

Paper

Tenckhoff Peritoneal Dialysis Catheter Insertion in a Northern Ireland District General Hospital.

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ABSTRACT

Introduction: Chronic kidney disease (CKD) affects approximately 5% of the population. Based on 2014 data, peritoneal dialysis (PD) is underutilised in Northern Ireland with a prevalence of only 11% in patients requiring renal replacement therapy (RRT). Recent National Institute of Clinical Excellence (NICE) guidelines aim to increase the rate of PD utilisation to 39% amongst patients requiring RRT. In order to implement these guidelines, nephrologists must have access to a reliable, effective PD catheter insertion service. The aim of this study was to assess the outcomes of PD catheter insertions and incident rates of PD use in a single centre in anticipation of a potential increased uptake.

Methods: A retrospective analysis was conducted of all patients who underwent PD catheter insertion between April 2003 and October 2011. Case notes were reviewed for demographic information, complications, need for re-intervention, and primary catheter patency at 12 months. The UK Renal Registry annual reports were also reviewed for data on annual uptake of PD in our institution.

Results: Fifty-four patients underwent PD catheter insertion between 2005 and 2011; 61% were male with a median age of 58 (range 21-82) years. Early complications (≤ 30 days) included bowel perforation (n=1) and wound infection (n=2). During this study period 17 (31%) patients required manipulation or reinsertion for catheter obstruction/migration. The primary catheter patency at 12 months was 76%. The average uptake of PD as the first treatment modality (incident use) was 21.3% compared to a Northern Ireland (NI) average of 12.4%.

Conclusion: Complication rates were comparable to the International Society of Peritoneal Dialysis (ISPD) guidelines in this case series and PD uptake was higher than the NI average. Therefore, local provision of an expert surgical PD catheter insertion service may potentially facilitate an increased uptake of this modality amongst RRT patients but further research is warranted.

INTRODUCTION

Chronic kidney disease is a major burden in the United Kingdom (UK) affecting approximately 5% of the population.¹ Annually, 2% of the NHS budget is spent on renal replacement therapy (RRT) alone.¹ In June 2014, there were more than 720 people on chronic dialysis in Northern Ireland (NI). Currently 620 of these patients require hospital based haemodialysis (HD), 35 have independent home haemodialysis and 80 utilise peritoneal dialysis (PD).¹ Peritoneal dialysis is underutilised in NI with only 11% of patients on RRT receiving PD compared to a 15% average in the rest of the UK in 2014.^{1,2}

Patients who receive HD attend hospital approximately three times a week for 4-6 hours at a time.³ In HD, waste products are removed from the blood by extracorporeal means via a dialysis machine.³ In continuous ambulatory peritoneal dialysis (CAPD), the metabolic products are removed via a fixed catheter in the abdominal cavity where dialysis fluid is exchanged using the peritoneum as a dialysis membrane.³

Peritoneal dialysis has many advantages over HD, including improving patient independence, social life, well-being and quality of life.^{4,5} The CHOICE study, which compared patient satisfaction between HD and PD, demonstrated that patients receiving PD were 1.5 times more likely to rate their care as excellent.⁵ A major factor in this is removing the requirement to attend for HD three times a week, especially in cases involving lengthy commutes.

Recent National Institute of Clinical Excellence (NICE) guidelines recommend PD to be considered as the first treatment modality for adults requiring RRT with the aim of increasing the percentage of those on RRT receiving PD to 39%.² NICE have calculated annual savings of £20 million

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if the prevalent number of patients on peritoneal dialysis in England increases from the current 15% to the optimal 39%.²

In order to successfully implement the NICE guidelines, nephrologists must have good access to a reliable, effective PD catheter insertion service. The aim of this study was therefore to assess the outcomes of a Tenckhoff peritoneal dialysis catheter insertion service along with incident rates of PD use in a single centre in NI in anticipation of the potential increased uptake of this modality of renal replacement.

METHODS

All patients who underwent peritoneal dialysis catheter insertion between April 2003 and October 2011 in our district general hospital were identified from records within the Department of Nephrology. A team of nurse specialists facilitate delivery of the PD service and maintain specific records for individual patients undergoing PD.

A single surgeon performed all insertions using a standardised open paramedian dissection technique.⁶ Briefly, an incision is made 3cm lateral to the midline, at the level of the umbilicus, that extends inferiorly. Dissection of the abdominal wall is then performed in layers under direct vision to expose the anterior rectus sheath. The anterior sheath is sharply divided and the rectus fibres are then bluntly dissected down to the posterior sheath before an incision is made in the peritoneum to create a small opening. The intraperitoneal part of the Tenckhoff catheter is positioned in the pelvic cavity using a malleable introducer. The inner cuff is then sutured to the peritoneum and then the rectus sheath is closed with continuous sutures. Before tunneling the catheter in the subcutaneous layer, peritoneal dialysis fluid is introduced to test flow. The skin is then closed with subcuticular sutures.

The medical and nursing records were reviewed for demographic information, medication history, past medical history, date of PD catheter insertion, occurrence of post-operative complications, and dialysis history. Peri-operative complications included bowel perforation. Post-operative complications included exit site infection, wound infection, peritonitis and catheter migration / obstruction. Re-manipulations of PD catheters were performed laparoscopically. All patients were followed up for at least 12 months and the primary outcome was the presence of a patent functioning catheter at 12 months that did not require manipulation / repositioning, removal or replacement. Patients were excluded from this specific analysis if they (i) underwent renal transplant within 12 months of catheter insertion and the catheter was functioning up to the point of transplant or (ii) had a functioning catheter but died within 12 months of insertion and the cause of death was not catheter related.

The UK Renal Registry annual reports provided information on the annual incidence of PD uptake and prevalence of PD use within the population of adults requiring RRT in our institution. This data was available from 2005.

RESULTS

Fifty-four patients (male n=33), with a median age of 58 (range 21 – 82) years were included in the study cohort. The most common cause of renal failure was diabetes (n=12), followed by polycystic kidney disease (n=10), IgA nephropathy (n=9), and hypertensive nephropathy (n=6). Other causes (n=17) included pyelonephritis, Wegener's and glomerulonephritis. The time interval between catheter insertion and use ranged from 3 days to 11 months, with a median of one month.

Review of the UK Renal Registry's annual reports between 2005 and 2011 demonstrates that the average uptake of PD in our institution was of 21.3% and reached 39% in 2013.⁷⁻¹⁵ This compares with an average uptake of PD across NI of 12.4% between 2005 and 2011.⁹⁻¹⁵ Table 1 demonstrates the average PD uptake across the other sites within NI during the study period and the longitudinal changes in uptake up to 2013. The prevalence by the end of 2011 of PD in the dialysis population in our institution was 9.8% (n= 12 of 123). The corresponding average figure for all centres in Northern Ireland was 9.7% (n= 78 of 803).¹⁶

Proportion of patients requiring RRT who received PD as first modality of treatment (%)					
	SHSCT*	NHSCT	BHSCT	SEHSCT	WHSCT
Average (2005-2011)	21.3	11.4	12.3	9.1	8.1
Year					
2013**	39%	10%	16%	7%	27%
2012**	33%	19%	10%	10%	14%
2011	21%	17%	12%	6%	18%
2010	10%	5%	8%	5%	0%
2009	10%	5%	8%	0%	16%
2008	15%	10%	12%	23%	20%
2007	27%	3%	12%	0%	0%
2006	36%	13%	16%	13%	3%
2005	30%	27%	18%	17%	0%

Table 1. The proportion of patients requiring renal replacement therapy (RRT) receiving peritoneal dialysis (PD) as the first modality of treatment (incident use) in each Trust per year and the average proportions during the study period 2005-2011. (SHSCT – Southern Health and Social Care Trust (*study institution); NHSCT – Northern Health and Social Care Trust; BHSCT – Belfast Health and Social Care Trust; SEHSCT – South Eastern Health and Social Care Trust; WHSCT – Western Health and Social Care Trust; ** Years not part of initial study period).

Peri- and post-operative complications

One patient had a bowel perforation due to the catheter-tip breaching a colonic diverticulum during placement. The presentation was delayed for three days before the patient underwent a Hartmann's procedure and made an otherwise uneventful recovery. This patient was subsequently managed with HD and survived for a further six years. Two diabetic patients developed wound infections, in the first 30 days of operation, which were successfully treated with intravenous antibiotics. There were no episodes of exit-site infection or peritonitis within 30 days.

Catheter-specific outcomes

The median duration of catheter survival was 17 months, ranging from 3 days to 5 years and 8 months. At 12 months, 38 patients had a primary functioning catheter corresponding to a rate of 76% for our primary outcome. Four patients progressed to renal transplant or died within 12 months of catheter insertion with a primary functioning catheter in-situ.

During the study period, seventeen (31%) patients required manipulation or reinsertion of their PD catheter due to catheter obstruction or migration. Of these patients, 12 (71%) had fully functioning working catheters after surgical manipulation or re-insertion up until the point of death, renal transplantation or the last recorded entry prior to the study endpoint. The remaining five patients (29%) were transferred to HD after a median time of 10 months (range from 2 weeks to 3 years.) Only two patients required re-insertion within 30 days of catheter insertion.

DISCUSSION

This study presents the results of a single centre, single surgeon experience in PD catheter insertion between 2003 and 2011. Overall there was one bowel perforation and two wound infections but no exit site infections or peritonitis in the first 30 days post-operatively. At 12 months the primary catheter patency rate was 76%. Our institution's outcomes therefore compare favourably with reference to the International Society for Peritoneal Dialysis (ISPD) guidelines on clinical practice for peritoneal access (table 2).¹⁷

Outcome	ISPD recommendation	Current study
Catheter patency at 12 months	>80%	76%
Bowel perforation	<1%	1.9%
Significant haemorrhage	<1%	0%
Exit-site infection within 2 weeks of insertion	<5%	0%
Peritonitis within 2 weeks of insertion	<5%	0%

Table 2. A comparison of our institution's outcomes with the International Society of Peritoneal Dialysis (ISPD) recommendations.¹⁷

During the study period there were no recorded episodes of peritonitis or exit site infections within four weeks, which is below ISPD's recommendation of 5%. This could be attributed to the routine administration of prophylactic intravenous vancomycin prior to the insertion of PD catheters. The Renal Association guidelines recommend the administration of prophylactic antibiotics prior to PD catheter insertion, with the choice of antibiotic based upon local guidelines.¹⁸ Gadallah *et al* (2000) conducted a three arm randomised controlled trial where vancomycin was superior in the prevention of post-operative peritonitis over cephalosporins and no preoperative prophylactic antibiotics.¹⁹ In our institution all patients were regularly followed up by the specialist PD nurse at five day intervals post-operatively for the first three weeks as a standard. Patients whose catheter was not yet in use were followed up every four weeks to review their exit site and flush the catheter. Therefore, as any PD catheter problems would be communicated by the patients directly to the specialist nurses and subsequently documented we feel the observed level of zero for significant exit site infections is robust.

Our outcomes are comparable to those in other published series as highlighted in table 3. A large retrospective review over 4 years by Liu *et al* (2009) looked at complications after 384 PD catheter insertions.⁶ In this study all catheters were inserted using a similar open paramedian approach however they report a significantly higher rate of early catheter migration. Interestingly, a heterogenous group of 22 urologists and general surgeons inserted the catheters in this cohort therefore the inclusion of non-specialists may have contributed to the relatively poor results observed in this regard. In comparison, the strength of our study is the continuity provided by one consultant general surgeon who performed all PD catheter insertions. Another retrospective review of complications after PD catheter insertion by Tiong *et al* (2006) demonstrated that our institution had significantly lower complication rates.²⁰ In this Singaporean study, PD catheters were inserted via an open paramedian approach by various grades of operator including consultants, registrars and fellows. There was a high rate of infections in this study, however there was no difference in the complication rates between those of varying levels of experience. It could

Study	Year	Patients (n)	Complications recorded	Complication subtype (%)			
				Migration/obstruction	Exit site infection	Wound infection	Peritonitis
Current study	2011	54	Within 4 weeks	3.7	0	3.8	0
Wright <i>et al</i> ²⁴	1999	24	Within 6 weeks	0	16.7	-	4.1
Gadallah <i>et al</i> ²⁷	1999	72	Within 2 weeks	8.3	37	-	6
Daschner <i>et al</i> ²⁵	2002	23	Within 4 weeks	8.7	-	-	-
Ogunc <i>et al</i> ²⁶	2003	21	Within 4 weeks	23.8	38	-	38
Jwo <i>et al</i> ²²	2006	40	Within 4 weeks	15	0	-	0
Tiong <i>et al</i> ²⁰	2008	139	Within 4 weeks	24	22	38	6
Liu <i>et al</i> ⁶	2009	319	Within 4 weeks	13.3	6.3	3.6	2.9

Table 3. Observed complication rates in comparative studies using an open technique

therefore be suggested that a higher quality service can be delivered by a dedicated multidisciplinary team with a smaller number of expert surgeons.

In addition to our comparable outcomes with respect to ISPD guidelines and other published series, our institution also had a higher rate of PD uptake in contrast to the other units in Northern Ireland during the study period (table 1).⁷⁻¹⁵ Reviewing the local longitudinal trends in PD uptake there was a relative dip between 2009 and 2010, which interestingly was also evident regionally throughout all centres in NI. However, rates of PD uptake have increased continuously since 2011 in the majority of units in NI, which may be representative of the release of specific NICE guidance at that time.² In 2013 39% of patients requiring RRT were treated with PD in our unit in 2013 and while the definitive reasons for a higher uptake compared with other units is beyond the remit of this study, it is interesting to speculate on the direct impact of local access to appropriate surgical expertise. However further studies are required to answer this question as both the number of patients involved and the observation period are relatively small.

Finally, despite the relatively high incident rates over the period 2005-2011, the prevalent rate of PD use amongst dialysis patients in our institution was equivalent to that of other institutions in Northern Ireland. Peritoneal dialysis attrition occurs as a result of transition to haemodialysis, transplantation, or death and we have demonstrated a median PD period of 17 months in this study. Given the observed poor incident rates of primary PD use in 2009 and 2010 across all centres it is not unsurprising therefore that our prevalent rates were similarly poor. The overall results of this study remain encouraging however and the publication of most up to date prevalence rates are keenly anticipated to determine the local impact of recent incident improvements as we strive to accomplish NICE's 39% prevalence goal.

We acknowledge there are weaknesses in our retrospective observational study. Firstly, the variation in time between the insertion of a PD catheter and its use is variable. This can be explained by the fact that PD catheters are often inserted when the patient is stable anticipating its use soon, but sometimes the deterioration does not progress as expected, as was the case in very early use of one catheter. This study was also retrospective and the sample size is small but the nurse specialist records were complete and detailed. The strengths of this study are that all patients underwent a standardised open paramedian approach by a single general surgeon removing variability within our cohort. Our patient sample also reflects the common causes of renal disease and median age for PD insertion in the UK.²¹ We also recognise there are other techniques for PD catheter insertion including laparoscopic and percutaneous options. A prospective randomized study by Jwo *et al* (2010) demonstrated that laparoscopic assisted PD catheter insertion was not superior to an open approach and that it was also a less cost effective option.²² A recent study by Park *et al* (2014) also demonstrated increased mechanical

complications with the percutaneous technique compared to the open technique therefore the latter remains the favoured option in our institution.²³

CONCLUSION

In conclusion, the complication rates observed in this cohort are comparable to other published series and closely reflect the standards set by ISPD. The uptake of PD in our institution was higher than the NI average however the exact reasons for this are unknown. It is interesting to speculate that direct access to a local service with appropriate surgical expertise may be a contributing factor but further studies are required.

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