UK Renal Registry 16th Annual Report: Chapter 14 2012 Multisite Dialysis Access Audit in England, Northern Ireland and Wales and 2011 PD One Year Follow-up: National and Centre-specific Analyses

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Summary

- Data are presented from the first combined vascular and peritoneal dialysis access audit.
- In 2012, 51 centres in England, Wales and Northern Ireland (representing 82% of all centres) returned data on first access from 3,720 incident haemodialysis (HD) patients and 1,018 incident peritoneal dialysis (PD) patients.
- Of the incident HD patients, 38.3% started therapy on an arteriovenous fistula (AVF), 36.9% on a tunnelled line (TL), 23.5% on non-tunnelled line (NTL) and 1.2% by means of arteriovenous graft (AVG).
- Referral time had an influence on PD catheter insertion technique: of patients starting PD within 90 days of initial referral, 50.6% underwent percutaneous PD catheter insertion. This contrasts with patients known to renal services in excess of 90 days, 32.4% of whom underwent percutaneous PD catheter insertion.
- Initial surgical assessment was a key determinant of the likelihood of AVF formation; 70.4% of patients assessed by a surgeon at least three months before commencing dialysis started on an AVF. By contrast, only 9.7% of patients not surgically assessed at least three months before commencing dialysis used an AVF as first dialysis access.
- Length of time known to nephrology services and likelihood of commencing dialysis using either an AVF or a PD catheter are strongly associated. For patients presenting late, 84.6% started on a line (TL/NTL). Amongst patients known to the centre for at least a year only 33.9% started via a line.
- Data on PD catheter failure rates at one year were poorly completed. Of 44 centres who reported data on PD patients in 2011, only 28 completed the one year follow up request, returning data on a total of 649 patients.
- For centres returning data on one year peritoneal dialysis outcomes, the majority of centres maintained >50% of patients on PD at one year, however only five centres maintained >80% on PD at one year.
- Further enhancement of data fields, improved data completeness and accuracy of returns will be essential to improve the quality of future audits.
- Further work is required to define optimal dialysis access care pathways that are comprehensive, high quality and responsive to patient needs.

Introduction

This report represents the first combined vascular and peritoneal dialysis access audit in England, Wales and Northern Ireland. Previously, vascular and peritoneal dialysis access audits have been published separately [1, 2, 3].

Dialysis access (regardless of modality) should be timely, minimise complications and maintain functionality for as long as it is required. Both haemodialysis (HD) and peritoneal dialysis (PD) require good functional access in order for the renal replacement technique to be successful.

The Department of Health National service framework for Renal Services 2004 [4] states that by 2014:

'All children, young people and adults approaching established renal failure are to receive timely preparation for renal replacement therapy so the complications and progression of their disease are minimised, and their choice of clinically appropriate treatment options is maximised.'

'All children, young people and adults with established renal failure are to have timely and appropriate surgery for permanent vascular or peritoneal dialysis access, which is monitored and maintained to achieve its maximum longevity.'

Previously reported vascular access and peritoneal access audits [1, 2, 3] have therefore been performed with the intention of providing clinically useful information relating to timely and appropriate access interventions in order to achieve permanent access based on these recommendations and quality requirements. The core principal of these audits has been to highlight the performance variation of renal centres across England, Wales and Northern Ireland and explore factors that may contribute to the provision of excellent quality vascular and peritoneal access.

High quality vascular access represents a key modifiable risk factor for patients on dialysis and is an important measure of clinical care [5]. Whilst it is possible to postulate plausible factors that influence access provision, such as variation in patient demographics and physician attitudes, the exact reasons for such variations are unknown. Audit is essential to define relevant issues relating to HD access formation and PD catheter insertion, and to understand practice variation with the aim of standardising the provision of a high-quality service to all patients who require it. Determination of the type of access first used for dialysis, investigation of operational effectiveness (surgical referral, conversion rates between access types) and documentation of complications continue to be the main endpoints of this joint access audit.

There is substantial evidence to suggest that prompt permanent vascular access is clinically advantageous. Indeed, current best practice indicates that vascular access should be in place by a minimum of six months before starting treatment [6]. Observational data has repeatedly demonstrated a strong association between the use of central venous catheters and increased mortality and morbidity [2, 7]. Similarly, patients presenting late commencing dialysis via a PD catheter rather than a tunnelled line are also less likely to experience bacteraemia [8].

Whilst this, in part, may reflect late presentation and co-morbidity, studies attempting to correct for this have identified an independent effect of access on patient outcomes [7, 9]. Permanent vascular access delivers a higher, more effective dialysis dose, and those with venous catheters may require an increase in frequency and duration of dialysis to compensate. Permanent vascular access will also remain functional for much longer than a venous catheter, requiring fewer hospital admissions with attendant health economic benefits [7, 9].

The provision of high quality PD access is equally important. The National Institute of Health and Clinical Excellence (NICE) has recommended that PD should be offered as a first-line therapy for the majority of patients with established renal failure (ERF) on the basis of equivalent outcomes with haemodialysis [10]. Despite this guidance, PD is only used for 20% of UK dialysis patients. Furthermore, the UK Renal Registry (UKRR) 2012 annual report documents a 10–fold national variation in PD utilisation between otherwise similar renal clinical centres [11].

The term established renal failure used within this chapter is synonymous with the terms end stage renal failure and end stage renal disease, which are in more widespread international usage. Patients have disliked the term 'end stage' which reflects the inevitable outcome of this disease.

Methods

All adult renal centres in England, Wales and Northern Ireland were contacted regarding vascular and peritoneal access for all

incident dialysis patients in 2012. Data were collected using Microsoft Excel spreadsheets circulated by the UK Renal Registry. Of 62 centres contacted, data were received from 51 centres. Data fields were refined from the audit performed in 2011 based on the quality of the returned questionnaires and the feedback received from centres.

Patients who were identified by the renal centres as having acute kidney injury (AKI) in the free text fields or patients who were reported to have recovered renal function within three months were categorised as having AKI for the purposes of this audit and excluded ($n = 367/5,105$). The remaining records received were validated against the UKRR database to confirm that the population collected at each centre for the audit was the same as, or representative of, the incident population at that centre as collected via the usual UKRR methodology. Data checks were made by cross-referencing with the UKRR database. Any patients identified from the UKRR as not incident to dialysis between 1st January 2012 and 31st December 2012 were excluded. The cross-referencing also enabled ascertainment of information on mortality within three months of commencing dialysis.

Centres who reported data on PD patients in the 2011 vascular and peritoneal access audit were asked to complete a one year follow up of their PD patients. Additional information was requested on the date of PD catheter failure, the reason for catheter failure, the number of catheters used during the year, and the modality in use at one year after starting PD.

Patients starting HD were grouped by type of first vascular access: arteriovenous fistula (AVF), arteriovenous graft (AVG), tunnelled dialysis line (TL), non-tunnelled dialysis line (NTL). Patients starting PD were categorised by the insertion technique: laparoscopic, peritoneoscopic, open surgery, percutaneous. Access at three months was defined as the type of access in use at three months after starting dialysis. If a patient was no longer receiving dialysis at three months then the reason was recorded instead, for example died or transplanted. Referral time was defined as the number of days between the date of first being seen by a renal physician and the date of commencing dialysis. A patient was classified as presenting late if they had a referral time of less than 90 days. In the analyses involving whether or a not a patient had received surgical assessment at least three months before starting dialysis, patients were excluded if they were categorised as a late presenter.

Access failure was defined as the access no longer being usable for treatment. Data about the date and cause of access failure were collected. Access failure was censored for death, transplantation, withdrawal from renal replacement therapy (RRT) and elective switching of access type. It was the intention to only capture access failures relating to the first type of access. If the reason recorded for access failure was incompatible with the first type of access recorded then the data was not included in this analysis.

Separate or combined analyses have been performed for incident HD patients and incident PD patients as appropriate. Due to the exploratory nature of the audit the analyses have been limited to descriptive statistics of frequencies, percentages and unadjusted associations between variables. If a centre had more than 50% missing returns for a particular data field, then all patients from the centre were excluded from analyses involving that data field. The data were analysed using SAS 9.3.

Results

Data completeness

Fifty-one centres returned data on first dialysis access on 3,720 incident HD patients and 1,018 incident PD patients. The UKRR incident patient data for the same year were 3,818 HD and 1,035 PD, thus there were access returns on 97% of HD and 98% of PD patients.

Forty-one patients were excluded from all the analyses due to missing RRT start date or first access type. Figure 14.1 illustrates the data completeness for key variables.

Variations in first dialysis access
Patient demographics

The median patient age when starting RRT was 67 years in the HD cohort and 59 years for patients commencing PD. Overall, 62.6% of the patients were male, 37.4% female; the proportional distribution of the sexes was similar for both the HD and PD subgroups.

A significant proportion of patients starting dialysis had diabetes (43.0%), however diabetes associated nephropathy was the primary renal disease (PRD) in only 26.1% (table 14.1). There was however, a large volume of missing data relating to diabetes status (1,144 patients on HD (31.1%) and 204 patients on PD (20.1%)).

Table 14.2 presents HD and PD patient subgroups stratified by age, gender, dichotomised body mass index (BMI) (<30 or $\geqslant 30$), PRD, referral time (<90 or $\geqslant 90$ days) and surgical assessment status.

There was an apparent association between the access modality (HD vs. PD), referral time (<90 days vs. $\geqslant 90$ days) and surgical assessment status in excess of three months prior to dialysis start. The following observations can be made:

For HD:

- AVF was the initial access for 38.3% of patients, with 1.2% on an AVG, 36.9% on a tunnelled line and 23.5% on a non-tunnelled line.
- Patients aged 60 or over were more likely to initiate RRT on an AVF (40.7%) when compared to patients <60 years (33.9%). Similarly, older patients were less likely to start on a tunnelled line (33.3% vs. 43.7%).
- Patients with polycystic kidney disease (PKD) as primary renal diagnosis were most likely to start on an AVF (65.5%).
- Patients who had been seen by a surgeon at least three months before starting dialysis were more
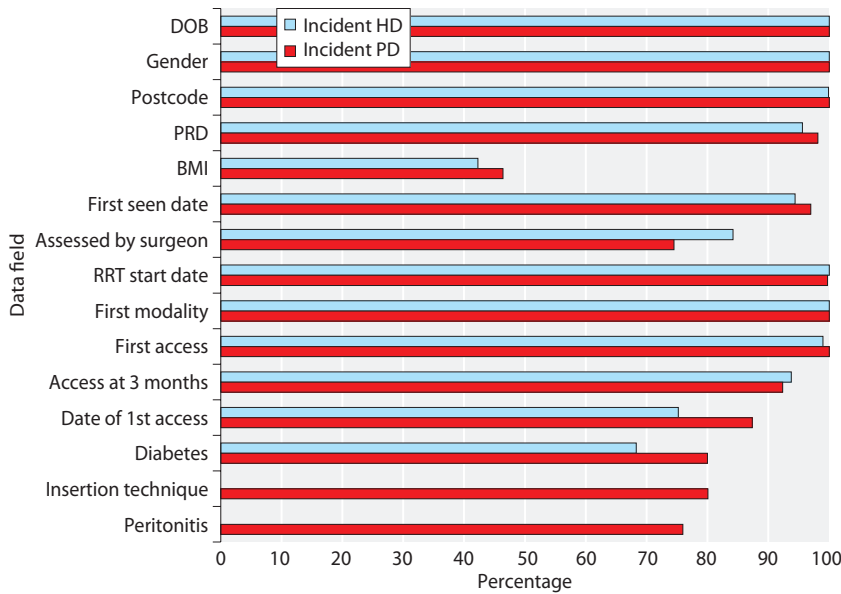
Fig. 14.1. Data completeness for key variables, stratified by first modality HD = haemodialysis; PD = peritoneal dialysis; DOB = date of birth; PRD = primary renal diagnosis; BMI = body mass index

likely to start on an AVF than those not assessed (67.7% *vs*. 5.6%).

- Of those referred at least 90 days prior to commencing dialysis, 50.1% started on an AVF compared to only 4.3% of those starting more acutely.

For PD:

- PD catheters were placed in 44.4% of patients by using open surgical techniques, 18.1% using laparoscopic techniques, 34.6% using percutaneous techniques and only 3.0% inserted using a peritoneoscope.
- Patients who were assessed by a surgeon at least three months before starting dialysis were more likely to undergo laparoscopic placement (24.4% *vs*. 5.9% for non-surgical assessment) and were less likely to have open surgical placement (36.8% *vs*. 55.6%) or percutaneous catheter placement (33.4% *vs*. 37.6%).

Table 14.1. Patient demographics

		Total N = 4,697	HD N = 3,682	PD N = 1,015
		Med (IQR)	**Med (IQR)**	**Med (IQR)**
	Age	65 (52, 75)	67 (54, 76)	59 (47, 71)
	BMI	27 (24, 32)	27 (23, 32)	27 (24, 31)
		N (%)	**N (%)**	**N (%)**
Gender	Female	1,759 (37.4)	1,372 (37.3)	387 (38.1)
	Male	2,938 (62.6)	2,310 (62.7)	628 (61.9)
Diabetes	Missing	1,348 (28.7)	1,144 (31.1)	204 (20.1)
	Yes	2,018 (43.0)	1,503 (40.8)	515 (50.7)
	No	1,331 (28.3)	1,035 (28.1)	296 (29.2)
PRD	Diabetes	1,227 (26.1)	980 (26.6)	247 (24.3)
	Glomerulonephritis	610 (13.0)	446 (12.1)	164 (16.2)
	Hypertension	374 (8.0)	289 (7.8)	85 (8.4)
	Other	784 (16.7)	654 (17.8)	130 (12.8)
	Polycystic kidney	257 (5.5)	171 (4.6)	86 (8.5)
	Pyelonephritis	274 (5.8)	209 (5.7)	65 (6.4)
	Renovascular disease	298 (6.3)	251 (6.8)	47 (4.6)
	Uncertain aetiology	693 (14.8)	521 (14.1)	172 (16.9)
	Missing	180 (3.8)	161 (4.4)	19 (1.9)

IQR = interquartile range; BMI = body mass index; PRD = primary renal diagnosis; HD = haemodialysis; PD = peritoneal dialysis

Table 14.2. Patient characteristics stratified by type of first dialysis access

		HD N	% of HD patients				PD N*	% of PD patients			
Variable			AVF	AVG	TL	NTL		Open surgery	Laparo-scopic	Peritoneo-scopic	Percuta-neous
	Total patients	**3,682**	1,412	46	1,358	866	**813**	361	147	24	281
	%		38.3	1.2	36.9	23.5		44.4	18.1	3.0	34.6
Age at first dialysis	<60	**1,269**	33.9	1.1	43.7	21.4	**421**	43.7	18.3	3.3	34.7
	≥60	**2,413**	40.7	1.3	33.3	24.7	**392**	45.2	17.9	2.6	34.4
BMI (kg/m^2)	≤30	**1,056**	42.8	1.3	32.9	23.0	**263**	58.9	11.8	7.2	22.1
	>30	**432**	53.2	2.3	29.6	14.8	**97**	76.3	8.2	3.1	12.4
PRD	Diabetes	**980**	41.4	1.7	39.3	17.6	**202**	44.1	18.8	1.0	36.1
	GN	**446**	39.5	0.2	37.0	23.3	**131**	44.3	17.6	4.6	33.6
	Hypertension	**289**	48.4	1.0	34.9	15.6	**64**	42.2	25.0	4.7	28.1
	Other	**654**	21.4	1.1	42.2	35.3	**111**	46.8	18.0	3.6	31.5
	PKD	**171**	65.5	1.2	25.7	7.6	**72**	45.8	9.7	4.2	40.3
	Pyelo	**209**	40.2	3.3	35.9	20.6	**45**	42.2	11.1	2.2	44.4
	RVD	**251**	37.8	0.0	33.9	28.3	**41**	46.3	24.4	4.9	24.4
	Uncertain	**521**	43.6	1.2	33.2	22.1	**133**	45.9	14.3	2.3	37.6
Referral time (days)	<90	**853**	4.3	0.6	48.5	46.5	**85**	22.4	23.5	3.5	50.6
	≥90	**2,538**	50.1	1.3	33.6	15.0	**720**	47.4	17.4	2.9	32.4
Assessed by surgeon	No	**1,435**	5.6	0.3	53.5	40.6	**306**	55.6	5.9	1.0	37.6
	Yes	**1,690**	67.7	2.0	21.4	8.9	**386**	36.8	24.4	5.4	33.4

*PD patients with missing insertion technique are excluded
Patients from centres with more than 50% missing data for a variable are excluded from the table for that variable
AVF = arteriovenous fistula; AVG = arteriovenous graft; TL = tunnelled line; NTL = non-tunnelled line; GN = glomerulonephritis; BMI = body mass index; PRD = primary renal diagnosis; GN = glomerulonephritis; PKD = polycystic kidney disease; Pyelo = pyelonephritis; RVD = reno-vascular disease

- Referral time had an influence on PD catheter insertion technique; 50.6% of patients referred less than 90 days before starting dialysis underwent percutaneous insertion compared to 32.4% of patients known longer to the service. These data were reversed for general surgical insertion: 22.4% of patients who presented late versus 47.4% of patients who did not present late.

The proportional distribution of HD access modality was similar for different primary renal disease diagnoses (figure 14.2). Of note, patients with polycystic kidney disease were more likely to start HD on an AVF. This likely results from the opportunity for timely access preparation as these patients are often known to renal services for many years before dialysis is required and indeed there is also evidence of a higher transplantation rate amongst this group [12]. Where no primary renal diagnosis was available (either missing or coded as uncertain aetiology), the numbers of patients starting dialysis with a tunnelled or non-tunnelled dialysis venous catheter were higher, suggesting that this may represent a cohort of patients who present later and in whom a PRD cannot be ascertained.

Patients with body mass index (BMI) >30kg/m^2 were more likely to undergo open surgical placement (76.3%) than those with BMI ≤30kg/m^2 (58.9%) (figure 14.3). The percutaneous approach was nearly half as likely to be used in patients in the higher BMI category (12.4%) compared with those with a lower BMI (22.1%). Equally, peritoneoscopic placement in the higher BMI category was 50% less likely than in the lower BMI group (3.1% vs. 7.2%). It should be noted that the analysis was limited due to a high proportion of missing data for BMI.

Patients aged less than 60 at the point of commencing RRT were less likely than older patients to start dialysis using an AVF (33.9% vs. 40.7%) (figure 14.4). The reason for this is unknown but may reflect patient engagement with renal services or varying progression of chronic kidney disease in the older population [13, 14, 15]. Similarly, utility of non-tunnelled lines was lower in younger dialysis patients (21.4% vs. 24.7%) in contrast to the use of tunnelled lines which were more common in those aged less than 60 (43.7% vs. 33.3%).
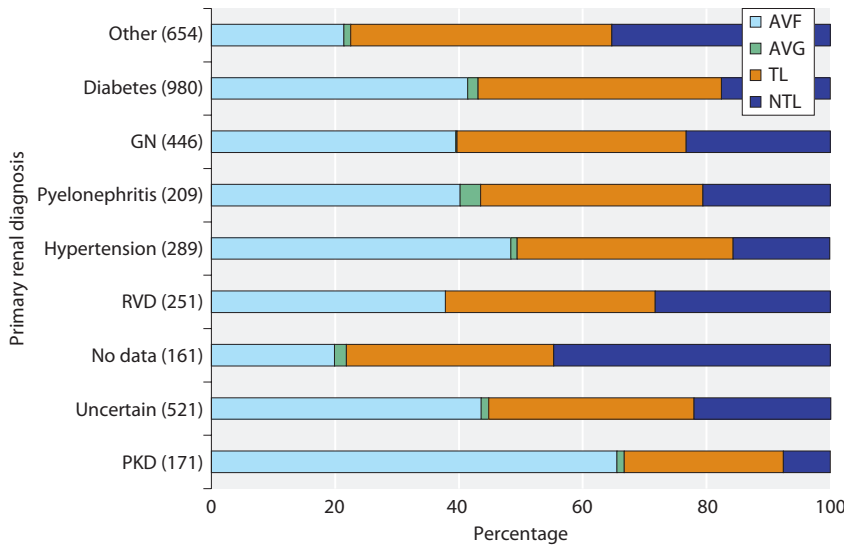
Fig. 14.2. Type of haemodialysis access stratified by primary renal disease
Number of patients in each primary renal diagnosis group in brackets
Primary renal diagnosis groups sorted by percentage of tunnelled lines
AVF = arteriovenous fistula; AVG = arteriovenous graft; TL = tunnelled line; NTL = non-tunnelled line; GN = glomerulonephritis; RVD = reno-vascular disease; PKD = polycystic kidney disease

First dialysis access and renal centre

Large variations were apparent between centres when considering patients commencing dialysis via an AVF (figure 14.5). At one end of the spectrum was Ulster who reported a total of 27 patients with 7.4% starting on an AVF, 0% on an AVG, 48.1% starting on a tunnelled line, 33.3% using a non-tunnelled line and 11.1% PD catheter. In contrast, Liverpool Aintree reported a total of 57 patients with 54.4% using an AVF, 3.5% on an AVG, 5.3% using a tunnelled line, 15.8% on a non-tunnelled line and 21% on a PD catheter.

Use of a PD catheter as first access varied between 44.4% (Wolverhampton) and 0% (Colchester) (figure 14.5). Centres that had high usage of AVFs as starting access were also more likely to start patients on a PD catheter. There was some evidence (p = 0.02) that the proportion of HD patients starting on an AVF increased as the proportion of dialysis patients starting on PD increased. This may indicate variation in local processes for access planning and delivery.

The current audit question asked centres to report which type of access was used for the first ever dialysis session. The problem with this audit question is that
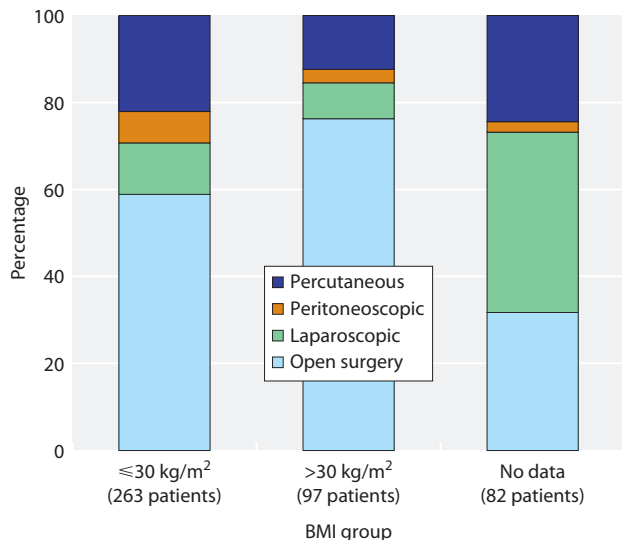
Fig. 14.3. Method of PD catheter insertion stratified by body mass index
BMI = body mass index
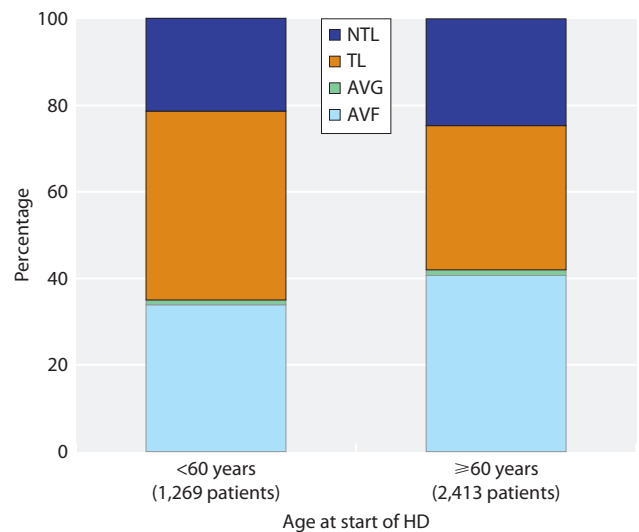All patients from centres with more than 50% missing data for BMI were excluded

Fig. 14.4. Type of haemodialysis access stratified by age group
AVF = arteriovenous fistula; AVG = arteriovenous graft; TL = tunnelled line; NTL = non-tunnelled line
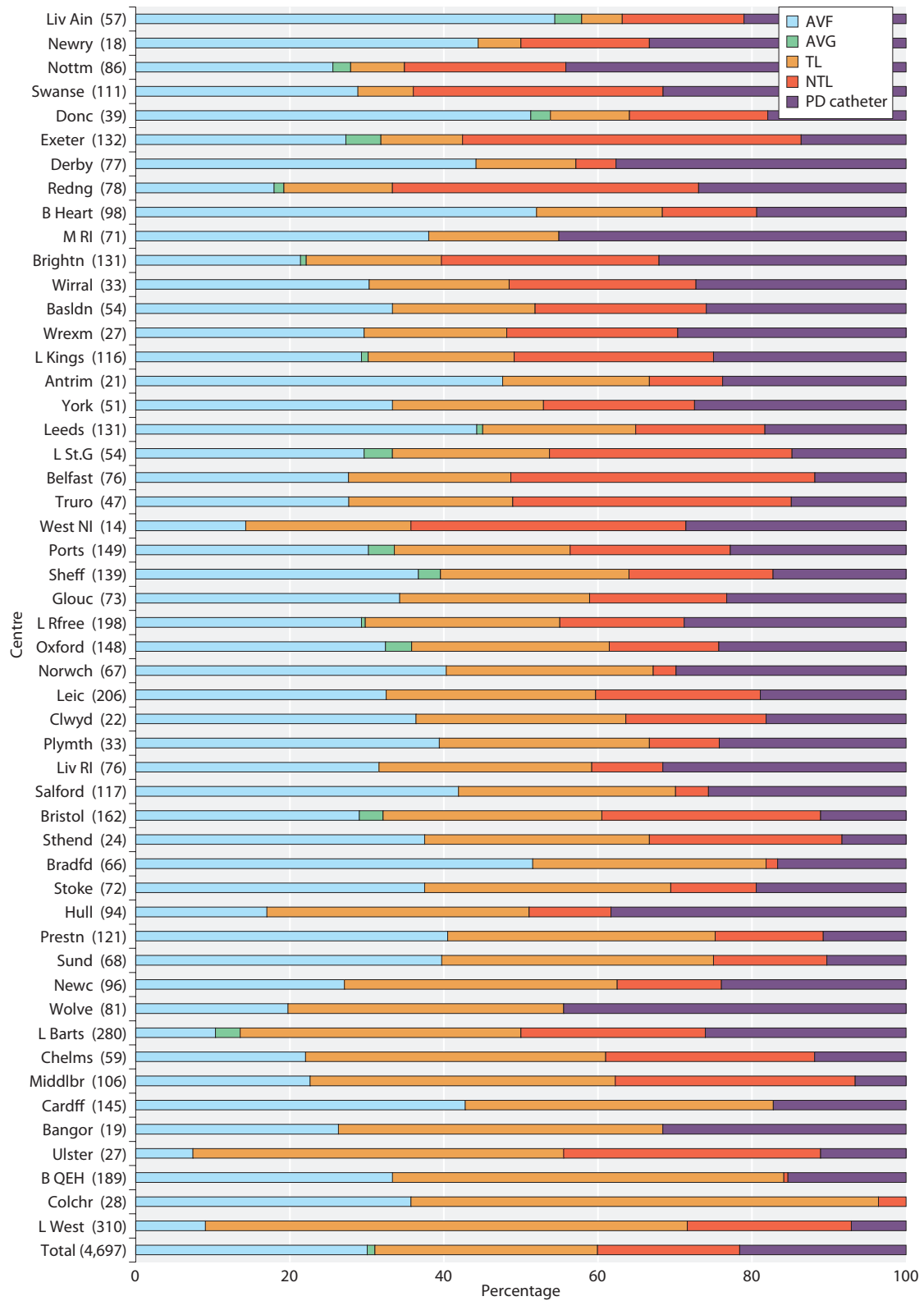
Fig. 14.5. Type of first dialysis access stratified by centre
Centres are ordered by the percentage of patients using a tunnelled line
AVF = arteriovenous fistula; AVG = arteriovenous graft; TL = tunnelled line; NTL = non-tunnelled line; PD = peritoneal dialysis
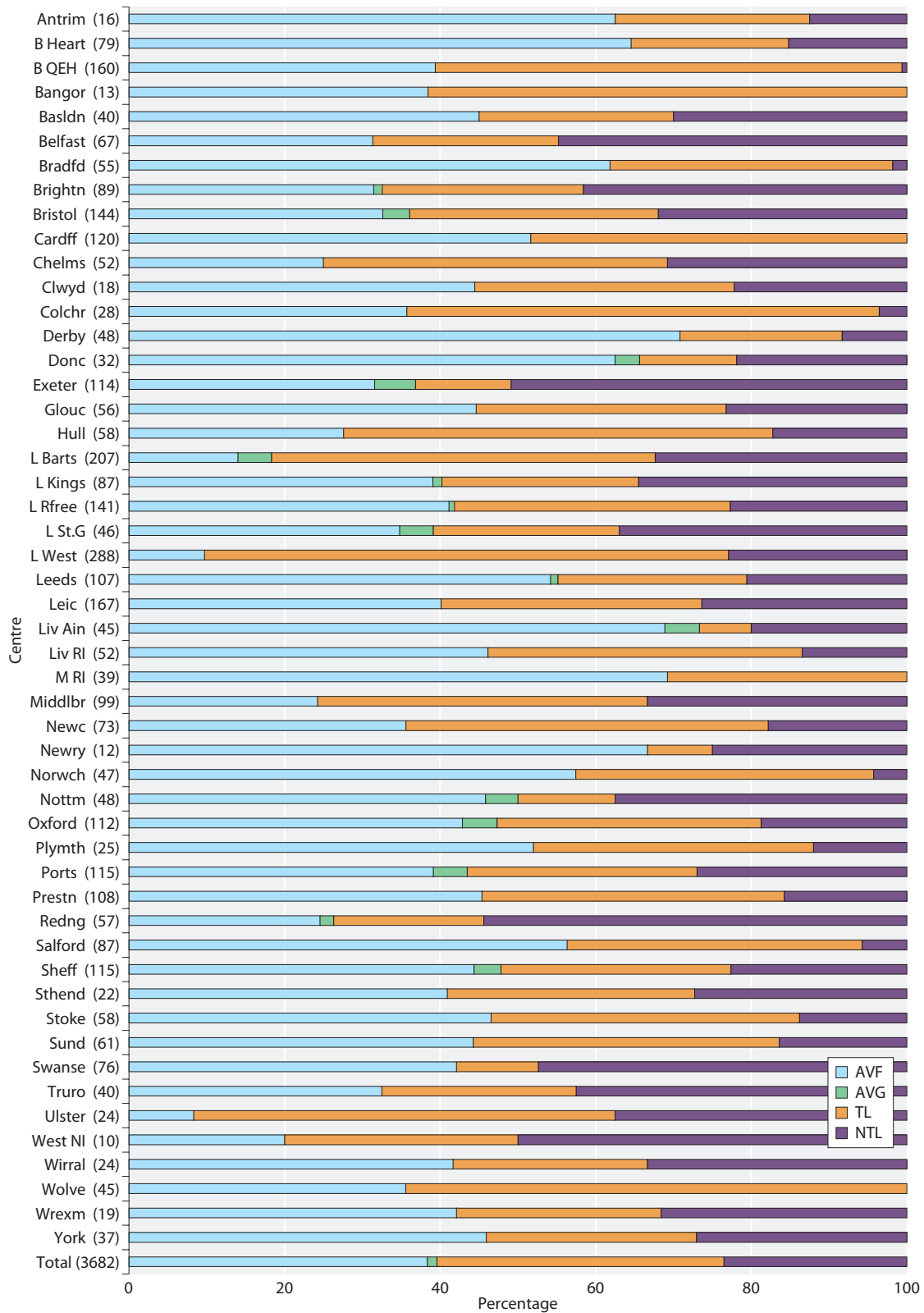
Fig. 14.6. Type of first access for haemodialysis stratified by centre
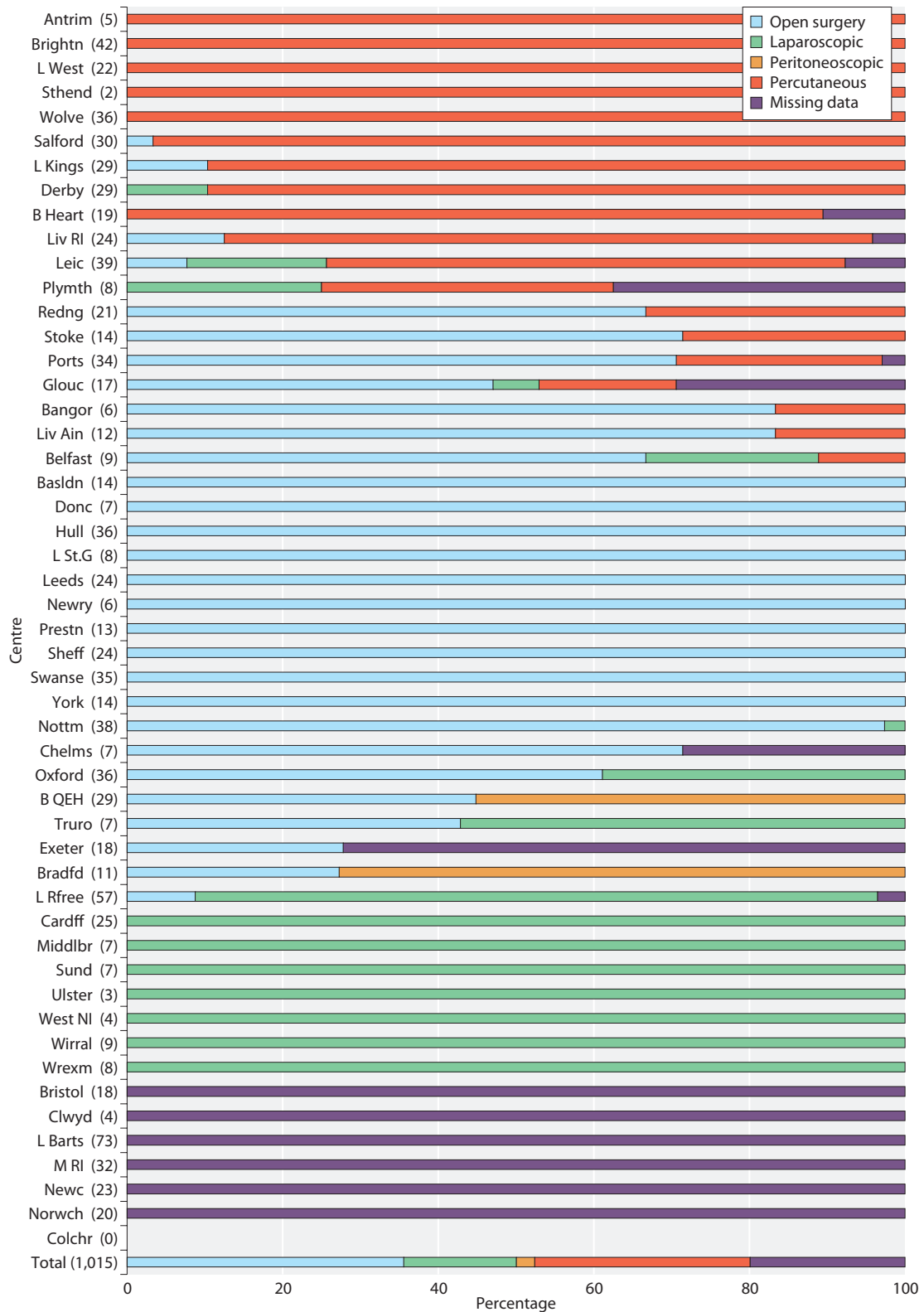AVF = arteriovenous fistula; AVG = arteriovenous graft; TL = tunnelled line; NTL = non-tunnelled line

Fig. 14.7. PD catheter insertion technique stratified by centre

many centres use a non-tunnelled line for a few days while either a tunnelled line for HD or a PD catheter is placed, and therefore in retrospect the access used for the fourth dialysis session may provide a better description of the dialysis access selected for patients presenting late.

Consideration of haemodialysis access separately from the PD group revealed wide variation in the use of AVFs for first HD (figure 14.6). This was demonstrated with the range being from 8.3% in Ulster to 70.8% in Derby (38.3% of HD patients at all centres). Central venous lines were clearly the main form of access where an AVF was not available. The centres with highest tunnelled line use were London West (67.3%), Wolverhampton (64.4%), Bangor (61.5%), and Colchester (60.7%). Two centres reported non-tunnelled lines as the starting form of access in more than 50% of HD patients (Reading 54.4%, Exeter 58.9%). It will be important to understand the variations in practice patterns that lie behind these statistics which were not provided by current data.

Eighteen centres reported less than 10 patients using PD catheters for first dialysis in 2012 (figure 14.7). For a total of 1,015 first PD catheters the insertion techniques were 35.6% open surgical, 14.5% laparoscopic, 2.4% peritoneoscopic and 27.7% percutaneous. Insertion technique was not reported for the remaining 19.9%. There seems to be a strong tendency for many centres to rely on one single approach to PD catheter placement, it is notable that 22 centres reported using a single technique for all of their patients. This is important if evidence were to suggest a benefit to offering an individualised technique (e.g. percutaneous approach for low BMI patients without previous surgery, or an open surgical approach for more complex patients). Only 19 centres reported using the percutaneous technique at all and these were Antrim, Birmingham Heartlands, Bangor, Belfast, Brighton, Derby, Gloucester, Leicester, London Kings, London West, Liverpool Aintree, Liverpool Royal Infirmary, Plymouth, Portsmouth, Reading, Salford, Southend, Stoke and Wolverhampton. Amongst these centres were some of those with the highest proportion of patients using a PD catheter as first access (Wolverhampton 44%, Derby 34%, Brighton 32%, Liverpool RI 26%, Salford 25%, Antrim 24%, London Kings 22%). Of the 20 centres with the lowest PD usage as first access only three used the percutaneous approach.

First dialysis access and referral time
Figure 14.8 shows first access for centres providing data for patients presenting late (known to renal services

for <90days). Amongst the 977 patients for whom data were reported, 43.1% started dialysis on a tunnelled line, 41.5% on a non-tunnelled line, 11.0% using a PD catheter with only 4.0% having first access documented as an AVF. There was, however, wide variation amongst centres and clearly an understanding of practice patterns could lead to potential improvements in access service provision. There may also be reporting differences which need to be explored. Non-tunnelled haemodialysis lines are often used as a bridge to a more definitive form of access and it would be important to know what access was used at the end of the first week. As discussed above, revision of the question used in the audit to investigate the access used for the fourth rather than the first dialysis session in patients presenting late may provide more valuable information.

Only 13 centres reported that more than 15% of patients presenting late had a peritoneal dialysis catheter inserted for use as first dialysis access. As the large part of the remainder of patients presenting late start dialysis using a tunnelled vascular line, the centres that were able to make use of PD catheters for patients presenting late had a lower requirement for tunnelled or non-tunnelled lines. However, the number of patients presenting late reported in some centres was extremely small and it is difficult to make firm observations about clinical pathways for the development of dialysis access in this cohort.

Figure 14.9 combines PD and HD access data to demonstrate the association between referral time to renal services and the type of access used for the first treatment. A strong relationship is seen between being known to the renal centre for more than a year and the likelihood of commencing dialysis using either an AVF or a PD catheter. For patients presenting late, 84.6% start on some form of central venous line; however, amongst patients known to the centre for a year or more this percentage falls to 33.9%. Amongst HD patients there was a strong relationship between being known to the centre for more than a year and the use of AVF in preference to a venous line. Figure 14.9 demonstrates that as the time known to renal services increases, the proportion of patients starting dialysis on a line falls, whilst the proportion starting with an AVF or PD catheter increases. The number of patients starting dialysis with an AVG appears to remain the same regardless of the referral time, but numbers are very small.

First dialysis access and surgical assessment
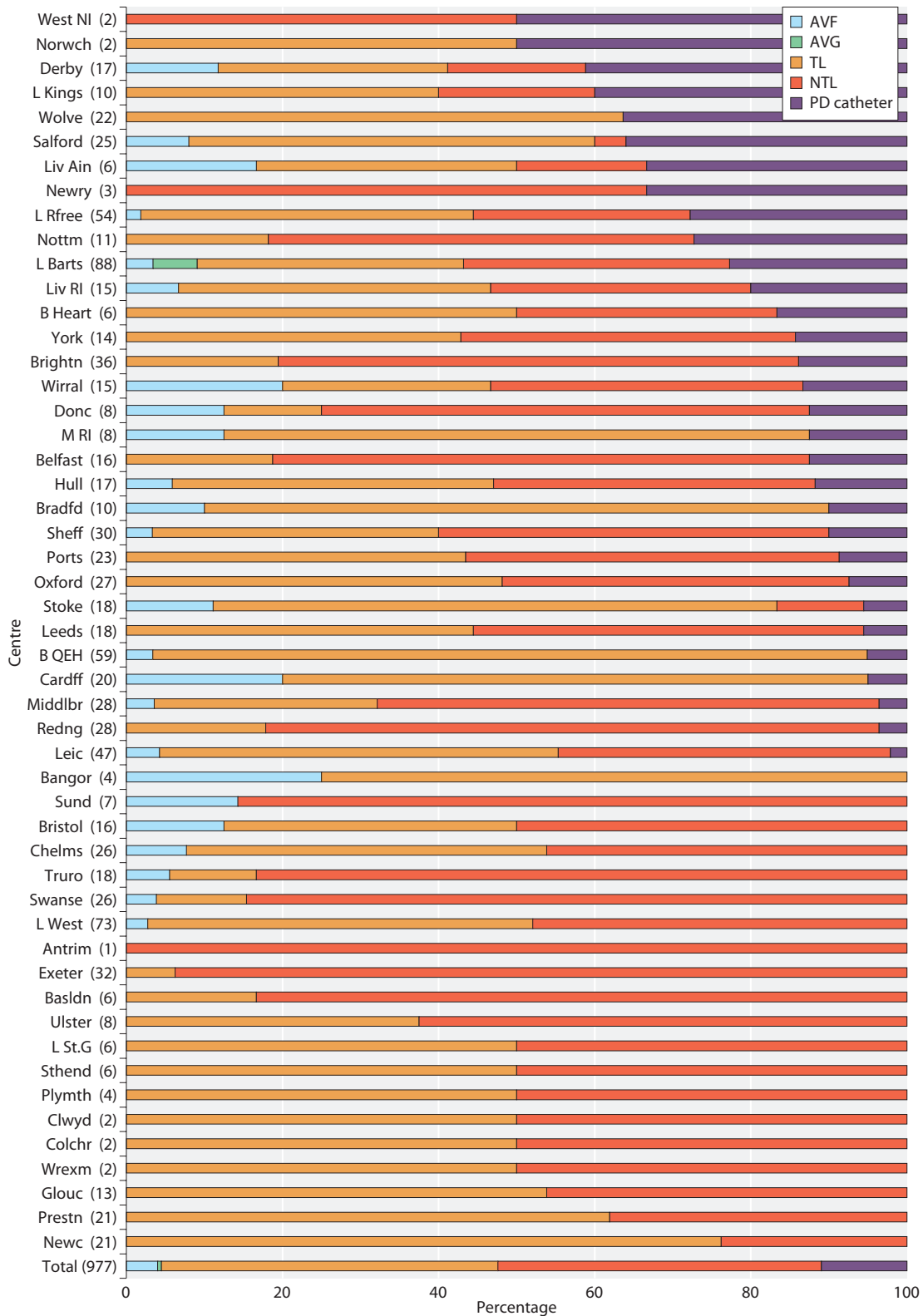Figure 14.10 shows the variation in centres according to whether PD catheters were inserted at least two

Fig. 14.8. Type of access for the first dialysis in patients presenting to a nephrologist <90 days prior to dialysis start
AVF = arteriovenous fistula; AVG = arteriovenous graft; TL = tunnelled line; NTL = non-tunnelled line; PD = peritoneal dialysis
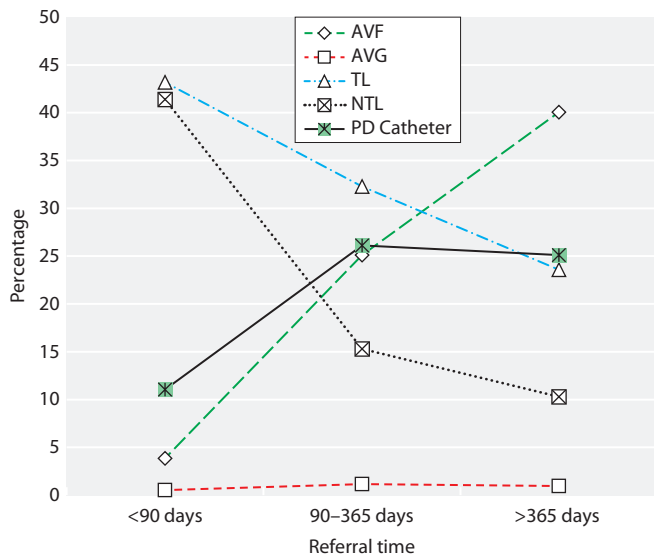
Fig. 14.9. Type of first dialysis access stratified by referral time
AVF = arteriovenous fistula; AVG = arteriovenous graft; TL = tunnelled line; NTL = non-tunnelled line; PD = peritoneal dialysis

weeks prior to commencing dialysis. Renal Association Peritoneal Access Clinical Guidelines state that [16]:

'Whenever possible, catheter insertion should be performed at least 2 weeks before starting peritoneal dialysis. Small dialysate volumes in the supine position can be used if dialysis is required earlier.'

This guideline was intended to reduce the risk of dialysate leakage following catheter insertion, however it may actually have resulted in patients being less likely to use the PD catheter for early start PD and therefore possibly be exposed to the hazards of a central venous line. It will be important to understand the association between early use and catheter outcomes. This has been explored in previous publications demonstrating a modest increase in dialysate leakage can be mitigated by careful preventative management [17]. It is quite possible that this guideline has been a disincentive to using PD for patients presenting late or for acute kidney injury and revision should be considered in the next iteration of the guideline.

From figure 14.11 it is clear that PD patients seen by a surgeon at least three months prior to starting RRT were more likely to have a laparoscopic insertion. Of those receiving surgical assessment at least three months prior to commencing dialysis, 24.4% underwent laparoscopic insertion *vs.* 5.9% of those who did not. Indeed, patients who underwent surgical assessment at least
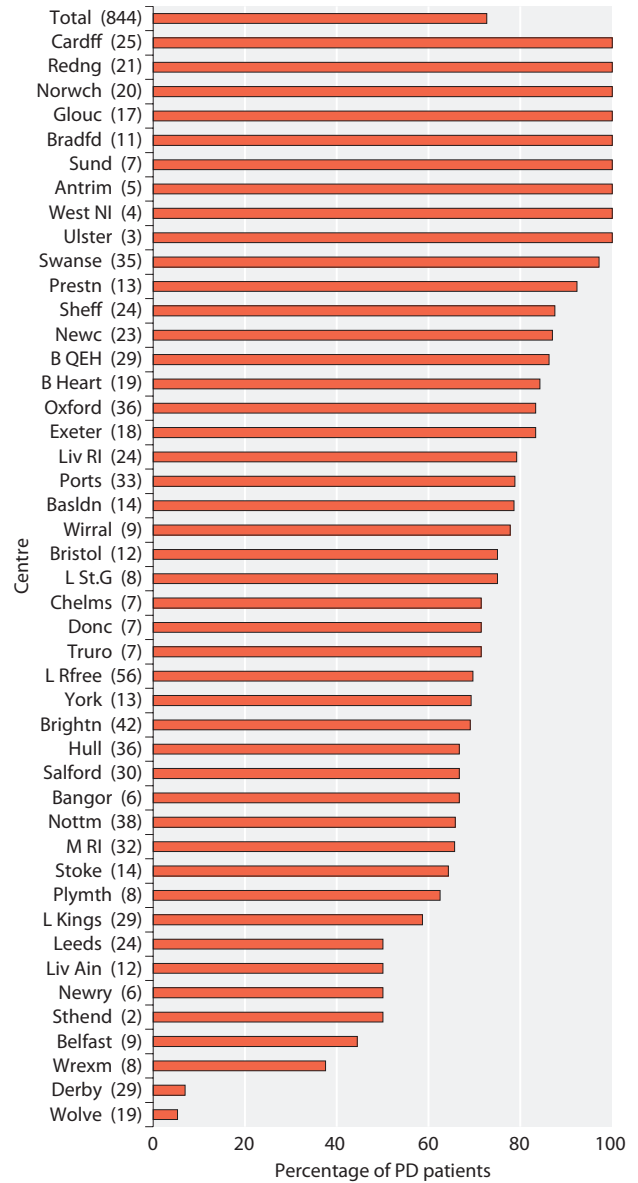

Fig. 14.10. Percentage of patients with PD catheter insertion >2 weeks before starting dialysis

three months prior to starting PD were less likely to have catheter placement via open surgical technique than those who did not, possibly because such patients were more likely to have the laparoscopic approach. There does not appear from this data to be a relationship between surgical assessment and percutaneous catheter placement.

This relationship was very different from that between surgical assessment and AVF formation (see the next section). It is quite possible that the time required to plan PD catheter placement is less than that required
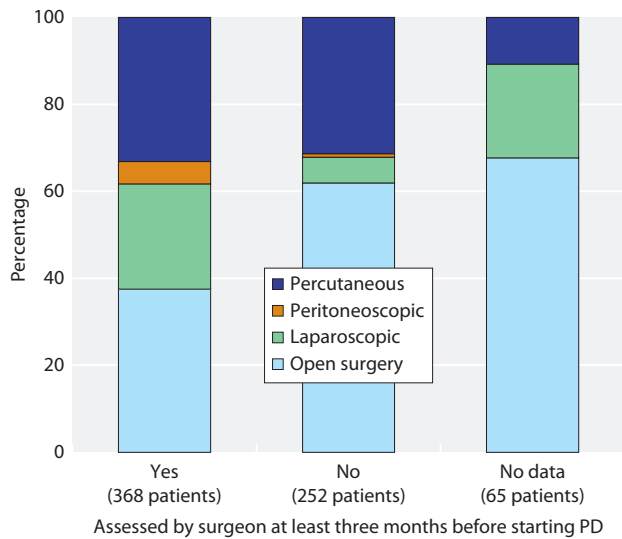
Fig. 14.11. PD catheter insertion technique stratified by surgical assessment

Fig. 14.12. Frequency of surgical assessment more than three months prior to starting dialysis

for AVF formation where vein mapping may be necessary.

Figure 14.12 highlights the proportion of patients who had been referred for surgical assessment at least three months prior to starting dialysis. Six renal centres were excluded because they returned data regarding surgical assessment or first seen date on fewer than half of their patients (Clwyd, London Barts, Leicester, Manchester Royal Infirmary, Norwich, Plymouth). There was considerable variation between the remaining renal centres. Overall, the proportion referred to a surgeon was highest in York (92.0%) and Middlesbrough (91.7%). Out of 2,246 patients with a referral time to nephrological services of more than 90 days, 67% per cent had been referred to a surgeon at least three months prior to dialysis start.

A detailed understanding of factors that prevent patients from being assessed for access in a timely fashion is required. These may reflect organisational factors or clinical uncertainty around the need for dialysis.

Figure 14.13 demonstrates a strong relationship between being assessed by a surgeon at least three months before starting dialysis and the likelihood of starting on an AVF. This relationship was much stronger than that between surgical assessment and method of PD catheter placement. This suggests that the role of surgical assessment is more important in relation to AVF placement. Of those assessed by a surgeon at least three months prior to starting dialysis, 70.4% started dialysis on an
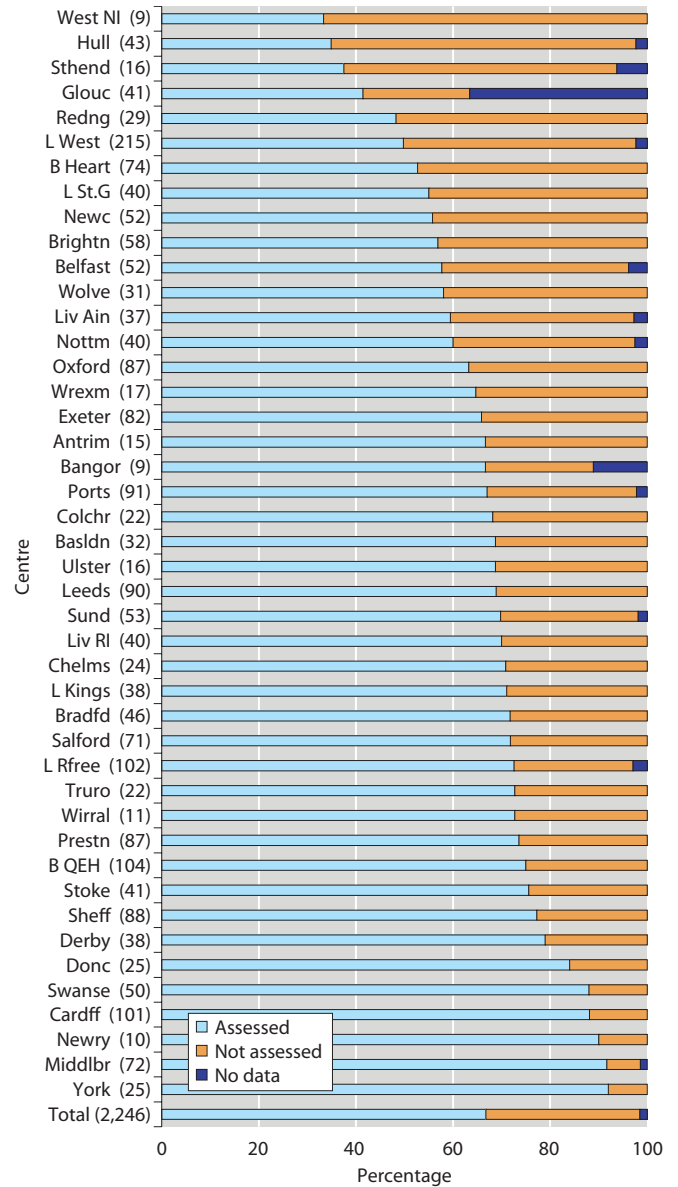
AVF whereas of those who were not seen by a surgeon only 9.7% did. Clearly, timely surgical assessment is a key component of the clinical pathway to fistula placement.

If data from figures 14.11 to 14.13 are considered together, the importance of timely referral for surgical assessment (if haemodialysis is the selected modality) is clear. Without such assessment, patients are more likely to require temporary haemodialysis access such as a tunnelled or non-tunnelled dialysis catheter.
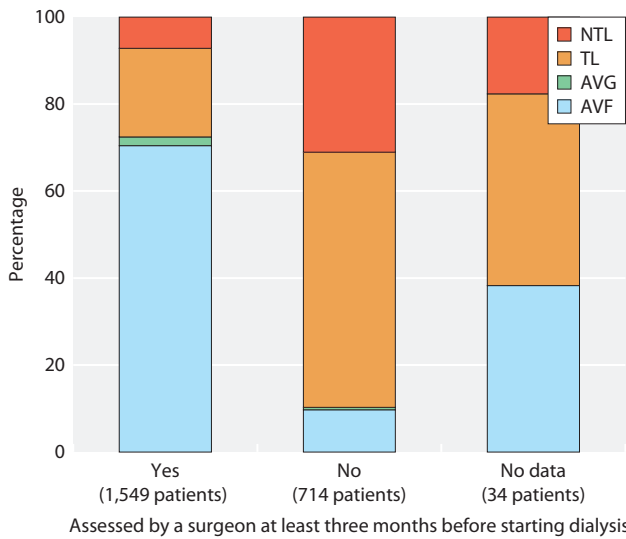
Fig. 14.13. Type of haemodialysis access stratified by surgical assessment
AVF = arteriovenous fistula; AVG = arteriovenous graft; TL = tunnelled line; NTL = non-tunnelled line

Fig. 14.14. Type of dialysis access at three months
AVF = arteriovenous fistula; AVG = arteriovenous graft; TL = tunnelled line; NTL = non-tunnelled line; PD = peritoneal dialysis; Tx = transplanted; LTFU = lost to follow up

Dialysis access at three months after starting RRT

The type of access used three months after starting dialysis gives an important insight into the responsiveness of the access formation pathway. Table 14.3 expresses the proportion of patients still dialysing using a particular form of access as a percentage of the access they originally started dialysis with. For example, 87.2% of patients starting dialysis with an AVF were still using this at three months and 83.4% of patients starting on PD remained on this modality at three months. Of patients starting dialysis via a tunnelled line, the majority continued to use this form of access at three months (72.6%) and of 864 patients who commenced dialysis via a non-tunnelled line, 502 (58.1%) were dialysing
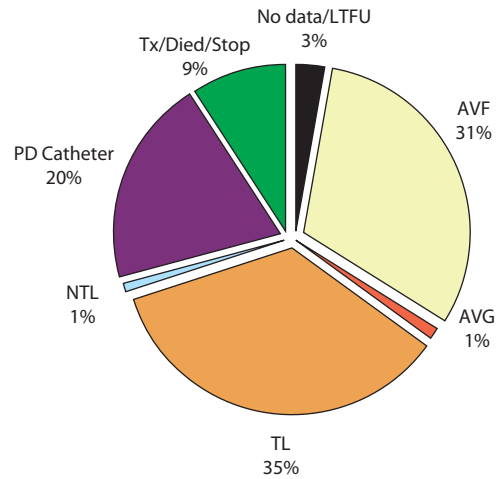
through a tunnelled line at three months. This may suggest that obtaining definitive access for HD within three months of starting treatment remains a challenge.

Figures 14.14 and 14.15 demonstrate the differences in access outcomes in aggregate and stratified by centre respectively. By three months, 30.9% of patients were dialysing using an AVF (range 7.5% London Barts to 59.6% Liverpool Aintree); 0.9% were using an AVG (0% many sites to 6.1% Exeter); 34.5% tunnelled lines (5.3% Liverpool Aintree to 77.7% London West); 1.3% non-tunnelled lines; and 19.7% were using a PD catheter (0% Plymouth to 48.1% Wolverhampton).

The majority (59.8%) of patients presenting late were being dialysed using tunnelled lines at three months after dialysis start (figure 14.16). The between centre range was from 0% in three centres (Clwyd, Newry,

Table 14.3. Type of dialysis access at 3 months stratified by first access type

Access in use at first dialysis (N)	Access in use at three months								
	AVF	AVG	TL	NTL	PD catheter	Transplanted	Died	Stopped/LTFU	No data
AVF (1,358)	**87.2**	0.3	3.7	0.0	0.9	0.9	4.6	0.1	2.4
AVG (46)	2.2	**71.7**	6.5	0.0	2.2	0.0	6.5	0.0	10.9
TL (1,328)	11.0	0.2	**72.6**	0.4	2.7	1.3	8.4	0.3	3.2
NTL (864)	8.4	0.1	58.1	**6.4**	5.2	0.0	16.4	0.3	5.0
PD (963)	0.4	0.1	5.7	0.0	**83.4**	2.4	2.5	0.2	5.3

AVF = arteriovenous fistula; AVG = arteriovenous graft; TL = tunnelled line; NTL = non-tunnelled line; PD = peritoneal dialysis; LTFU = lost to follow up
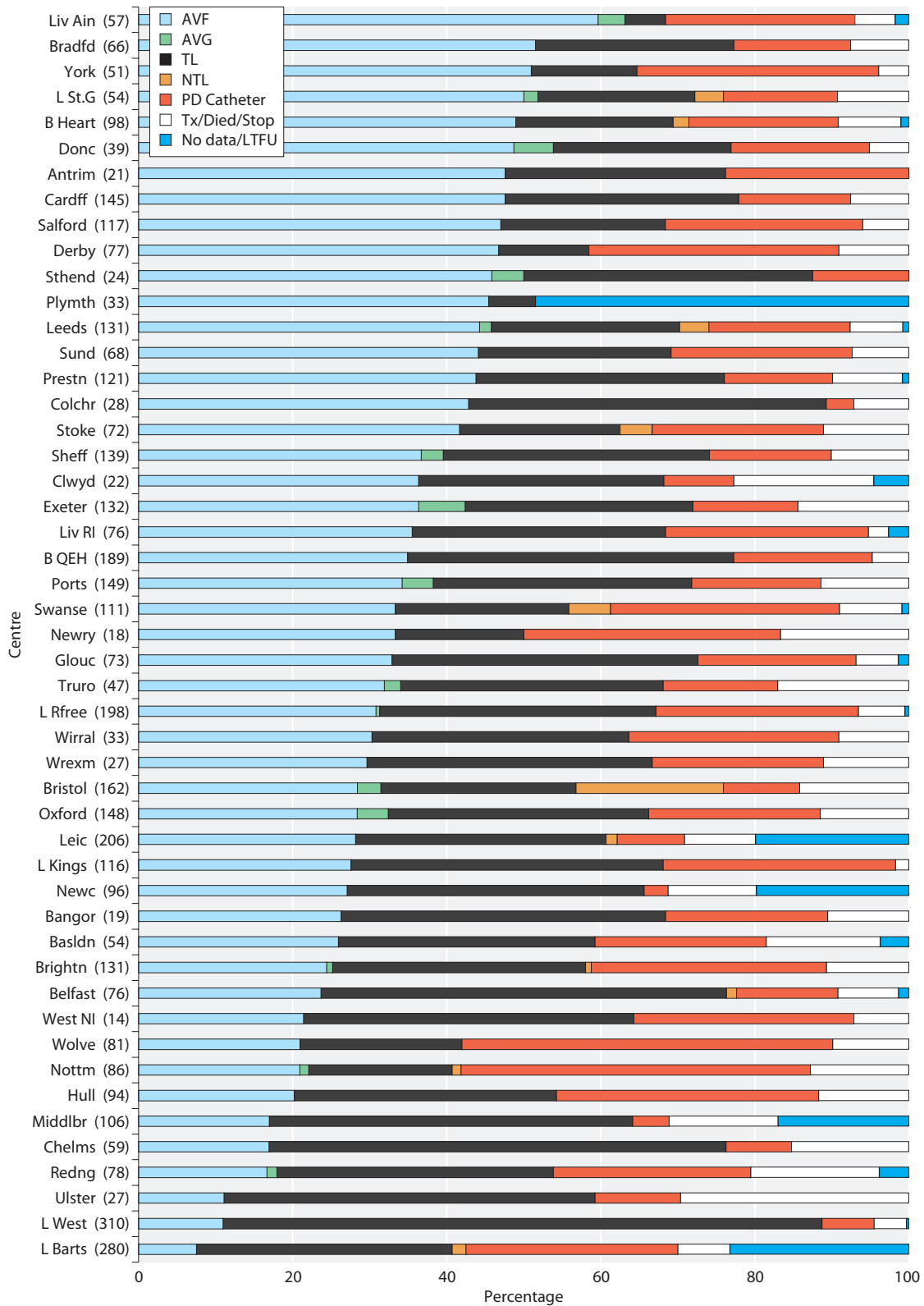
Fig. 14.15. Type of dialysis access at three months stratified by centre
AVF = arteriovenous fistula; AVG = arteriovenous graft; TL = tunnelled line; NTL = non-tunnelled line; PD = peritoneal dialysis;
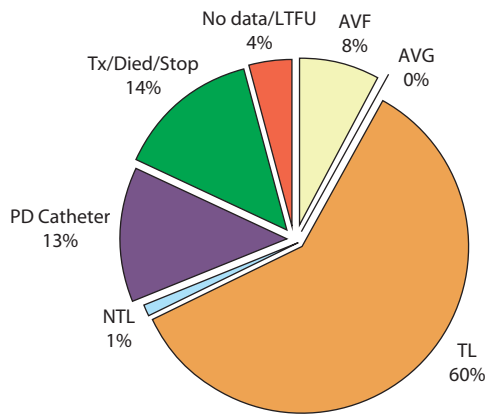Tx = transplanted; LTFU = lost to follow up

Fig. 14.16. Type of dialysis access at three months in patients referred to renal services less than 90 days before starting dialysis AVF = arteriovenous fistula; AVG = arteriovenous graft; TL = tunnelled line; NTL = non-tunnelled line; PD = peritoneal dialysis; Tx = transplanted; LTFU = lost to follow up

Sunderland) to 93.1% at London West (figure 14.17). Amongst patients presenting late, only 8.0% were using an AVF at three months (individual centres ranged from 0% in 16 centres to 75% in Plymouth). PD catheters were used by 12.7% of patients (range 0% in 14 centres to 85.7% in Sunderland). These percentages must be interpreted with caution as reported numbers of patients presenting late tended to be low in many centres.

Figure 14.18 shows comparative access failure for the different access types within three months. This was defined as a documented date of failure/discontinuation recorded within three months of starting dialysis unless a centre comment indicated that it was a planned discontinuation. Failure rates were generally less than 5%, apart from AVGs where it was closer to 15%. There were deficiencies in the way that failure was recorded in this audit, however it is interesting that for most forms of access the failure rates are rather similar at three months.

Numbers of access failures reported were small, however it can be seen from figure 14.19 that there was relatively poor reporting of the reason for failures. This may reflect local documentation procedure. Infectious causes were reported as contributing to 26.1% of access failures of tunnelled lines and 12.1% of non-tunnelled lines, and stenosis was reported as contributing to 22.7% of AVF failures. Steal syndrome was also a common reason for failure in AVF and AVG (29.5% and 28.6% respectively). This data should be regarded as provisional and would benefit from further detailed exploration in future audit.

Reported causes of access failures amongst peritoneal dialysis patients are not included here as the numbers reported were too low to make firm conclusions.

2011 PD access audit one-year follow-up

Centres who reported on PD patients in the 2011 vascular and peritoneal access audits were asked to complete a one year follow up of their PD patients. The additional information requested was the date of catheter failure, the reason for catheter failure, the number of catheters used during the year, and the modality in use at one year after starting PD. Of 44 centres who reported data on PD patients in 2011, 28 completed the one year follow up request returning data on 649 (70.9%) patients.

The reported numbers were too low to draw firm conclusions. Unsurprisingly the principal causes of catheter failure were flow or infection related (figure 14.20).

Figure 14.21 is a funnel plot which graphically displays the unadjusted percentage of PD patients experiencing a catheter failure within one year of commencement of RRT across multiple renal centres according to Speigelhalter's method [18]. PD catheter failure was censored for transplantation, elective transfer to HD or death. The bold dotted line represents the mean one-year catheter failure (23.0%). The 95% (solid lines) and 99.9% (dotted lines) binomial control limits (essentially corresponding to 2 and 3 standard deviations) were superimposed to indicate possible outlier thresholds for 'alert' and 'alarm' [19]. The results have to be cautiously interpreted due to the extent of and variation in missing data, small numbers of patients in some centres and non-adjustment for any patient related factors.

Of the centres for which data were available ($n = 28$), no outlier centres were identified with failure rates above the upper 95% 'alert' or 99.9% 'alarm' limits for PD catheter failures. Such data is suggestive of the absence of outlier centres with abnormally poor one year catheter survival rates relative to the other centres. Contrastingly, four renal centres reported one-year catheter failure rates *below* the 95% control limit. Furthermore, of these, one centre reported a one-year catheter failure rate of zero. This centre was thus considered as an 'alarm' outlier raising questions over data integrity or accuracy.

Of note, although the overall mean one-year catheter failure rate was similar to that which was recommended in the guidelines issued by the ISPD/RA [16, 20] (23% vs. 20%), reported failure rates of as low as 10% raise questions of whether such modest targets should be revised to improve practice [21].
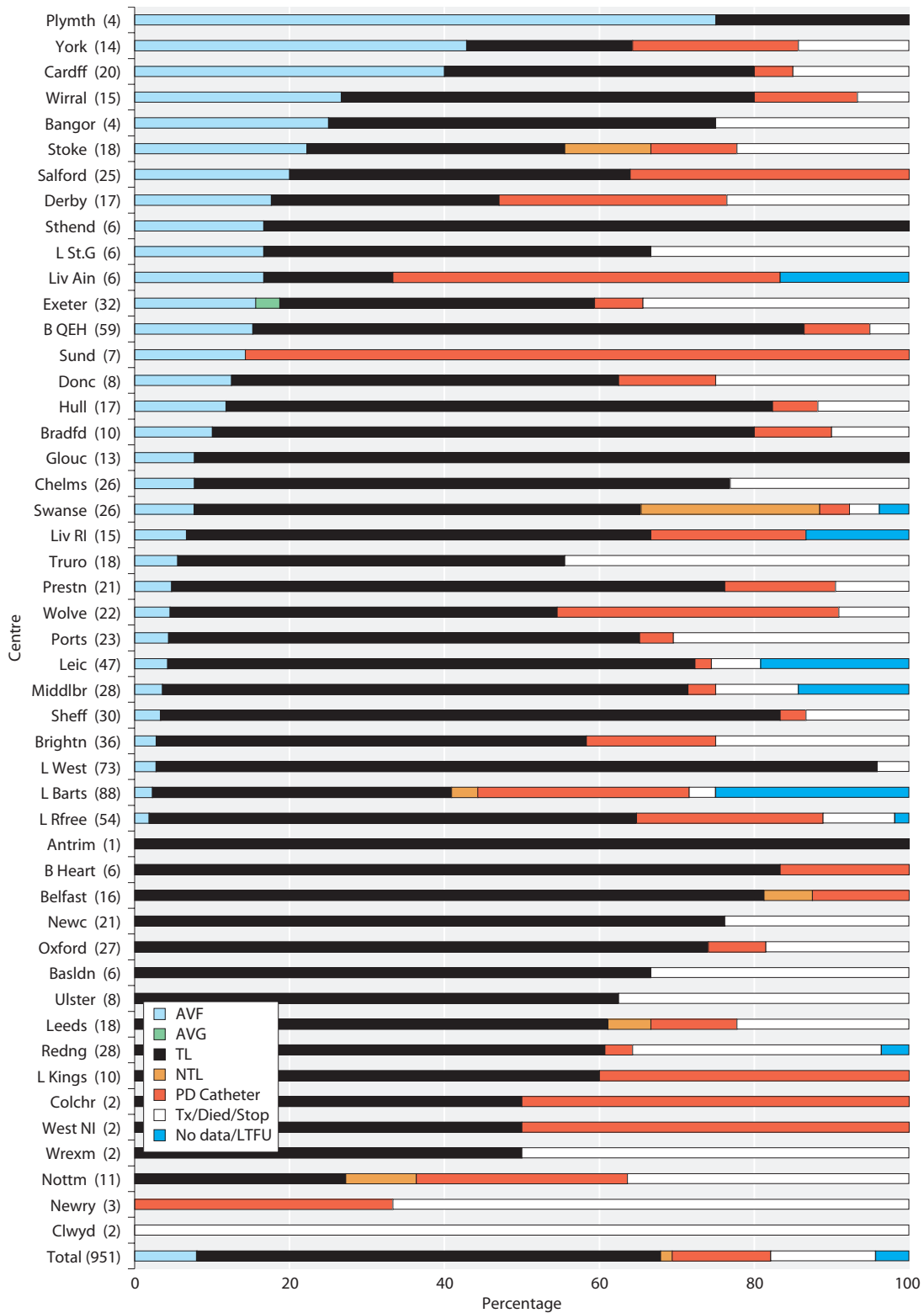
Fig. 14.17. Type of dialysis access at three months in patients referred to renal services less than 90 days before starting dialysis, stratified by centre

AVF = arteriovenous fistula; AVG = arteriovenous graft; TL = tunnelled line; NTL = non-tunnelled line; PD = peritoneal dialysis; Tx = transplanted; LTFU = lost to follow up
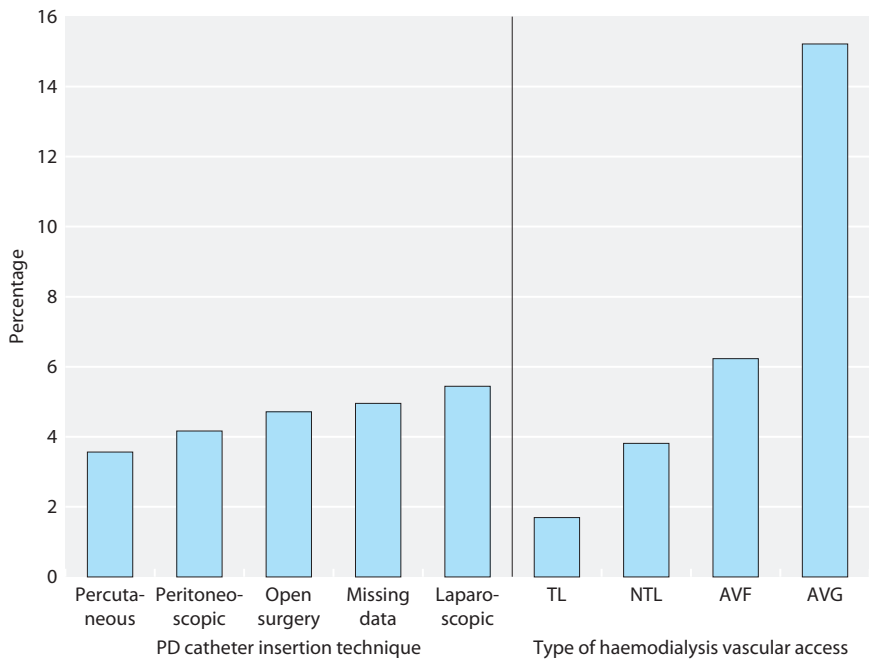
Fig. 14.18. Percentage of patients experiencing failure of first access within three months, by type of first access
AVF = arteriovenous fistula; AVG = arteriovenous graft; TL = tunnelled line; NTL = non-tunnelled line; PD = peritoneal dialysis

Discussion and recommendations

• This multisite dialysis access audit from England, Wales and Northern Ireland has provided important information regarding the variation in access provision and outcomes. Although this audit represents an important advance for the UK, data collection is still not optimal as significant amounts of missing data across a range of fields exist. Equally, there remain ambiguities in the data fields which need to be refined to simplify collection and improve accuracy. It may be preferable to collect dialysis access at the fourth rather than the first dialysis session since non-tunnelled lines are often used for one or two dialysis sessions before more permanent access is achieved (PD catheter or tunnelled line).
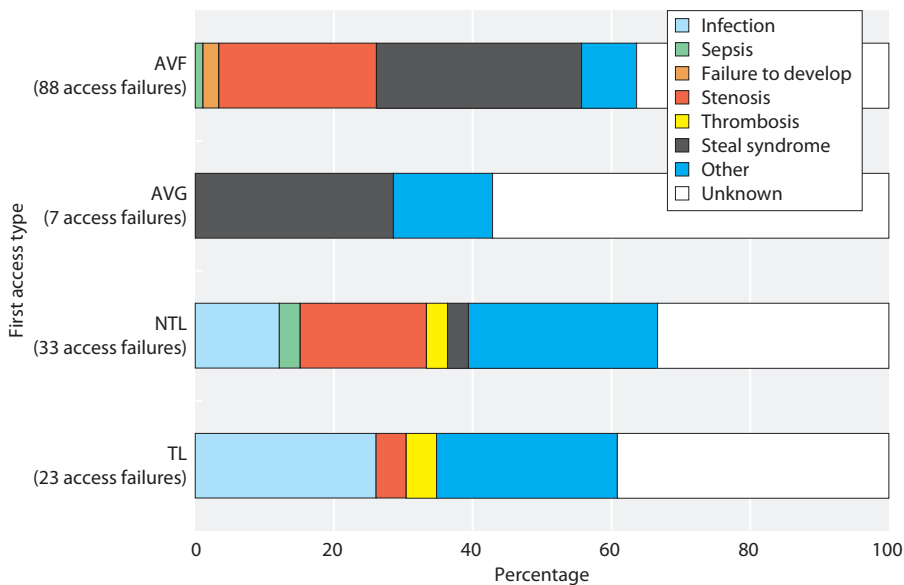

Fig. 14.19. Reported causes of access failure within three months (haemodialysis) stratified by first access type
AVF = arteriovenous fistula;
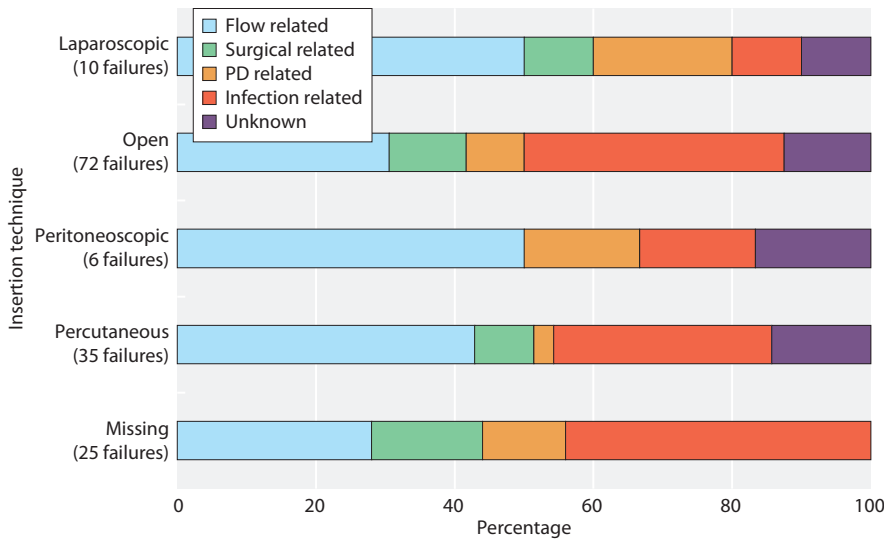AVG = arteriovenous graft; TL = tunnelled line; NTL = non-tunnelled line

Fig. 14.20. Causes of dialysis access failure within one year of PD catheter insertion

- It is clear from the data that many centres still utilise high numbers of tunnelled and non-tunnelled dialysis catheters especially in patients presenting late. Of concern is that tunnelled lines continue to be used in approximately a third of patients three months post dialysis start and this figure is higher for patients presenting late (60%).
- Surgical assessment is of high importance in the development of permanent vascular access (AVF/AVG). Whereas, in those assessed by a surgeon at least three months prior to starting dialysis, 70.4% received an AVF, only 9.7% of those not assessed did. This strong relationship was not seen between surgical assessment and PD catheter placement, apart from the use of the laparoscopic insertion technique.

- The practice of PD catheter insertion in patients presenting late was used by relatively few centres. Only 13 out of 50 centres with sufficient data on patients presenting late placed a peritoneal dialysis catheter in more than 15% of patients as first dialysis access. If the National Service Specification for dialysis recommendation that PD catheters should be placed within 72 hours of being required is to be complied with, a significant practice change is needed [22]. This timeframe may be shortened in the future. It is relevant here that 50% of centres only reported using a single technique for PD catheter insertion.
- Variation demonstrated in PD catheter functionality suggests that further exploration of centre specific practice around PD access would also be of value.
- The guideline recommending that PD catheters should be inserted at least two weeks prior to use [16] should be reconsidered since it may be a disincentive to using PD for patients presenting late.
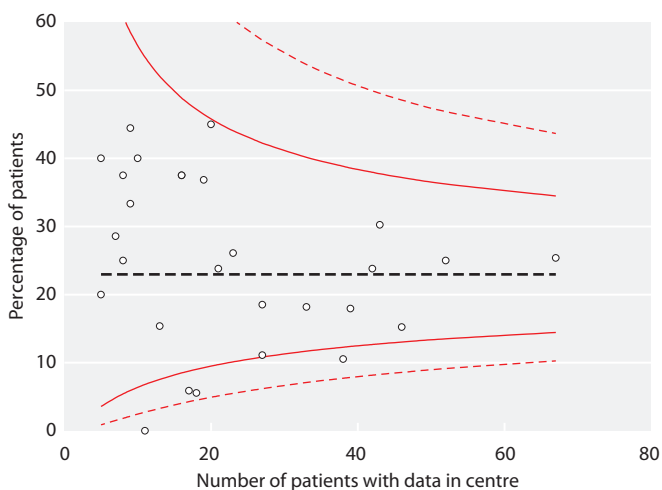

Fig. 14.21. Funnel plot of the percentage of PD catheter failures within one year of insertion

Acknowledgement

Conflicts of interest: none

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