much of the NRD, but not necessarily in their clinical system. The staff need to identify which items they do not currently collect, and also those that they perhaps collect in alternative systems, such as in spreadsheets.

In some cases these items will already be in the clinical system, and once the system supplier has upgraded the extract routine that compiles the UKRR submission the unit is able to contribute to the Audit. Units that currently collect the items in an alternative system will need to slightly adapt their processes so they record the items in their updated clinical system. Some units will need to look at how they can collect the relevant data items as part of their standard processes.

Chapter 2 Data Quality

Overview

Renal centres within England and Wales took part in the data collection for vascular access, and are listed in Table 1. For 2009, information on patients commencing dialysis had data extracted from information systems and passed to the renal registry. A variety of systems were utilized by the centres and are also detailed in Table 1. Eleven centres provided details on 738 patients who commenced haemodialysis during 2009.

Five key data items were extracted from renal unit information systems as follows:

- 1) NHS number – required to identify the individual patient within the database and to link vascular access items with other databases (eg HES).
- 2) Type of access at first dialysis – the type of vascular access at the first haemodialysis treatment undertaken by a patient. Vascular access was coded as either an arteriovenous fistula (AVF), arteriovenous graft (AVG), tunnelled venous catheter (TC) or non-tunnelled venous catheter (NTC).
- 3) Date the patient first saw a specialist in renal medicine – the date on which a patient who commenced haemodialysis first saw a clinician specialising in renal medicine (either as an in patient or an out patient).
- 4) Date on which the patient commenced dialysis.
- 5) The estimated glomerular filtration rate prior to commencing dialysis.

Data were also requested on access procedures. This related to dates and types of procedure undertaken to provide patients with vascular access.

Results of data quality

The principle aim of the Audit was to determine the proportion of individuals commencing dialysis with either an arteriovenous fistula or with an arteriovenous graft (access at first dialysis). Measures of process were to include data on when people were first seen by a renal specialist (date when first seen and eGFR) and assess the impact of referral patterns. Finally, the NHS number was crucial to allow linkage of this database with the complication data.

Table 2 summarises the proportion of complete data for each of those items.

NHS number

The rate of availability of the NHS number was at 96 per cent (711/738). Two of the smaller returning centres returned no NHS numbers with only 1 other patient item missing.

Access at first dialysis

As the principle audit measure for the project, access at first haemodialysis session was a key data item. Only 417/738 patients had a documented access type at first dialysis, representing 57 per cent of the total. Five centres had returns of less than 50 per cent, covering 307 patients. The largest reporting centre (Leicester General Hospital) reported on only 2 out of 165 patients. Two centres returned 100 per cent (Birmingham Heartlands and Royal Free Hospital).

Date the patient first saw a specialist in renal medicine

Overall, 429 patients had the date of first contact returned, with two centres (Derby and Middlesbrough) returning on all reported patients. Four centres returned less than 50 per cent.

Table 1
Participating centres and IT systems in use at time of data extraction.

Unit Name	Total Patients	Software
Birmingham – Heartlands Hospital	65	PROTON
Bradford – St Luke’s Hospital	7	PROTON
Bristol – Southmead Hospital	159	PROTON
Derby City General Hospital	45	VitalData
Dorchester – Dorset County Hospital	40	Emed
Leicester General Hospital	165	PROTON
London – Royal Free Hospital	116	In House
Middlesbrough – The James Cook University Hospital	5	PROTON
Plymouth – Derriford Hospital	15	PROTON
Swansea – Morriston Hospital	90	VitalData
Truro – Royal Cornwall Hospital, Treliske	31	PROTON

Estimated GFR prior to commencing dialysis

Again, returns were variable. Overall 536/738 (73 per cent) had a documented eGFR returned. Middlesbrough and the Royal Free Hospital, London had a 100 per cent return. Only one centre returned under 50 per cent. There was also uncertainty as to when in relation to the start of dialysis the eGFR result pertained to, due to different interpretations within extraction routines.

Access constructions

A separate extract identified the number of access constructions for the identified patients. This access construction could represent a formal surgical procedure (eg the formation of an arteriovenous fistula) or the placement of a venous catheter (tunnelled or non-tunnelled). Table 3 identified the number of access procedures by centre and a ratio of patients to access procedures. Overall 1319 procedures were recorded for a ratio of 1.8 procedures per patient. Only one centre had a reported ratio of less than 1, with a range of 0.5-2.4 and a median of 1.7.

Discussion

Overall, the reporting rate was low with, crucially, the rate of return for access at first dialysis reported in less than 60 per cent of patients. There was wide variation in the reporting rate between centres, particularly for this item. Five out of eleven centres reported less than 50 per cent of patient access.

There was also variation in reporting within centres. Only one centre consistently reported at a high rate for all the data items. Interestingly, this was the only centre using an in house system, with a purpose built extract to a data file. All other centres used commercial systems.

Three centres had low levels of patient numbers, suggesting under reporting of patients commencing haemodialysis. There are a number of reasons for this including the lack of a uniform process for data entry by the surgical/kidney team and possibly for some systems a problem with data extraction routines for all incident patients. Further analysis and discussion with the submitting units is required to understand these problems.

Table 2
Data completeness

Unit Name	Number of individual patients reported by centre	Number of NHS numbers to identify patients		Record of type of vascular access used at first dialysis		Date on which patient first saw nephrology service		eGFR reported at access referral or construction	
		Present	%	Present	%	Present	%	Present	%
Birmingham – Heartlands Hospital	65	65	100	65	100	0	0	40	61
Bradford – St Luke's Hospital	7	0	0	0	0	5	71	4	57
Bristol	159	158	99	124	78	97	61	126	79
Derby	45	45	100	39	87	45	100	24	53
Dorchester	40	40	100	17	43	35	88	0	0
Leicester	165	165	100	2	1	138	83	134	81
Middlesbrough	5	5	100	0	0	5	100	5	100
Plymouth	15	0	0	10	67	0	0	10	67
Royal Free Hospital	116	112	97	116	100	96	83	116	100
Swansea	90	90	100	24	27	0	0	59	66
Truro	31	31	100	20	64	8	26	18	58
Total	738	711	96	417	57	429	58	536	73

Table 3
Access procedures by centre with procedure to patient ratios

Unit Name	Number of individual patients reported by centre	Access construction episodes reported	Ratio: Access constructions per patient
Birmingham – Heartlands Hospital	65	108	1.7
Bradford – St Luke's Hospital	7	7	1.0
Bristol	159	340	2.1
Derby	45	50	1.1
Dorchester	40	74	1.9
Leicester	165	404	2.4
Middlesbrough	5	7	1.4
Plymouth	15	17	1.1
Royal Free Hospital	116	56	0.5
Swansea	90	197	2.2
Truro	31	59	1.9
Total	738	1319	1.8

The Audit requirements have been complex, both in terms of the data items requested and the internal process by which they are acquired. It is unclear whether such data items are not routinely recorded, whether the correct item is collected from the database of the renal centre. Given the complexity of the Audit, clarity of the data item definitions needs to be refined. Access construction is a good example, where it was perhaps unclear to centres whether 'surgical access' procedures or all access procedures were required.

However, the provision of good quality vascular access is a key component of the delivery of care to individuals requiring haemodialysis. Therefore, the audit of this aspect of care is essential to improve outcomes within the dialysis population. With the prospect of a best practice tariff in England, the scale of payment for a dialysis session will be dependent on the type of access in use. Therefore, the documentation of vascular access will be critical for income also.

Clearly, the Audit has had an ambitious dataset requirement. Some simplification of the national dataset is perhaps required. Many of the process markers may be superfluous for the purposes of national comparative audit. With simplification, the process of data collection will be easier for centres, with a clearer set of definitions and consequently higher quality data returns. In one area, however, an extension of data items are necessary – the type of access at each dialysis session for all patients. Such a data item can be collected at each dialysis session at the point of care. In many centres it is already in practice. It will fulfil the tariff requirements but also measure the overall performance for the entire haemodialysis population.

Recommended mandatory data items for vascular access

- 1) The date and type of vascular access used at each haemodialysis session
- 2) Date of first medical contact with nephrologist (either out patient or in patient)
- 3) Estimated GFR at start of dialysis

Recommendations

The following recommendations are suggested in respect of data collection:

- 1) Data items relevant to the audit of vascular access in haemodialysis should be reviewed with a view to simplification. The key mandatory item should be access type in use at each dialysis session.
- 2) Individual dialysis centres should review data collection and extraction to the renal registry and work with their system suppliers/information technology colleagues to build these processes into daily practice.
- 3) The UK Renal Registry should collect data on vascular access and return data quality reports to centres prior to analysis. Correction and improvement of data quality should remain the responsibility of the provider centre.
- 4) Centres should develop data items to enable local and regional audit of process and outcomes related to vascular access.

Summary

Eleven renal centres have provided data on 738 patients commencing haemodialysis in 2009. Data returns were variable between centres and between data items. Improvements are required to information systems and data collection. There is a need to simplify the national markers whilst retaining the objectives of the national audit.

Chapter 3 Vascular Access Data: 2009 Incident Patients

Introduction

Following the data-completeness analysis, all submitted data were tested against central NHS registers to validate or ascertain NHS numbers, required in order to allow later linkage with complications data. As a result of this, NHS numbers for 12 audit patients were added. However there remained 15 records which still had no NHS number match and these patients, plus one patient whose NHS number could not be verified, had to be excluded from all subsequent analyses. The remaining cohort, therefore, was 722 patients. No unit-level breakdown is presented since this would expose small numbers for some units, and no unit-level analysis has been undertaken for the remainder of report.

The starting vascular access may be influenced by age (due to the presence of comorbidities), gender and by time from first referral to a nephrologist to the commencement of dialysis. Late referral has been defined as a duration of 90 days or less between first contact with nephrology specialists and the commencement of dialysis.

Due to the relatively low completion rate of access at first dialysis, patients with unknown starting access are presented as a separate category.

Results

Gender and ethnicity

The majority of patients were of male gender (59 per cent). 67 per cent were of white British ethnicity with 10 per cent of unknown ethnic origin.

First access

Figure 6 illustrates the type of vascular access used at the first haemodialysis session. The largest group was unknown (44 per cent, n=315). Just 22 per cent (n=161) used an AVF fistula and 1 per cent an AV graft (n=4). A total of 33 per cent used some form of venous catheter (either tunnelled or non-tunnelled). When unknown access types are excluded, the proportion using an AVF is 40 per cent (Figure 7). The majority of patients still experience the first dialysis treatment with a venous catheter.

Age

The average age of all patients was 66 years (SD 15). There were no significant differences between patients related to starting access. The peak age was in the band 65-79 years, with over 50 per cent over the age of 65 (Figure 5). Less than 50 patients were younger than 40.

Figure 4
Gender distribution of all patients

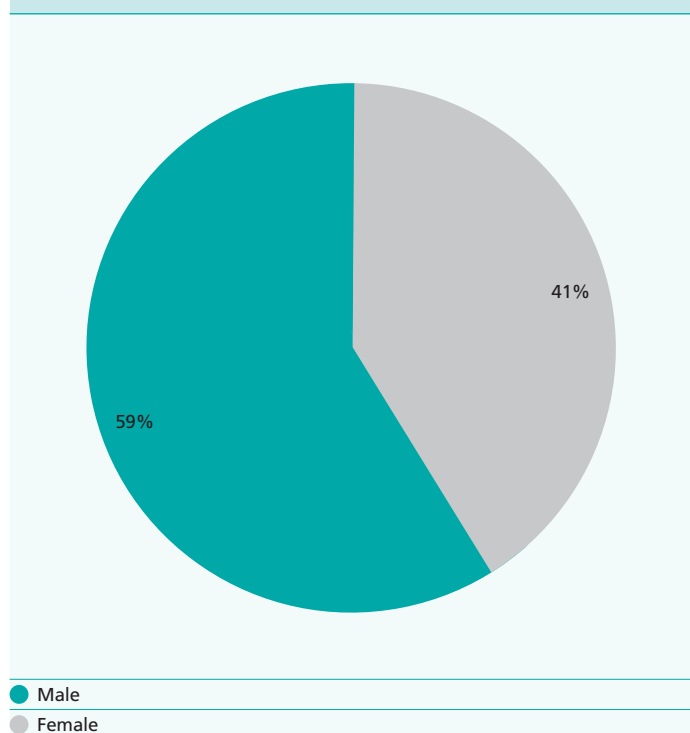


Table 4
Average age of patients in audit group, by access type

Access Type	Mean Age	Standard Deviation
Non-Tunnelled	68	14.5
Tunnelled line	65	15.2
Arteriovenous fistula	67	15.4
Arteriovenous graft	68	18.9
Unknown	67	14.8
All patients	66	15.0

There were no significant differences between male and female gender related to access type at dialysis start (Figures 8a and 8b). A slightly higher proportion of females did not have access at first dialysis recorded, but the proportion of known access types was identical.

Figures 9a and 9b provide the distribution of access comparing 65 years of age versus over 65. Again, no significant differences were seen.

Figure 5
Age distribution of sampled population

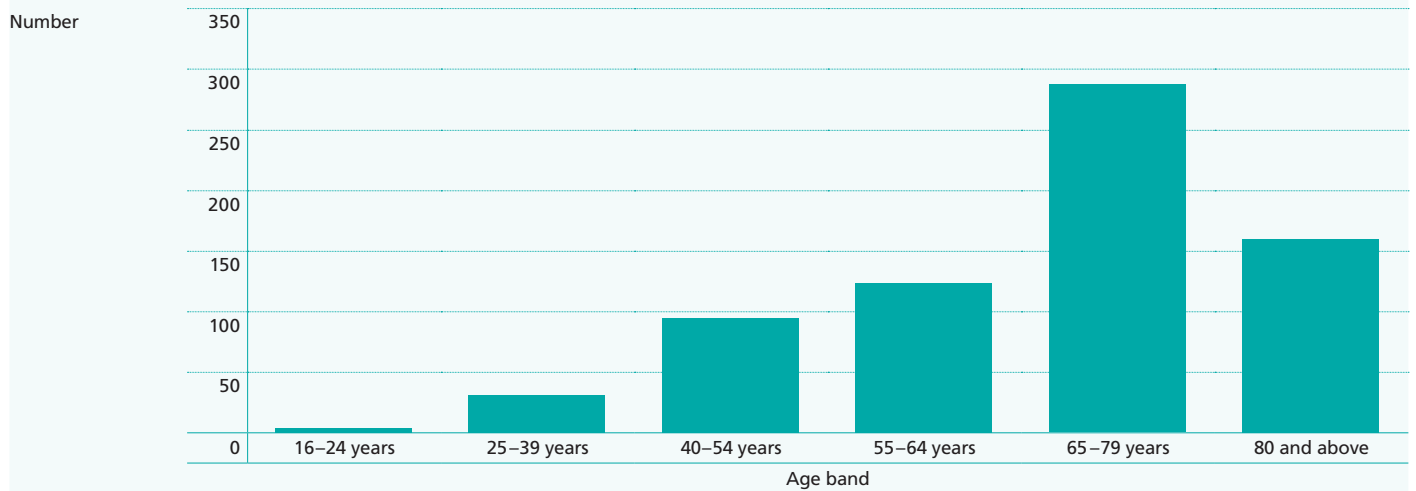


Figure 6
Access at first haemodialysis session (including unknown access)

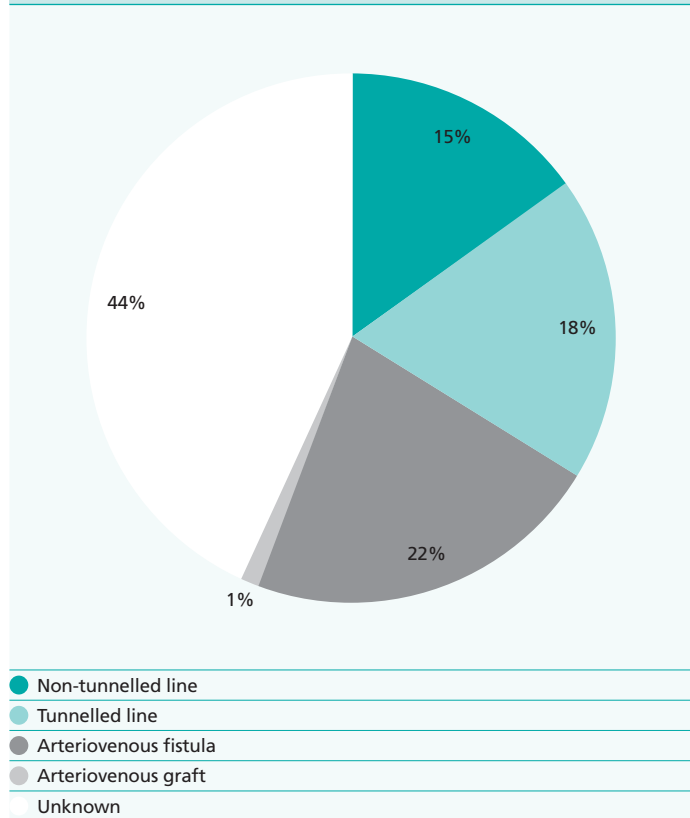


Figure 7
Access at first haemodialysis (excluding unknown access)

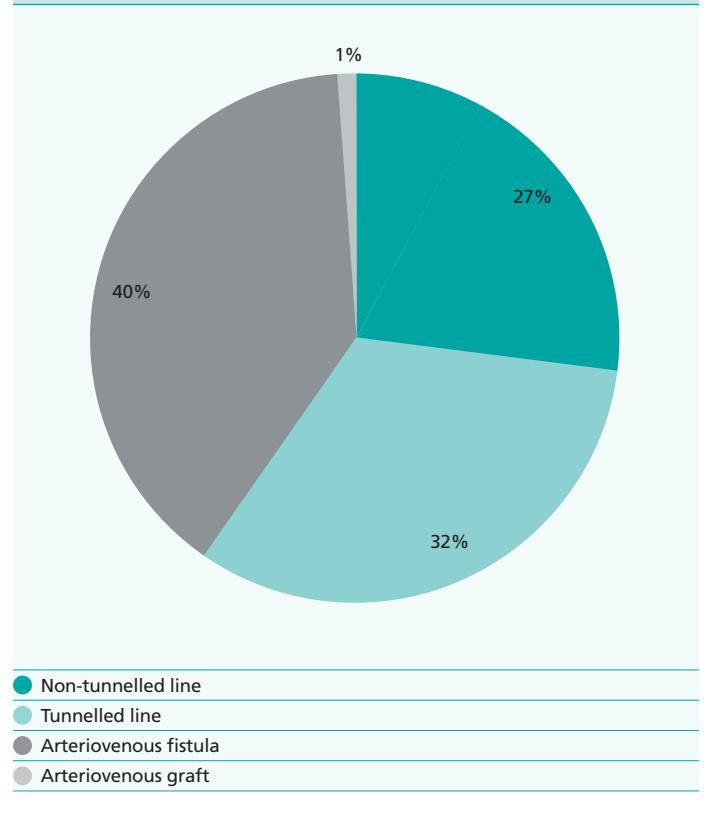


Figure 8a
Access at first dialysis by gender (including unknown access)

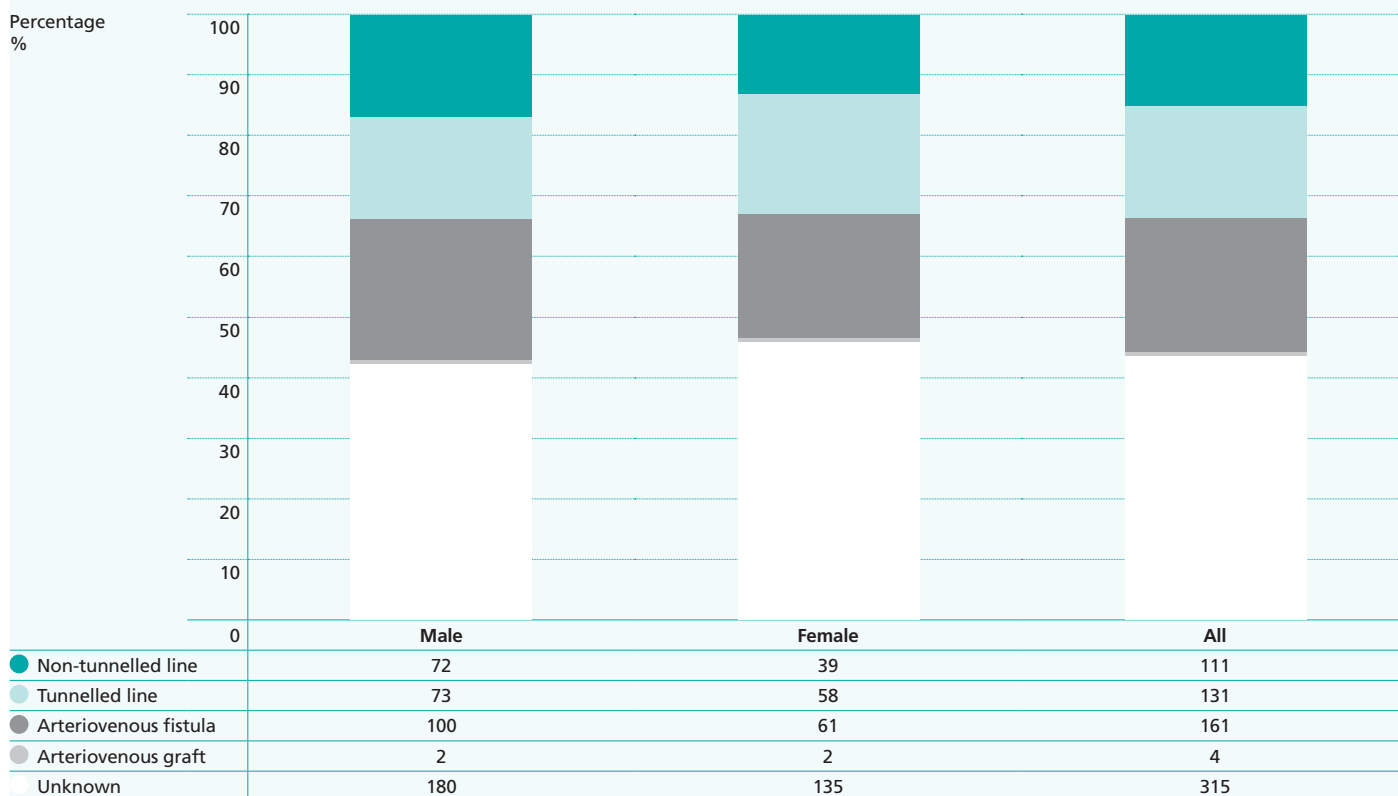


Figure 8b
Access at first dialysis by gender (excluding unknown access)

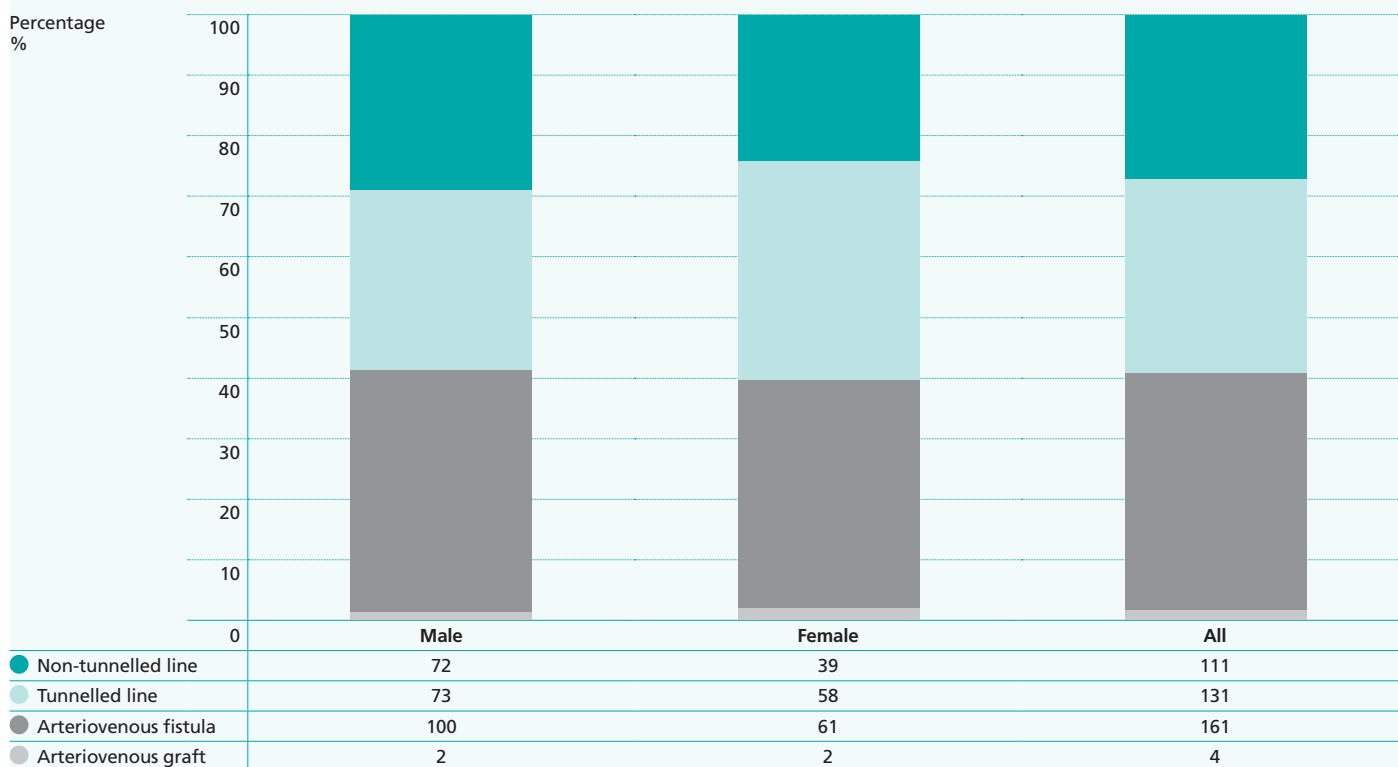


Figure 9a
Access by age group (including unknown access)

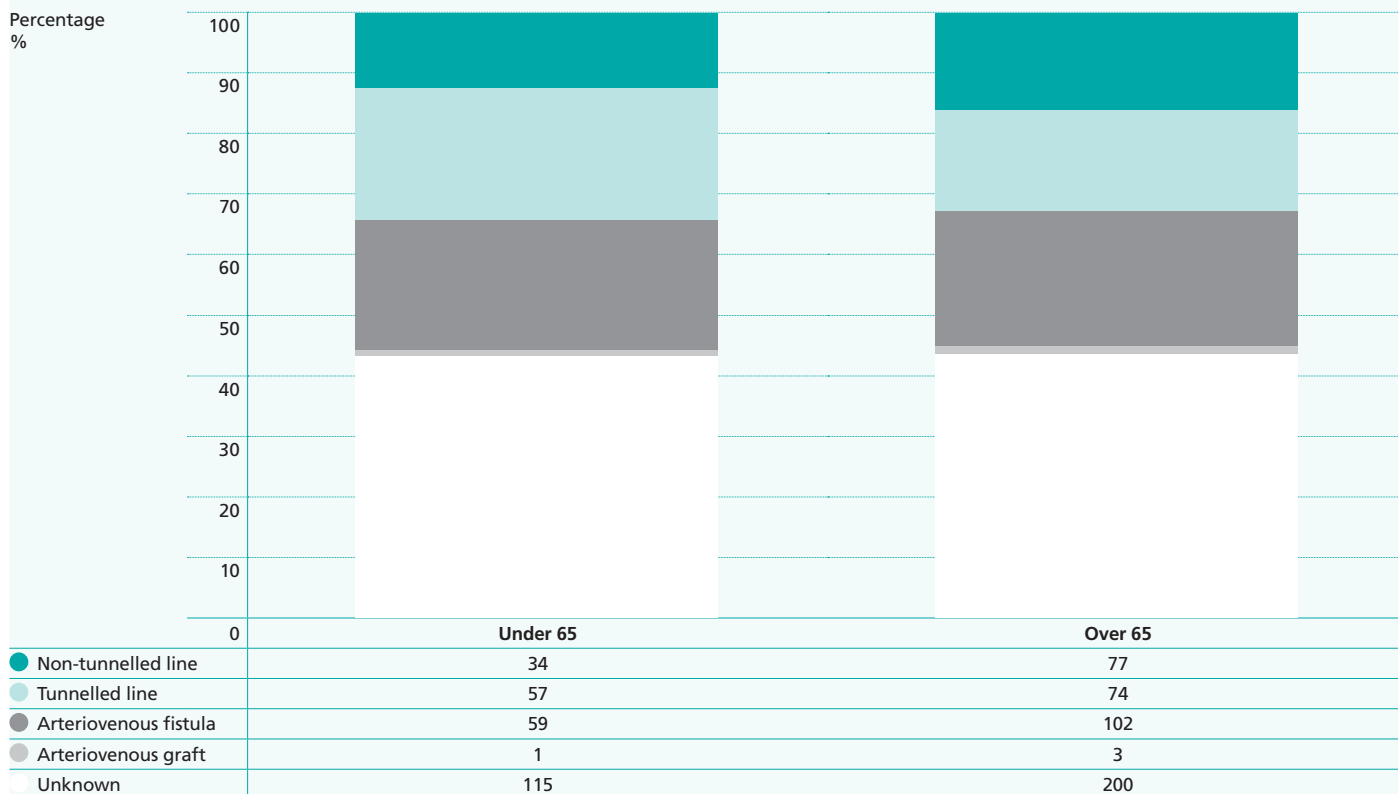
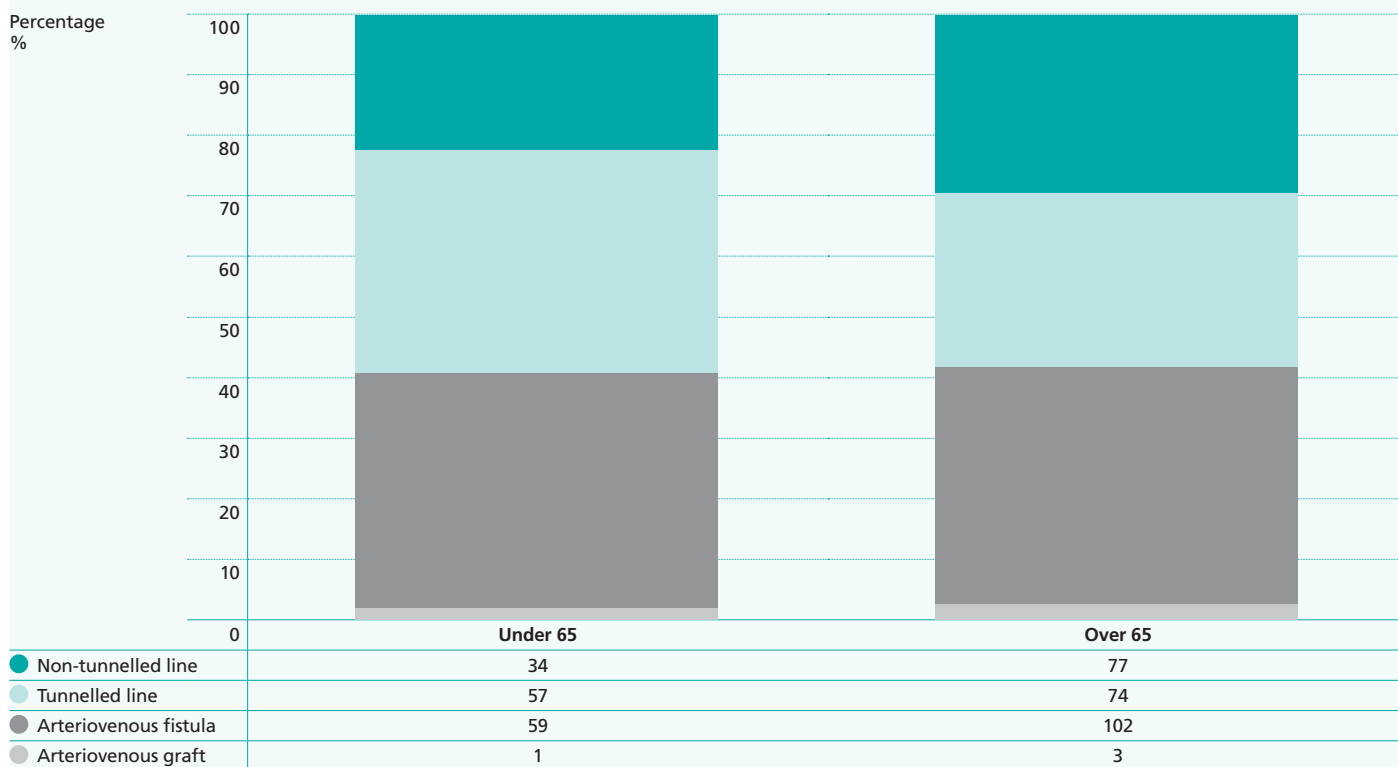


Figure 9b
Access by age group (excluding unknown access)



Referral interval and access at start of dialysis

Prior preparation is important to provide the opportunity to fashion either an AV fistula or graft. Late referral is conventionally defined as dialysis start within 90 days of first seeing a nephrologist. Figures 10a and 10b present the starting access split by late (less than 90 days) or timely referral (90 days or more). Data were available on 722 of the original patients. Of those 115 were late referrals and 309 at 90 days or more. 298 had an unknown referral interval.

Again, there was an equal distribution between late, timely and unknown referral times of unknown access (Figure 10a).

Consistent with previous studies, late referral was associated with a high utilisation of venous catheters (60/65, 92 per cent). A total of 96/176 patients who had a timely referral commenced dialysis with either an AV fistula or graft (55 per cent). For those patients where the referral time was unknown, 102/166 (61 per cent) commenced dialysis via a tunnelled catheter.

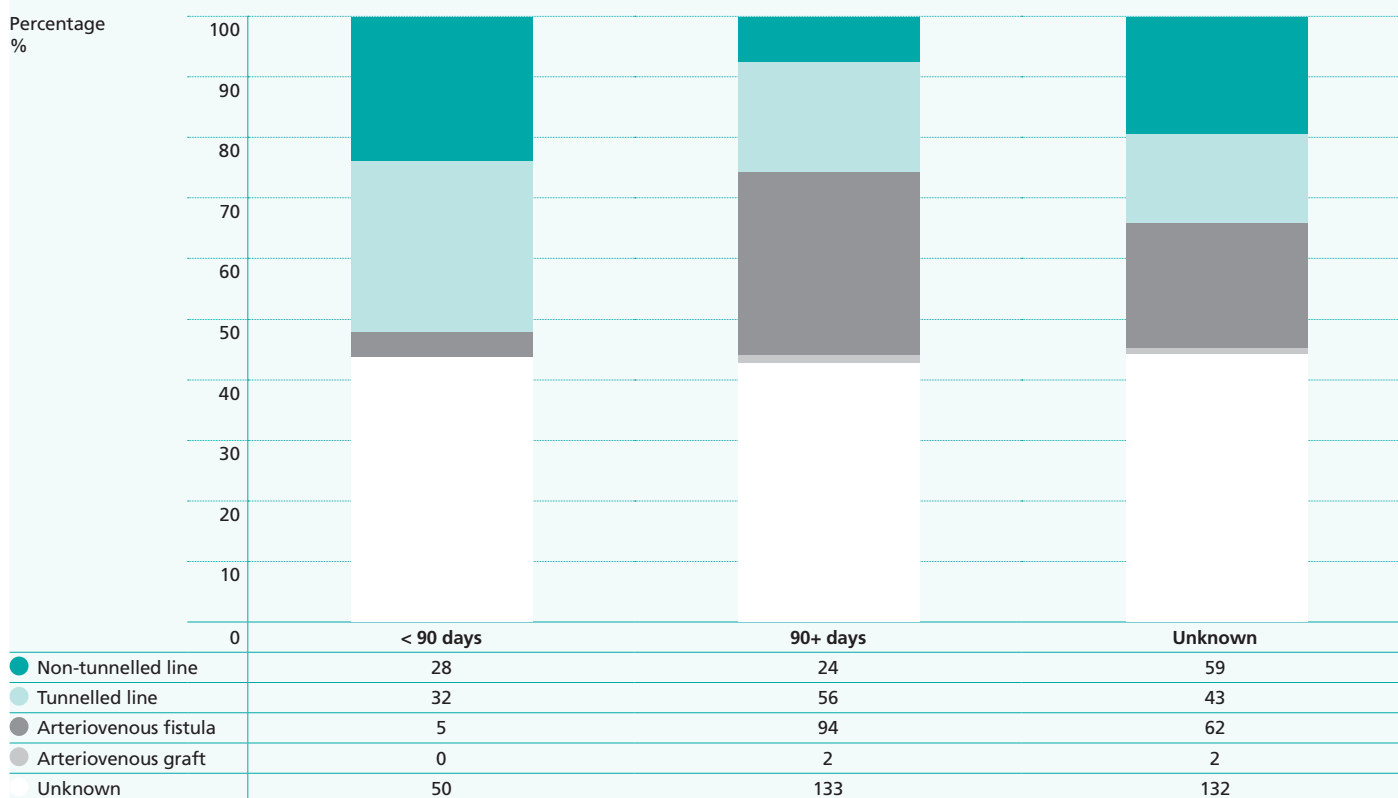
Discussion

Overall, these data demonstrate a similar pattern to both UK and international studies. Few patients commence haemodialysis in the best way, with nearly 2 in 3 using a venous catheter. Late referral as a precipitant for an unplanned start does result in the majority of patients using a venous catheter for the first episode of haemodialysis, and only 55 per cent of patients with adequate referral used a fistula or a graft.

There was no association between age and gender on the use of access, suggesting that comorbidities and the medical inability to fashion a fistula is not the principle driver behind low rates of AV fistula use. Instead, it points to organisational issues. These may be lack of capacity, eg operating time or surgeons. Equally, it may be that the prediction of the need for renal replacement therapy is not fully appreciated and consequently referral into the surgical pathway does not occur or is not timely.

The current data collection for the national audit does not allow these issues to be differentiated. It is therefore important that centres develop local and regional audit to supplement national audit. This should allow detailed analysis of the blocks within centres to achieving a higher initial rate of AV fistula use at first dialysis.

Figure 10a
Referral interval vs starting access (including unknown access)



Three broad areas need addressing:

First, the rate of late referral needs to be minimized. Where patients arrive late to dialysis, alternative strategies need to be considered to bridge them to a fistula where possible. This may require the use of peritoneal dialysis or delay the commencement of dialysis until access is in place. Recent concerns about the premature start of dialysis with adverse consequences (eg Rosansky et al, Arch Intern Med. Published online November 8, 2010) do suggest that this is a viable alternative.

Second, the methodology for predicting the need for renal replacement therapy needs development. At present, guidance is vague and the evidence about when to fashion access absent or unclear.

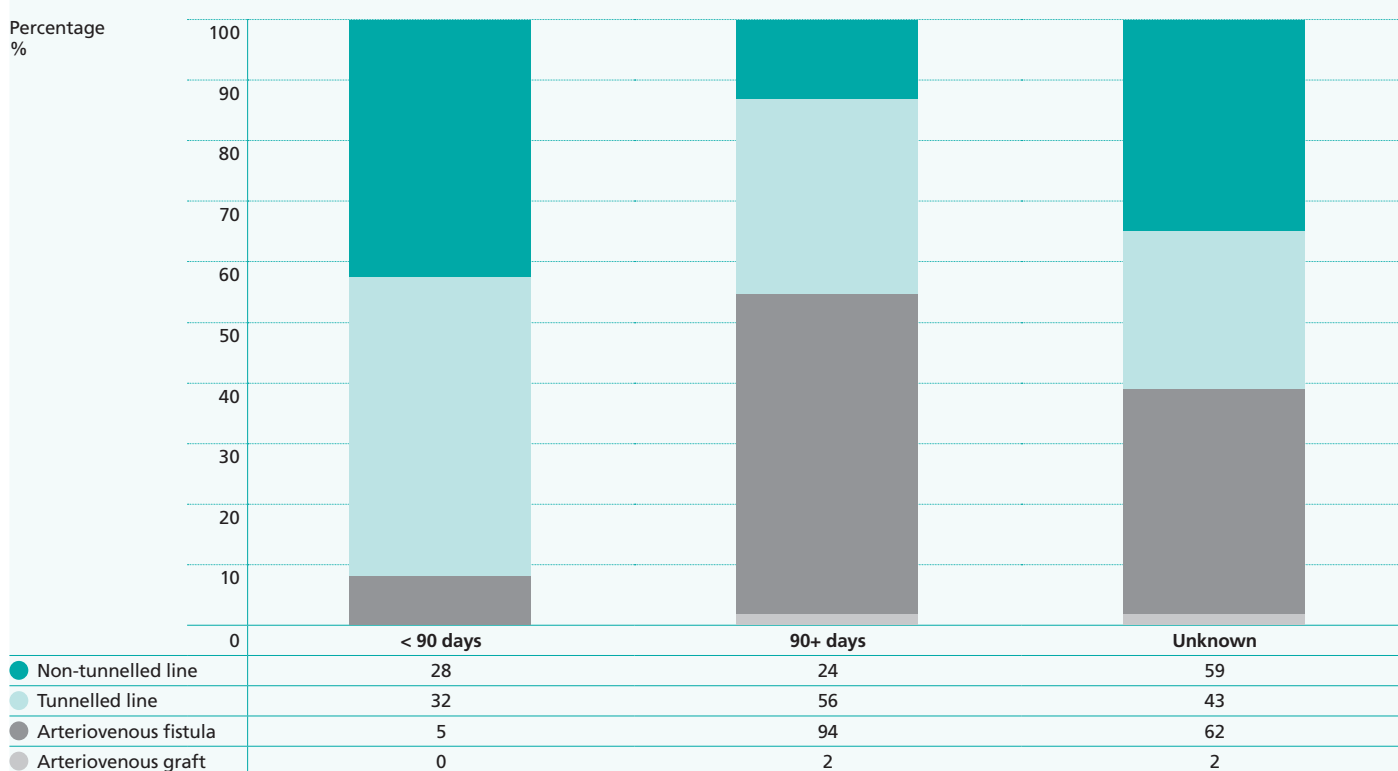
Third, individual centres and commissioners need to assess both process and capacity locally.

Recommendations

The following recommendations are made:

1. Late referral should be minimized by joint working with primary and secondary care to identify chronic kidney disease.
2. Where patients present late, requiring renal replacement therapy, alternative therapies should be considered to allow time for the formation of vascular access.
3. The current target of 65 per cent of patients commencing haemodialysis via a fistula or a graft is not being achieved. Where patients commence dialysis with a venous catheter, a root cause analysis should be undertaken to determine the reasons and to improve the process.
4. Research and development into the prediction of dialysis start dates and the optimal timing of access placement is urgently required.

Figure 10b
Referral interval vs starting access (excluding unknown access)



Chapter 4 Linkage with complication data

Introduction

Much of the morbidity of end stage renal failure managed by haemodialysis is related to the type of vascular access used to deliver therapy. For example, recent Dialysis Outcome and Practice Patterns Study (DOPPS) data has ascribed the majority of difference in mortality between counties in the DOPPS study to be associated with the provision of vascular access (Goodkin et al, Am J Kidney Dis 56:1032-1042). Such differences may be down to the risk of infection, but other mechanisms may be relevant, such as cardiovascular events.

Outline

To explore this risk, Hospital Episode Statistics (HES) and Patient Episodes Database for Wales (PEDW) data were aligned with the sample patient group and analysed by access type at incident start. This relies on coding accuracy that may affect the precision of the analysis, but is sufficiently robust for audit purposes.

Only inpatient codes were used for this audit. Codes related directly to the performance of dialysis were censored from the dataset. Diagnostic codes were then placed within 'baskets' of codes, to cover a topic area. A single patient may have more than one episode of care within the data, and associated with that multiple codes. Due to the small numbers of patients, detailed analysis of this aspect is not possible.

Results

Overall data

Table 5 details the overall number of diagnostic codes, broken down by access category, and covers the six main coding groups. These are cardiovascular, episodes related to vascular access, mechanical complications, other bacterial infections (eg pneumonia), viral and atypical infections and miscellaneous for all other codes. Clearly it is not possible to absolutely align a code to a single category but a broad approach was taken.

Overall there were 2422 recorded bed days after dialysis commenced. Due to small numbers comparative analysis is not possible. Across the six coding groups there were no differences between access types (Figure 11).

Episodes directly related to vascular access

Although the overall number of events between access types were equivalent, infection related to access were significantly lower in the arteriovenous fistula group compared to all others, with a relative risk 6 fold higher in venous catheters (Figure 12).

In contrast, other complications were equivalent.

Table 5
Complication diagnostic categories and patient events

Diagnosis Category	Access type				
	Arteriovenous fistula	Arteriovenous graft	Non-tunnelled line	Tunnelled line	Unknown
Cardiovascular complications	88	3	60	87	154
Episodes directly related to vascular access (including infection)	44	1	27	47	58
Mechanical complications related to vascular access	7		13	17	29
Miscellaneous	153	4	95	131	248
Other bacterial infections	76	1	70	73	143
Viral and other infections	9	1	9	16	14
Total patient number in access category	161	4	111	131	315

Figure 11
Events expressed as number per 100 patients

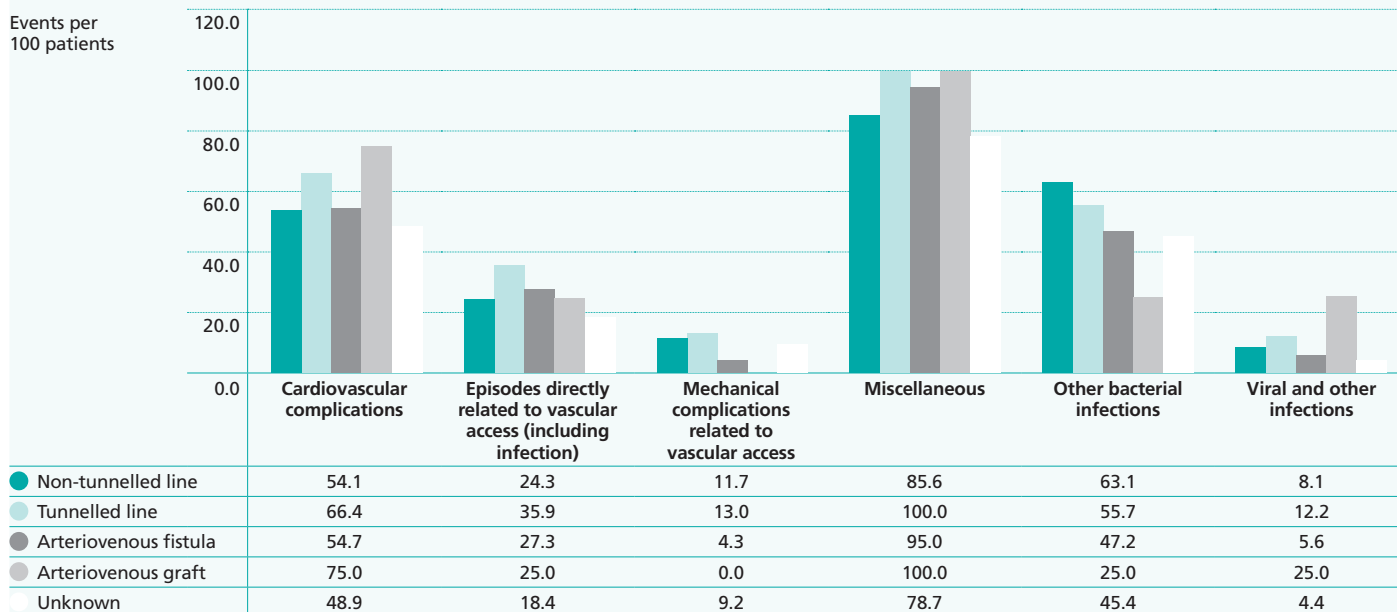
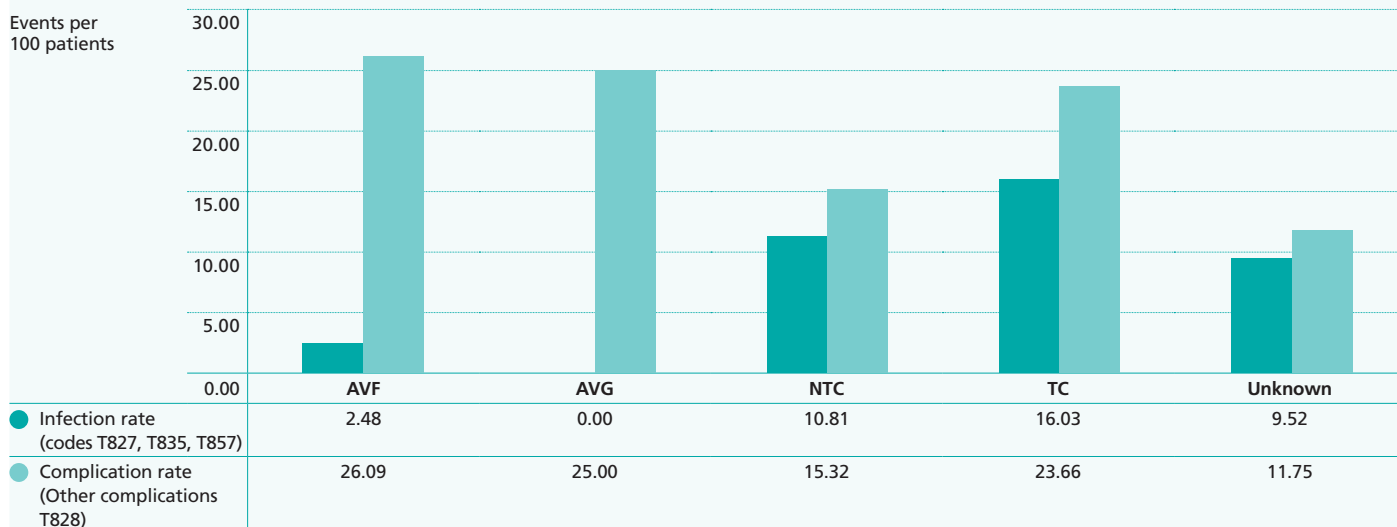


Figure 12
Complications relating to Vascular Access



Cardiovascular events

There are associations between infection and cardiovascular events and this might suggest that patients at higher risk of infections might have a higher cardiovascular event rate.

Conversely, patients with an AV fistula may be prone to high output heart failure related to the haemodynamic consequence of the fistula.

Overall the numbers of reported events were high (Table 6), the majority being either cardiac events (myocardial infarction, angina etc) or related to salt and water overload (pulmonary oedema, left ventricular failure).

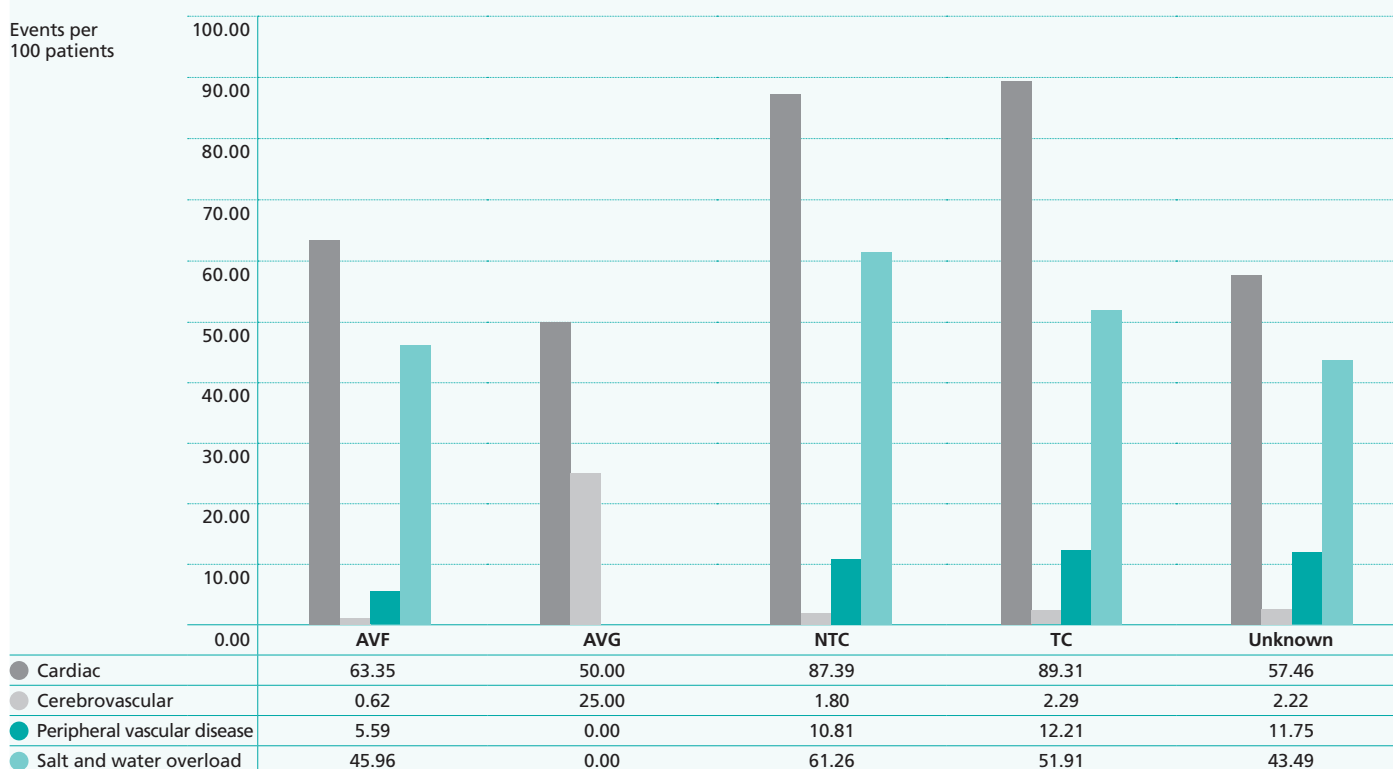
Cerebrovascular events (stroke, TIA) and peripheral vascular events were low in number.

In comparative terms, all events rates were lower in the arteriovenous fistula group, except the unknown access type, with 20-50 per cent reductions in cardiac, cerebrovascular and salt and water overload. This does not imply causality, since cardiac events may determine the unplanned start to dialysis (Figure 13). It is nonetheless reassuring not to see an excess of events related to heart failure related to AV fistula use, and the overall observation deserves further study.

Table 6
Number of coded diagnosis events related to cardiovascular events by access type

Access	Arteriovenous fistula	Arteriovenous graft	Non-tunnelled line	Tunnelled line	Unknown
Cardiac	102	2	97	117	181
Cerebrovascular	1	1	2	3	7
Peripheral vascular disease	9	0	12	16	37
Salt and water overload	74	0	68	68	137
Total patient number	161	4	111	131	315

Figure 13
Cardiovascular Events



Other bacterial infections

Whilst venous catheters may act as a portal to infection, thereby increasing the risk of systemic infections, catheters may also act as a reservoir for infections from other sources. This may prolong the episode, worsen outcome and potentiate other consequences, such as metastatic infection.

Many of the events may overlap with those coded under vascular infections, but also include codes for pneumonia, osteomyelitis and endocarditis.

The relative event rate is high overall, with a ratio overall that exceeds one event code per patient in the database. There is an increased risk from AV fistula to venous catheter of 50-90 per cent (Figure 14). This again does not prove causality but is only an association.

Mechanical events

Access of all types are prone to mechanical problems, be it a catheter with poor flows to a fistula that has occluded. Figure 15 summarises mechanical events by access type (codes T823/4/5, T856/8, Z458).

Overall, AV fistulae tend to have a lower event rate.

Figure 14
Event rate per 100 patients (ratio) or number of episodes of other bacterial infections

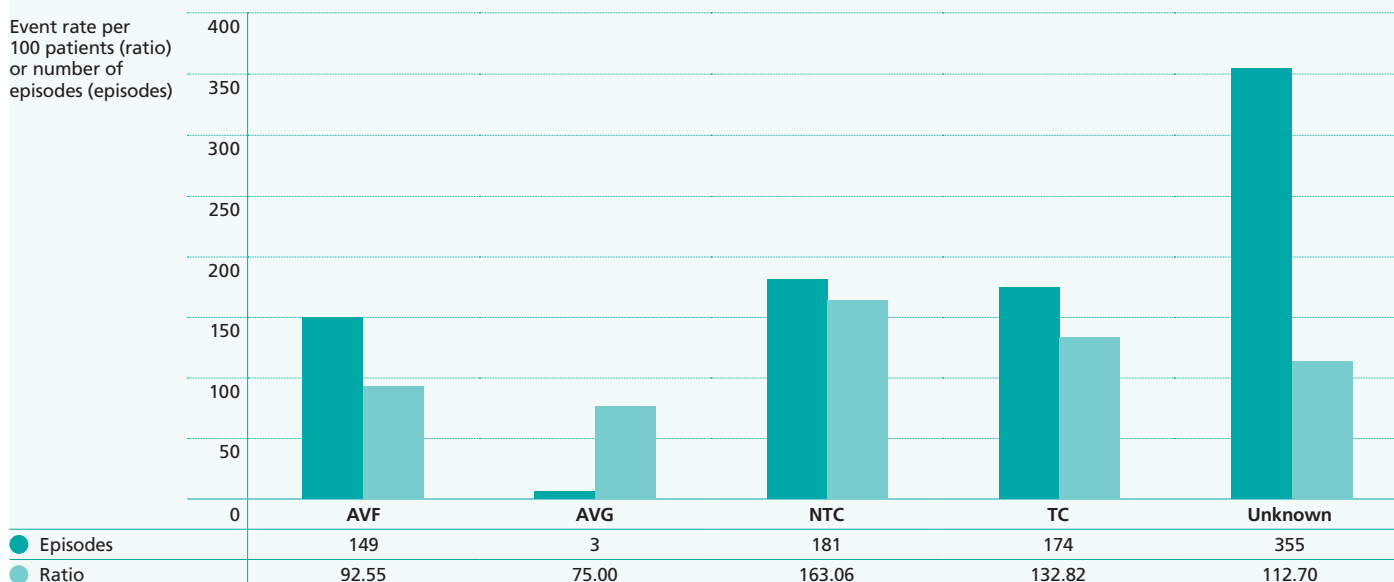
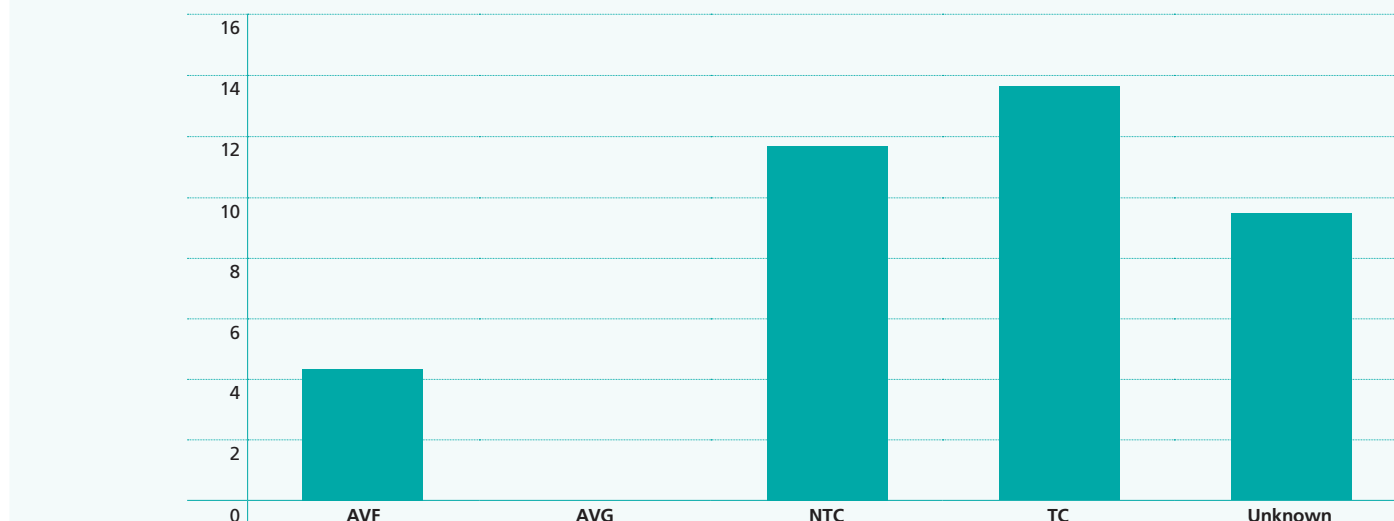


Figure 15
Mechanical events per 100 patients (ratio) by access type



Summary

Whilst the overall event numbers are similar between types of access for patients starting haemodialysis, there is evidence of the benefit of good quality vascular access (AV fistula). These include reductions in infection related to the access itself, a general reduction in infection episodes, and a trend towards reduced cardiovascular events.

Recommendations

Infection remains the leading preventable cause of harm amongst individuals requiring haemodialysis.

1. Renal providers should record and audit episodes of infection. Key markers should be episodes of bacteraemia, pneumonia and metastatic infection such as endocarditis.
2. Infection rates should be reduced by improving the rate of AV fistula use at the start of dialysis.

Cardiovascular events are a second important cause of death and harm for patients on dialysis. The link between such events and access requires further investigation.

3. Research into the role of vascular access and cardiovascular events is urgently required and should be addressed.

Chapter 5 Recommendations

Next steps

The National Kidney Care Vascular Access audit enters its final phase in 2011. The objectives for 2011 are to:

1. Extend data collection to up to 25 centres in the UK.
2. Improve data collection for audit purposes, by offering a simpler dataset, to be completed directly by centres.
3. Explore organisational metrics with an online survey, administered by the UK Renal Registry.
4. Include Health Protection bacteraemia data, looking at a wide spectrum of pathogens.
5. Develop the ongoing legacy of the Audit to ensure that audit in this field continues after the project itself has finished by passing on the structure and lessons to the UK Renal Registry.
6. Inform patients, carers, commissioners and providers of the priority areas of practice to be improved upon.

The Audit has been challenging for providers and for the Audit itself. Data collection in this complex area remains at the core of the issues, but whilst the data collection volume itself has not met the original ambitious targets, crucial issues and solutions have been refined.

Principle amongst those is the need to simplify the audit dataset at a national level, concentrating on the key end point of access provision, whilst allowing more complete collection to take place. At the same time, in due course, prevalent access usage will also be collated locally, regionally and nationally. There are three principle drivers for this need:

- clinical, as a marker of quality care
- financial, as best practice tariff becomes a commissioning mandate
- research, to answer key questions in the management of dialysis populations.

Recommendations

There are key recommendations related to the three areas reported on within the report, around data collection, access provision and access related harm. They are collated below:

Data collection

1. Data items relevant to the audit of vascular access in haemodialysis should be reviewed with a view to simplification. The key mandatory item should be access type in use at each dialysis session.
2. Individual dialysis centres should review data collection and extraction to the renal registry.

3. The UK Renal Registry should collect data on vascular access and return data quality reports to centres prior to analysis. Correction and improvement of data quality should remain the responsibility of the provider centre.
4. Centres should develop data items to enable local and regional audit of process and outcomes related to vascular access.

Access provision

1. Late referral should be minimized by joint working with primary and secondary care to identify chronic kidney disease.
2. When patients present late, requiring renal replacement therapy, alternative therapies should be considered to allow time for the formation of vascular access.
3. When patients commence dialysis with a venous catheter, a root cause analysis should be undertaken to determine the reasons and to improve the process.
4. Research and development into the prediction of dialysis start dates and the optimal timing of access placement is urgently required.

Morbidity and mortality

1. Renal providers should record and audit episodes of infection. Key markers should be episodes of bacteraemia, pneumonia and metastatic infection such as endocarditis.
2. Infection rates should be reduced by improving the rate of AV fistula use at the start of dialysis.
3. Research into the role of vascular access and cardiovascular events is urgently required and should be addressed.

Conclusions

The picture for the provision of vascular access requires simple and robust data collection. It needs to be supplemented by local deeper analysis of outcomes and service issues. The final phase of the vascular access audit promises to be instructive in both the mechanics of data collection and of the pattern of service delivery. As Marion Higgins so clearly states, for a patient needing haemodialysis a fistula is their lifeline. There remains much to be done to minimize the adverse consequences of haemodialysis whilst reinforcing the benefit it delivers with good quality vascular access. Ambition to do the best, as stated in the foreword by the National Clinical Director, should not be limited.

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