NATIONAL INSTITUTE FOR HEALTH AND CLINICAL EXCELLENCE

INTERVENTIONAL PROCEDURES PROGRAMME

Interventional procedure overview of laparoscopic insertion of peritoneal dialysis catheter

A peritoneal dialysis catheter is a soft tube inserted into the abdomen and used to remove waste products (that would normally be removed by the kidneys) from the blood. Laparoscopic insertion – also known as 'keyhole surgery' – is a way of inserting the catheter using a fine telescope to guide the catheter into the abdominal cavity.

Introduction

This overview has been prepared to assist members of the Interventional Procedures Advisory Committee (IPAC) in making recommendations about the safety and efficacy of an interventional procedure. It is based on a rapid review of the medical literature and specialist opinion. It should not be regarded as a definitive assessment of the procedure.

Date prepared

This overview was prepared in July 2006.

Procedure name

- Laparoscopic insertion of peritoneal dialysis catheter.

Specialty societies

- British Association of Paediatric Nephrology.
- Royal College of Paediatrics and Child Health.
- Royal College of Surgeons of Edinburgh.
- The Renal Association.

Description

Indications

Peritoneal dialysis is an alternative to haemodialysis and is usually used to treat patients with end-stage renal disease.

Peritoneal dialysis involves infusing fluid into the peritoneal cavity via a catheter and leaving it for sufficient time to allow exchange of metabolic waste products through the peritoneal membrane into the dialysis fluid. In continuous ambulatory peritoneal dialysis, the patient manually drains and replaces the dialysis fluid several times a day. Another form of peritoneal dialysis is automated peritoneal dialysis, which obviates the need for more frequent exchanges of fluid bags.

Current treatment and alternatives

A peritoneal dialysis catheter is conventionally placed through a small open incision, which may be carried out under local or general anaesthesia. The incision is made in the abdomen through the skin, subcutaneous tissue and anterior rectus sheath. A small incision is made to the peritoneal cavity and the catheter is threaded through into the pelvic cavity. The posterior rectus sheath and the peritoneum are closed tightly around the catheter by a purse-string suture. The other end of the catheter is tunnelled subcutaneously to an exit site incision in the abdomen.

Percutaneous techniques have also been used to place the catheters. Under local anaesthesia, dialysis fluid is instilled in the peritoneal cavity by puncture. A small incision is made in the abdomen followed by blunt dissection of the subcutaneous tissue. A catheter guide is used to direct the catheter into the peritoneum. The other end of the catheter is tunnelled through to an exit site incision in the abdomen. The procedure may also be performed with a peritoneoscope.

What the procedure involves

Laparoscopic insertion of a peritoneal dialysis catheter is usually performed under general anaesthesia. The abdomen is insufflated and several small incisions are made. In one variation of the technique, the lateral inferior edges of the omentum are fixed onto the parietal peritoneum with sutures. The tip of the catheter is advanced through the abdominal cavity into the pelvic cavity and is sometimes held in place by sutures. The distal end of the catheter is then tunnelled subcutaneously to an exit site incision in the abdomen. Use of the laparoscope allows complete visualisation of the catheter's location and configuration during the procedure, potentially facilitating more accurate placement within the pelvis.

Efficacy

The efficacy evidence presented in this overview relates to one randomised controlled trial and five non-randomised controlled trials. [1,3-6,8]

The specialist advisers did not note any concerns about the efficacy of the procedure.

Catheter survival

A randomised controlled trial reported that 57% (12/21) of catheters inserted laparoscopically and 54% (13/24) of catheters inserted by open incision were still in use after a median follow-up of 18.5 months (p value not stated).[1]

A non-randomised controlled trial of 42 patients reported catheter survival at 12 months to be 90.5% in the laparoscopic group and 71.4% in patients with open catheter placement ($p = 0.019$).[4] A second non-randomised controlled trial reported revision-free catheter survival probabilities at 1, 2 and 3 years to be 87%, 81% and 76% for laparoscopic insertion compared with 74%, 57% and 39% for open insertion ($p < 0.001$)[5,6]. A third non-randomised controlled trial of 102 patients reported catheter survival to be 79% in the laparoscopic group at 1 year, 53% at 2 years and 37% at 3 years, compared with 65% in the open insertion group at 1 year, 43% at 2 years and 29% at 3 years (differences were not statistically significant).[3] Another non-randomised controlled trial reported that 70% (16/23) of catheters inserted laparoscopically were still functioning at the end of the study (follow-up period not stated) compared with 40% (8/20) of catheters inserted using a single trocar peritoneoscopic technique (p value not stated).[8]

Safety

The safety evidence presented in this overview relates to one randomised controlled trial, five non-randomised controlled trials and two case series.[1,3-9]

The specialist advisers listed potential adverse events as bowel perforation, fluid leaks, infection, catheter migration, catheter blockage and bleeding. Two advisers noted that potential adverse events were mainly adverse events of laparoscopic surgery, common to all laparoscopic procedures. They noted that the adverse events for this procedure would also be found in the open procedure for catheter insertion. None of the specialist advisers considered there to be uncertainties or concerns regarding the safety of this procedure.

Surgical revision

Two non-randomised controlled trials reported that 14% (3/21)[4] and 12% (3/25)[7] of patients in the laparoscopic groups needed surgical revision compared with 38% (8/21) and 17% (4/23) of patients, respectively, in the open surgery groups (p values not stated). Two case series reported surgical revision rates of 20% (25/123) and 23.5% (8/34).[9,10]

Catheter leakage

Eight studies reported the rate of catheter leakage ranging from 0% (0/25) to 9.5% (2/21).[1-8,10]

Catheter blockage

Five studies reported catheter blockage rates between 0.5% (1/200) and 29% (10/34) of procedures.[3,5-7,9,10]

Haemorrhage

Two non-randomised controlled trials and one case series reported peri- or postoperative haemorrhage in 0% (0/200), 2% (1/50) and 5% (7/148) of procedures.[3,5,6,9] Another case series of 34 patients reported that one patient

died of haemorrhage 6 days postoperatively, having resumed oral anticoagulation treatment immediately after the procedure.[10]

Infection

The randomised controlled trial reported that 29% (6/21) of patients in the laparoscopy group had peritonitis more than six weeks after catheter insertion compared with 46% (11/24) of patients in the open insertion group (p value not stated).[1] One non-randomised controlled trial reported similar rates of peritonitis for laparoscopic and open catheter (32% [16/50] versus 25% [13/52]).[3] One non-randomised controlled trial reported a significantly lower rate of peritonitis in the laparoscopy group than the open insertion group (5% [1/21] versus 14% [3/21], $p < 0.05$).[4]

The randomised controlled trial reported that 29% (6/21) of patients had exit site infections more than six weeks after catheter insertion compared with 17% (4/24) of patients in the open insertion group (p value not stated).Two non-randomised controlled trials reported exit site infections in 5% (1/21) and 6% (3/50) of laparoscopic procedures. Similar rates were reported for open catheter insertion.[3,4]

One large case series reported recurrent peritonitis or exit site infection after 18% (26/148) of procedures.[9]

Literature review

Rapid review of literature

The medical literature was searched to identify studies and reviews relevant to laparoscopic insertion of peritoneal dialysis catheter. Searches were conducted via the following databases, covering the period from their commencement to July 2006: Medline, PreMedline, EMBASE, Cochrane Library and other databases. Trial registries and the Internet were also searched. No language restriction was applied to the searches. (See appendix B for details of search strategy.)

The following selection criteria (Table 1) were applied to the abstracts identified by the literature search. If these criteria could not be determined from the abstracts the full paper was retrieved.

Table 1 Inclusion criteria for identification of relevant studies

Characteristic	Criteria
Publication type	Clinical studies were included. Emphasis was placed on identifying good quality studies. Abstracts were excluded if no clinical outcomes were reported, or if the paper was a review, editorial, laboratory or animal study. Conference abstracts were also excluded because of the difficulty of appraising methodology.
Patient	Patients requiring catheter insertion for peritoneal dialysis
Intervention/test	Laparoscopic catheter insertion for peritoneal dialysis
Outcome	Articles were retrieved if the abstract contained information relevant to the safety and/or efficacy.
Language	Non-English-language articles were excluded unless they were thought to add substantively to the English-language evidence base.

List of studies included in the overview

This overview is based on two randomised controlled trials, five non-randomised controlled trials and two case series. [1-10] Both of the randomised controlled trials and four of the non-randomised controlled trials compare laparoscopic catheter insertion with open catheter placement.[1-7] One compared laparoscopic insertion with a peritoneoscopic/single trocar technique.[8] One non-randomised controlled trial focused specifically on the use of the procedure in children.[7]

Other studies that were considered to be relevant to the procedure but were not included in the main extraction table (table 2) have been listed in appendix A.

Existing reviews on this procedure

A systematic review on catheter-related interventions to prevent peritonitis in peritoneal dialysis was published in 2004.[11] The review identified 37 randomised controlled trials of which three were described as comparing laparoscopy with laparotomy for insertion of the catheter One of these studies used peritoneoscopic placement rather than the laparoscopic procedure described in this overview. The other two studies have been included in table 2.[1,2] The review concluded that there was no significant difference in the risk of peritonitis (relative risk 0.68, 95% confidence interval [CI] 0.41 to 1.15), catheter removal or replacement (relative risk 1.02, 95% CI 0.49 to 2.13), technique failure (relative risk 0.70, 95% CI 0.45 to 1.08) and all-cause mortality (relative risk 1.08, 95% CI 0.52 to 2.26) with laparoscopy compared with laparotomy.

Related NICE guidance

There is currently no other NICE guidance related to this procedure.

Table 2 Summary of key efficacy and safety findings on laparoscopic insertion of peritoneal dialysis catheter

Abbreviations used: CAPD, continuous ambulatory peritoneal dialysis; NS, not significant

Study details	Key efficacy findings	Key safety findings	Comments
Wright MJ (1999)[1] Randomised controlled trial (prospective) UK Study period: not stated n = 45 Population: patients undergoing insertion of catheter for CAPD • 46.7% (21/45) laparoscopic catheter insertion • 53.3% (24/45) open laparotomy catheter insertion Indications: no inclusion or exclusion criteria were stated Technique: general anaesthesia used for all procedures; catheter was sutured in place during both techniques; Curlcath (Quinton Instruments, USA) catheter was used for all patients. CAPD started after 2 weeks for all patients Median follow-up: 18.5 months (range 7–26) Conflict of interest: none stated	Duration of operation (min): • Laparoscopic = 21.8 ± 2.9 • Open = 14.3 ± 3.3, p < 0.0001 Duration of hospital stay (days): • Laparoscopic = 3.1 • Open = 2.4 Catheters still in use at follow-up: • Laparoscopic = 57% (12/21) • Open = 54% (13/24) Catheter removal: 43% (9/21) catheters in laparoscopic group were removed before last follow-up: • 1 successful transplantation • 3 relapsing or resistant peritonitis • 1 treatment failure • 4 deaths 45.8% (11/24) catheters in open group were removed before last follow-up: • 2 successful transplantation • 6 relapsing or resistant peritonitis • 3 deaths	Conversions to open surgery = 16% (4/25) **Early complications (within 6 weeks)** Pain on drainage: • Laparoscopic = 14% (3/21) • Open = 8.3% (2/24) Mechanical dysfunction: • Laparoscopic = 0% (0/21) • Open = 0% (0/24) Fluid leak: • Laparoscopic = 9.5% (2/21) • Open = 0% (0/24) Exit-site infection: • Laparoscopic = 9.5% (2/21) • Open = 16.7% (4/24) Peritonitis: • Laparoscopic = 14.3% (3/21) • Open = 4% (1/24) **Late complications (more than 6 weeks after insertion)** Pain on drainage: • Laparoscopic = 0% (0/21) • Open = 0% (0/24) Mechanical dysfunction: • Laparoscopic = 0% (0/21) • Open = 0% (0/24) Fluid leak: • Laparoscopic = 0% (0/21) • Open = 0% (0/24) Exit-site infection: • Laparoscopic = 28.6% (6/21) • Open = 16.7% (4/24) Peritonitis: • Laparoscopic = 28.6% (6/21) • Open = 45.8% (11/24)	Randomisation described. Patients were blinded to treatment allocation. Dressings were applied to the same positions in all patients to blind ward staff to the technique used. 50 patients were initially included in study and randomised. Five patients were subsequently excluded from analysis; four laparoscopic procedures required conversion to open insertion and one patient undergoing open insertion suffered a fractured neck of femur 2 days postoperatively.

	Laparoscopic	Open
Mean age (years)	46.4 ± 14.8	49.3 ± 20.2
Male	67% (14/21)	62.5% (15/24)
BMI (kg/m^2)	27.7 ± 7.9	25.3 ± 3.5

Abbreviations used: CAPD, continuous ambulatory peritoneal dialysis; NS, not significant

Study details	Key efficacy findings	Key safety findings	Comments
Tsimoyiannis ECT (2000)[2] Randomised controlled trial (prospective) Greece Study period: not stated n = 50 Population: patients undergoing insertion of Tenckhoff catheter for CAPD • 50.0% (25/50) laparoscopic catheter insertion • 50.0% (25/50) open laparotomy catheter insertion Indications: patients were excluded only if there was a problem with general anaesthesia Technique: local anaesthesia used for open procedure, general anaesthesia used for laparoscopic procedure. Laparoscopic technique included suturing catheter in position. Tenckhoff catheter was used for all patients. CAPD started 24 to 48 hours after open insertion and immediately after laparoscopic procedure Mean follow-up: 21 months (range 4–36) Conflict of interest: none stated	Duration of operation (min): • Laparoscopic = 29 ± 7 • Open = 22 ± 5, p < 0.001 Catheter removal (all removed because of peritonitis): • Laparoscopic = 1 patient • Open = 3 patients, p > 0.25 'In both groups, the remaining catheters are functioning well, except for three patients in open group with diminished fluid return because of migration of the tip'	Peritonitis: • Laparoscopic = 3 patients • Open = 5 patients, p > 0.1 Fluid leaks: • Laparoscopic = 0 patients • Open = 8 patients, p < 0.005 Catheter tip migration: • Laparoscopic = 0 patients • Open = 5 patients, p < 0.005	Randomisation described. Six patients were excluded from the study because they developed severe cardiovascular or respiratory disease. Demographic data in the paper describe 20 patients in the open surgery group and 25 patients in the laparoscopy group. No denominators were given for outcome variables. Five patients in the laparoscopy group who had undergone previous laparotomies had an extended adhesiolysis performed before catheter placement. In four patients in open group, a paramedian incision with adhesiolysis near the incision was performed. Two cholecystectomies and one incisional hernia repair were undertaken at the same time as laparoscopic catheter insertion. No simultaneous therapy was performed in open group.

	Laparoscopic	Open
Mean age (range)	58 years (25 – 74)	62 years (48 – 72)
Male	72% (18/25)	80% (16/20)

Abbreviations used: CAPD, continuous ambulatory peritoneal dialysis; NS, not significant

<table>
<tr><th>Study details</th><th>Key efficacy findings</th><th>Key safety findings</th><th>Comments</th></tr>
<tr>
<td>
Soontrapornchai P (2005)[3]

Non-randomised controlled trial (prospective)

Thailand

Study period: 1999–2001

n = 102

Population: patients with end-stage renal disease commencing peritoneal dialysis.

49.0% (50/102) laparoscopic catheter insertion
51.0% (52/102) open catheter insertion

<table>
<tr><th></th><th>Laparoscopic</th><th>Open</th></tr>
<tr><td>Mean age (years)</td><td>55 ± 11</td><td>60 ± 11</td></tr>
<tr><td>Male</td><td>66% (33/50)</td><td>67% (35/52)</td></tr>
</table>
Indications: no inclusion or exclusion criteria were stated

Technique: local anaesthesia used for open procedure, general anaesthesia used for laparoscopic procedure. Laparoscopic technique included suturing catheter tip in place. CAPD was usually instituted 2 weeks after catheter placement

Mean follow-up (months):

laparoscopic catheter insertion = 26 ± 15
open catheter insertion = 19 ± 13

Conflict of interest: none stated
</td>
<td>
Duration of operation (min):

Laparoscopic = 65 ± 17
Open = 29 ± 3, p < 0.001

Outcomes
<table>
<tr><th></th><th>Laparo-scopic (n = 50)</th><th>Open (n = 52)</th></tr>
<tr><td>Still on CAPD</td><td>32 (64%)</td><td>33 (64%)</td></tr>
<tr><td>Death</td><td>3 (6%)</td><td>6 (11.5%)</td></tr>
<tr><td>Transplant</td><td>1 (2%)</td><td>0 (0%)</td></tr>
<tr><td>Transfer to haemo-dialysis</td><td>14 (28%)</td><td>11 (21%)</td></tr>
</table>
Catheter survival probability
<table>
<tr><th></th><th>Laparo-scopic</th><th>Open</th></tr>
<tr><td>1 year</td><td>79%</td><td>65%</td></tr>
<tr><td>2 years</td><td>53%</td><td>43%</td></tr>
<tr><td>3 years</td><td>37%</td><td>29%</td></tr>
</table>
There were no statistically significant differences in catheter survival between the two groups.

Catheter survival was calculated from day of insertion to day of revision or removal. Only removals related to mechanical or infectious complications were included in survival analysis.
</td>
<td>
Complications
Catheter obstruction:

Laparoscopic = 6% (3/50)
Open = 4% (2/52), p = NS

Catheter migration:

Laparoscopic = 0% (0/50)
Open = 12% (6/52), p = 0.027

Peritonitis:

Laparoscopic = 32% (16/50)
Open = 25% (13/52), p = NS

Exit-site infection:

Laparoscopic = 6% (3/50)
Open = 10% (5/52), p = NS

Bleeding (requiring reoperation):

Laparoscopic = 2% (1/50)
Open = 0% (0/52), p = NS

Fluid leak:

Laparoscopic = 2% (1/50)
Open = 2% (1/52), p = NS

Incisional hernia:

Laparoscopic = 6% (3/50)
Open = 2% (1/52), p = NS

Groin hernia:

Laparoscopic = 2% (1/50)
Open = 4% (2/52), p = NS

</td>
<td>Consecutive patients.</td>
</tr>
</table>

Abbreviations used: CAPD, continuous ambulatory peritoneal dialysis; NS, not significant

Study details	Key efficacy findings	Key safety findings	Comments
Öğünç G (2003)[4] Non-randomised controlled study (prospective) Turkey Study period: 1998–2001 n = 42 patients Population: patients with end-stage renal disease • 50.0% (21/42) laparoscopic catheter insertion • 50.0% (21/42) open catheter insertion Indications: no inclusion or exclusion criteria were stated Technique: local anaesthesia used for open procedure, general anaesthesia used for laparoscopic procedure. Laparoscopic technique included omental fixation. Curl Cath catheter (Sherwood Davis & Geck, Canada) was used for all patients. CAPD started 14 days postoperatively in open group and 7 days postoperatively in laparoscopic group Mean follow-up: not stated Conflict of interest: none stated	Duration of operation (min): • Laparoscopic = 45.4 • Open = 30.9, p < 0.05 Duration of hospital stay (days): • Laparoscopic = 1.1 • Open = 3.1, p < 0.05 Catheter removal: 14% (3/21) catheters in laparoscopic group were removed before last follow-up: • 1 successful transplantation • 1 persistent dialysate leak • 1 exit site infection 33% (7/21) catheters in open group were removed before last follow-up: • 1 successful transplantation • 1 patient chose to stop peritoneal dialysis • 3 relapsing or resistant peritonitis • 2 treatment failure Catheter survival at 12 months (Kaplan–Meier): • Laparoscopic = 90.5% • Open = 71.4%, p = 0.019	**Early complications (within 4 weeks)** Peritonitis: • Laparoscopic = 9.5% (2/21) • Open = 38% (8/21), p < 0.05 Exit site infection: • Laparoscopic = 19% (4/21) • Open = 38% (8/21), p < 0.05 Mechanical dysfunction: • Laparoscopic = 0% (0/21) • Open = 23.8% (5/21) **Late complications (more than 4 weeks post operation)** Peritonitis: • Laparoscopic = 4.7% (1/21) • Open = 14.2% (3/21), p < 0.05 Exit site infection: • Laparoscopic = 4.7% (1/21) • Open = 9.5% (2/21) Leak: • Laparoscopic = 4.7% (1/21) • Open = 0% (0/21) Tunnel infection: • Laparoscopic = 4.7% (1/21) • Open = 0% (0/21) Surgical revision required: • Laparoscopic = 14.2% (3/21) • Open = 38% (8/21)	No randomisation described. Patients in laparoscopic group were older and more obese than patients in open group (p value not stated). Accompanying surgical pathologies such as adhesions, inguinal hernias and ovarian cysts were also treated during the laparoscopic procedure.

	Laparoscopic	Open
Mean age (years)	51.1	44.2
Male (%)	57.1	38.0
Mean BMI (kg/m^2)	25.7	23.6
Prior abdominal surgery (%)	52.0	0

Abbreviations used: CAPD, continuous ambulatory peritoneal dialysis; NS, not significant

<table>
<tr><th>Study details</th><th>Key efficacy findings</th><th>Key safety findings</th><th>Comments</th></tr>
<tr>
<td>
Crabtree JH (2000, 2005) [5,6]

Non-randomised controlled trial (prospective)

USA

Study period: 1996–2002

n = 341 patients

Population: patients requiring peritoneal dialysis catheter insertion

18.5% (63/341) open
22.9% (78/341) basic laparoscopy
58.7% (200/341) advanced laparoscopy

<table>
<tr><th></th><th>Basic laparoscopy</th><th>Advanced laparoscopy</th><th>Open</th></tr>
<tr><td>Mean age (years)</td><td>55.8 ± 13.1</td><td>54.4 ± 14.3</td><td>49.5 ± 13.7*</td></tr>
<tr><td>Male</td><td>54% (42/78)</td><td>54% (108/200)</td><td>60% (38/63)</td></tr>
<tr><td>Previous laparotomy</td><td>55% (43/78)</td><td>53% (106/200)</td><td>30% (19/63)*</td></tr>
</table>
* p < 0.05

Indications: no inclusion or exclusion criteria were stated
Technique: between 71% and 76% of each procedure were carried out under local anaesthesia; no sutures used at the exit site for laparoscopic procedure to reduce the risk of infection; peritoneal dialysis generally delayed for at least two weeks to permit complete wound healing

Mean follow-up (months):

open catheter insertion = 23.3 ± 18.1
basic laparoscopy = 26.9 ± 21.2
open catheter insertion = 21.0 ± 16.3

Conflict of interest: none stated
</td>
<td>
One patient in open group, two patients in basic laparoscopy group and three patients in advanced laparoscopy group could not be implanted due to adhesions.

Revision-free catheter survival probability
<table>
<tr><th></th><th>Laparo-scopic (n = 150)</th><th>Open (n = 63)</th></tr>
<tr><td>1 year</td><td>87.4%</td><td>74.1%</td></tr>
<tr><td>2 years</td><td>81.2%</td><td>57.4%</td></tr>
<tr><td>3 years</td><td>75.5%</td><td>39.2%</td></tr>
</table>
p < 0.001
</td>
<td>
Conversion to open surgery = 0.4% (1/278)

Complications
Catheter flow obstruction:

Basic laparoscopy = 12.8% (10/78)
Advanced laparoscopy = 0.5% (1/200), p < 0.0001 (compared to open and basic laparoscopy)
Open = 17.5% (11/63)

Postoperative pericannular leak:

Basic laparoscopy = 1.3% (1/78)
Advanced laparoscopy = 2% (4/200)
Open = 1.6% (1/63)

Pericannular hernia:

Basic laparoscopy = 0% (0/78)
Advanced laparoscopy = 0% (0/200)
Open = 1.6% (1/63)

Superficial cuff extrusion:

Basic laparoscopy = 3.9% (3/78)
Advanced laparoscopy = 1% (2/200)
Open = not applicable (single cuff catheter used)

Visceral perforation:

Basic laparoscopy = 0% (0/78)
Advanced laparoscopy = 0% (0/200)
Open = 1.6% (1/63)

Reoperation for haemorrhage:

Basic laparoscopy = 0% (0/78)
Advanced laparoscopy = 0% (0/200)
Open = 1.6% (1/63)

</td>
<td>
Controls were patients with open implantation of catheter, performed between 1992 and 1996. Selection of controls is not described.

Laparoscopic data includes all implants performed at the study centre during the study period. Basic laparoscopic technique was used between 1996 and 1998 and the advanced technique was used from 1998 to 2002.

Advanced laparoscopic method included rectus sheath tunnelling, selective prophylactic omentopexy, and selective adhesiolysis. Basic laparoscopy was without associated interventions.

Revision-free catheter survival probabilities were only published in the earlier paper. This paper did not differentiate between basic and advanced laparoscopic technique.

Patients in the open placement group were statistically significantly younger and a lower proportion had previous laparotomy than the laparoscopic groups.
</td>
</tr>
</table>

Abbreviations used: CAPD, continuous ambulatory peritoneal dialysis; NS, not significant

<table>
<tr><th>Study details</th><th>Key efficacy findings</th><th>Key safety findings</th><th>Comments</th></tr>
<tr>
<td>Daschner M (2002)[7]

Non-randomised controlled trial (prospective)

Germany

Study period: 1998–2001

n = 48 procedures (42 patients)

Population: children requiring peritoneal dialysis for acute or chronic renal failure
• 52.1% (25/48) laparoscopic catheter insertion
• 47.9% (23/48) open catheter insertion
<table>
<tr><th></th><th>Laparoscopic</th><th>Open</th></tr>
<tr><td>Median age (years)</td><td>6.9</td><td>3.2</td></tr>
<tr><td>Age range</td><td>2 months to 19.3 years</td><td>2 days to 19 years</td></tr>
<tr><td>First catheter</td><td>52% (13/25)</td><td>78% (18/23)</td></tr>
</table>
Indications: inclusion criteria included elective catheter implantation and expected use of catheter of at least 4 weeks. Emergency procedures in critically ill patients were excluded

Technique: type of anaesthesia not described; Tenckhoff catheter used. Catheter was placed without sutures. Peritoneal dialysis was initiated immediately after surgery

Follow-up: not stated

Conflict of interest: none stated</td>
<td>One patient with severe intra-abdominal adhesions in laparoscopic group had to be transferred to haemodialysis due to persistence of outflow obstruction after laparoscopic catheter replacement</td>
<td>Early complications (within 4 weeks)

Outflow obstruction:
• Laparoscopic = 8.0% (2/25)
• Open = 8.7% (2/23)

Catheter leakage:
• Laparoscopic = 8.0% (2/25)
• Open = 21.7% (5/23)

Surgical revision required:
• Laparoscopic = 12.0% (3/25)
• Open = 17.4% (4/23)</td>
<td>Primary catheter insertions in patients with pre-existing abdominal adhesions and catheter replacements for outflow obstruction were preferentially performed laparoscopically.

Study included the results of the first 25 laparoscopic catheter placements in children and 23 conventional procedures performed during the same period.

The stated primary aim of the study was to assess the feasibility of laparoscopic catheter placement in children.

Additional interventions were adhesiolysis (n =2) and closure of preformed hernias (n = 2) in laparoscopic group and partial omentectomy (n = 2) in open group.

Included primary and secondary catheter placements.

Patients in the open group were younger than patients in the laparoscopic group (no statistical results reported).</td>
</tr>
</table>

Abbreviations used: CAPD, continuous ambulatory peritoneal dialysis; NS, not significant

Study details	Key efficacy findings	Key safety findings	Comments
Blessing WD (2005)[8] Non-randomised controlled trial (retrospective) USA Study period: 2001–2004 n = 43 patients Population: patients requiring peritoneal dialysis catheter • 53.5% (23/43) laparoscopic catheter insertion • 46.5% (20/43) peritoneoscopic/single trocar catheter insertion Indications: no inclusion or exclusion criteria were stated Technique: type of anaesthesia not described; Tenckhoff catheter introducer trocar used (Medigroup, USA). Catheters started to be used 1–2 weeks postoperatively Follow-up: not stated Conflict of interest: none stated	Functioning catheter at end of study (follow-up not specified): • Laparoscopic = 69.6% (16/23) • Single trocar = 40% (8/20)	**Complications** Bowel perforation: • Laparoscopic = 0% (0/23) • Single trocar = 5% (1/20) Exit site infection: • Laparoscopic = 4.3% (1/23) • Single trocar = 10% (2/20) *Clostridium difficile* colitis: • Laparoscopic = 4.3% (1/23) • Single trocar = 0% (0/20) Bowel obstruction: • Laparoscopic = 4.3% (1/23) • Single trocar = 0% (0/20) Dialysate leak trocar site: • Laparoscopic = 4.3% (1/23) • Single trocar = not applicable **Catheter-related complications** Dialysate leak peritoneal dialysis site: • Laparoscopic = 8.7% (2/23) • Single trocar = 5% (1/20) Primary nonfunction: • Laparoscopic = 13% (3/23) • Single trocar = 15% (3/20) Tunnel tract infection: • Laparoscopic = 0% (0/23) • Single trocar = 5% (1/20) Outflow pain: • Laparoscopic = 4.3% (1/23) • Single trocar = 10% (2/20) Infusion pain: • Laparoscopic = 0% (0/23) • Single trocar = 5% (1/20) Total peritoneal dialysis malfunction: • Laparoscopic = 26% (6/23) • Single trocar = 40% (8/20) Removal for malfunction: • Laparoscopic = 13% (3/23) • Single trocar = 35% (7/20)	Study included the first 25 patients treated with laparoscopic technique and most recent 25 patients treated with single trocar technique. 7 patients were lost to follow-up (5 in single trocar group and 2 in laparoscopic group). Single trocar procedures were carried out between February 2001 and February 2003. Laparoscopic procedures were carried out between September 2002 and June 2004. Patients in the single trocar group, therefore, had a longer follow-up – mean follow-up for either group was not stated. Hernias were repaired at the same time as catheter placement in laparoscopic group. Based on these initial results, this centre is now placing all peritoneal dialysis catheters using laparoscopic assistance.

	Laparoscopic	Single trocar
Mean age (years)	55	50
Male (%)	48	55
Mean BMI (kg/m^2)	28.0	28.1
Prior abdominal surgery (%)	70	45

Abbreviations used: CAPD, continuous ambulatory peritoneal dialysis; NS, not significant

Study details	Key efficacy findings	Key safety findings	Comments
Lu CT (2003)[9] Case series (prospective) Australia Study period: 1994–2001 n = 148 procedures (123 patients) Population: patients undergoing laparoscopic placement of a peritoneal dialysis catheter Mean age = 55 years (range 20–83) Male = 53.7% (66/123) Indications: no inclusion or exclusion criteria were stated Technique: Tenckhoff peritoneal dialysis catheters (Sherwood Medical Company, USA) were used. Catheters were routinely sutured into the pelvis (fixed to the posterior wall of the uterus in women or to the overlying peritoneum behind the bladder in men). A percutaneous introducing kit was used for the last 137 procedures. Commencement of peritoneal dialysis was delayed for 2 weeks whenever possible to allow for wound healing. Median follow-up: 42 months (range 3–68) Conflict of interest: none stated.	Mean operative time = 27 min (range 10–100) Successful catheter placement = 99% (147/148) (failure in 1 patient with extensive adhesions that obliterated most of the peritoneal cavity) At end of follow-up, 16.9% (25/148) catheters were still in use; 23% (34/148) were removed because of a successful transplantation; 31% (46/148) were removed because of infection or blockage; 0.7% (1/148) was removed because it was no longer necessary; 28.3% (42/148) catheters were in patients who died during the follow-up period	**Early surgical complications** Peri/postoperative haemorrhage = 4.7% (7/148) (4 required reoperation for early catheter blockage, two had trocar injury to inferior epigastric artery) **Late complications (requiring removal of catheter)** Recurrent peritonitis or exit site infection = 17.6% (26/148) Catheter blockage = 13.5% (20/148) (8 blockages were due to the formation of intra-abdominal adhesions ensheathing the catheter and 8 were due to catheter migration) Port site hernia requiring repair = 6.8% (10/148) 20% (25/123) patients underwent additional removal and reinsertion procedures	Study included the first 148 laparoscopic assisted catheter placement procedures to be carried out in the centre.

Abbreviations used: CAPD, continuous ambulatory peritoneal dialysis; NS, not significant

Study details	Key efficacy findings	Key safety findings	Comments
Bar-Zohar D (2006)[10] Case series (retrospective) Israel Study period: 2001–2004 n = 34 patients Population: patients undergoing laparoscopic peritoneal dialysis catheter Mean age = 65 years (range 21–86) Male = 64.7% (22/34) 26.5% (9/34) of patients had prior abdominal surgery Indications: chronic renal failure with or without congestive heart failure Technique: general anaesthesia; Tenckhoff catheter (Coiled Peritoneal Silicone Catheter, Horizon Medical Products, USA); catheter tip was fixed to the dome of the urinary bladder with a suture Median follow-up: 13 months (range 1–44) Conflict of interest: none stated	Mean operative time = 35 min (range 10–65) Mean hospital stay = 1.5 days (range 1–3) Mean time to first dialysis using implanted catheter = 20 days (range 5–60) One year failure-free rate of catheter = 80.8% Permanent catheter removal = 26.5% (9/34) • 1 successful transplantation • 1 patient chose to stop peritoneal dialysis • 3 catheter failure • 4 treatment failure 14.7% (5/34) patients switched to haemodialysis	No conversions to open laparotomy Procedure-related mortality = 2.9% (1/34) (oral anticoagulation was inadvertently resumed immediately after surgery and patient died of haemorrhage on sixth postoperative day) Exit site/tunnel infection = 14.7% (5/34) Pericatheter leak = 2.9% (1/34) (required surgical intervention) Peritonitis = 47% (16/34) (27 cases in 16 patients, 3 required surgical intervention) Catheter migration leading to malfunction = 5.8% (2/34) (both required surgical intervention) Outflow obstruction = 29.4% (10/34) (2 required surgical intervention) Incisional hernia = 8.8% (3/34) Total surgical interventions = 23.5% (8/34)	Patient selection not described.

Validity and generalisability of the studies

- There are many variations in the techniques used, including fixing the catheter inside the pelvic cavity with sutures, and omental fixation. Also, different catheters were used. The different techniques may have different safety and efficacy profiles.
- Additional procedures were sometimes performed during both laparoscopic and open catheter insertions making it difficult to draw any conclusions about the operative times.
- Only one non-randomised controlled trial included children.[7]

Specialist advisers' opinions

Specialist advice was sought from consultants who have been nominated or ratified by their Specialist Society or Royal College.

Mr M Akyol, Professor E Brown, Mr J Forsythe, Dr L Rees and Mr R Subramaniam

- Most of the advisers considered this procedure to be established practice and no longer new, although one adviser commented that it is not routine practice in paediatric nephrology.
- The appropriate comparator would be peritoneal dialysis catheter insertion by laparotomy or percutaneous techniques.
- One adviser commented that the potential impact of this procedure on the NHS, in terms of numbers of patients eligible for treatment and use of resources would be minimal because the procedure is already quite widespread.
- Two advisers considered that the potential impact of this procedure on the NHS, in terms of numbers of patients eligible for treatment and use of resources would be moderate in paediatrics.
- Different techniques are used by individual surgeons, including different types of peritoneal dialysis catheters.

Issues for consideration by IPAC

There are no additional issues for consideration.

References

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3. Soontrapornchai P, Simapatanapong T. (2005) Comparison of open and laparoscopic secure placement of peritoneal dialysis catheters. *Surgical Endoscopy* 19: 137–9.
4. Öğünç G, Tuncer M, Öğünç D et al. (2003) Laparoscopic omental fixation technique vs open surgical placement or peritoneal dialysis catheters. *Surgical Endoscopy* 17: 1749–55.
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7. Daschner M, Gfrörer S, Zachariou Z et al. (2002) Laparoscopic tenckhoff catheter implantation in children. *Peritoneal Dialysis International* 22: 22–6.
8. Blessing WD, Ross JM, Kennedy CI et al. (2005) Laparoscopic-assisted peritoneal dialysis catheter placement, an improvement on the single trocar technique. *The American Surgeon* 71: 1042–6.
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10. Bar-Zohar D, Sagle B, Lubezky N et al. (2006) Laparoscopic implantation of the Tenckhoff catheter for the treatment of end-stage renal failure and congestive heart failure: experience with the pelvic fixation technique. *Israel Medical Association Journal* 8: 174–8.
11. Strippoli GFM, Tong A, Johnson D et al. (2004) Catheter-related interventions to prevent peritonitis in peritoneal dialysis: a systematic review of randomised, controlled trials. *Journal of the American Society of Nephrology* 15: 2735–46.

Appendix A: Additional papers on laparoscopic insertion of peritoneal dialysis catheter not included in summary table 2

The following table outlines the studies that are considered potentially relevant to the overview but were not included in the main data extraction table (table 2). It is by no means an exhaustive list of potentially relevant studies.

Article title	Number of patients/ follow-up	Direction of conclusions	Reasons for non-inclusion in table 2
Al Dohayan A. (1999) Laparoscopic placement of peritoneal dialysis catheters (same day dialysis). *Journal of the Society of Laparoendoscopic Surgeons* 3: 327–9	11 patients	Dialysis started immediately; no leakage	Larger studies are included.
Batey CA, Crane JJ, Jenkins MA et al. (2002) Mini-laparoscopy-assisted placement of Tenckhoff catheters: an improved technique to facilitate peritoneal dialysis. *Journal of Endourology* 16: 681–4	26 patients (14 laparoscopic and 12 open placement)	No significant differences in complication rates Laparoscopic group used less narcotic analgesia, had shorter hospital stays and returned earlier to usual activities	Larger studies are included.
Bhagat SK, Viswaroop B, Devasia A, et al. (2006) An unusual complication of laparoscopic Tenckhoff catheter insertion. *Peritoneal Dialysis International* 26: 114–5	1 patient Follow-up = 19 months	Catheter functioned well for 14 months before patient presented with access failure. Catheter had migrated into abdominal wall, forming a pseudocyst	Case report (letter).
Borazan A, Comert M, Ucan BH et al. (2006) The comparison in terms of early complications of a new technique and percutaneous method for the placement of CAPD catheters. *Renal Failure* 28: 37–42.	42 patients (12 laparoscopic and 30 percutaneous placement) Follow-up = 6 months	No peroperative morbidity. Fewer complications in laparoscopic group compared with percutaneous group (20% vs 0% for mechanical complications and 27% vs 17% for infectious complications)	Larger studies are included.

Article title	Number of patients/ follow-up	Direction of conclusions	Reasons for non-inclusion in Table 2
Comert M, Borazan A, Kulah E et al. (2005) A new laparoscopic technique for the placement of a permanent peritoneal dialysis catheter. *Surgical Endoscopy* 19: 245–8	12 patients. Mean follow-up = 4.3 months	No operative morbidity, no leakage or outflow obstruction	Larger studies with longer follow-up are included.
Crabtree JH, Fishman A. (1999) Videolaparoscopic implantation of long-term peritoneal dialysis catheters. *Surgical Endoscopy* 13: 186–90	28 patients. Mean follow-up = 4.4 months	21% exit site infection. One case each of exit site/tunnel infection, catheter leak, peritonitis and outflow obstruction Nitrous oxide gas used for insufflation and local anaesthesia used	Larger studies with longer follow-up are included.
Crabtree JH, Fishman A. (2003) Selective performance of prophylactic omentopexy during laparoscopic implantation of peritoneal dialysis catheters. *Surgical Laparoscopy, Endoscopy & Percutaneous Techniques* 13: 180–4	231 patients. Mean follow-up = 16.9 and 15.7 months	78 patients without omental procedures compared to 153 patients with selective omentopexy. Obstruction rate 12.8% vs 0.7%.	Same study centre and study period as references 5 and 6 in table 2.
Gadallah MF, Torres-Rivera C, Ramdeen G et al. (2001) Relationship between intraperitoneal bleeding, adhesions, and peritoneal dialysis catheter failure: a method of prevention. *Advances in Peritoneal Dialysis* 17: 127 –9	317 patients. (362 procedures). Follow-up period not stated	Intraoperative bleeding (blood-tinged dialysate) in 6% (22/362) Continuous irrigation or early initiation of low-volume PD, or both, prevented catheter failure	Procedure described as laparoscopic but no details given. Paper is focused on the effect of intraperitoneal bleeding on catheter failure.
Harissis HV, Katsios CS, Koliousi EL et al. (2006) A new simplified one port laparoscopic technique of peritoneal dialysis catheter placement with intra-abdominal fixation. *American Journal of Surgery* 192: 125–9	13 patients. Mean follow-up = 5.8 months.	All catheters working at follow-up One catheter migration and two case of late leakage	Larger studies with longer follow-up are included.
Kimmelstiel FM, Miller RE, Molinelli BM, et al. (1993) Laparoscopic management of peritoneal dialysis catheters. *Surgery, Gynecology and Obstetrics* 176: 565–70	16 patients (19 procedures). Follow-up: 2– 20 months	Overall success rate = 75% Two catheters failed because of dislodgement and recurrent obstruction	Larger studies with longer follow-up are included.
Krug F, Herold A, Jochims H et al. (1997) Laparoscopic implantation of Oreopoulos-Zellermann catheters for peritoneal dialysis. *Nephron* 75: 272–6	25 procedures	36% (9/25) catheters removed. No leakages in tunnel or exit-site.	Larger case series are included.

Article title	Number of patients/ follow-up	Direction of conclusions	Reasons for non-inclusion in Table 2
Lessin MS, Luks FI, Brem AS et al. (1999) Primary laparoscopic placement of peritoneal dialysis catheters in children and young adults. *Surgical Endoscopy* 13: 1165–7	12 patients. (mean age 14 years) Follow-up ≥ 15 months	Revision-free catheter survival = 67% at 24 months. Seven complications in four patients	Larger studies with longer follow-up are included.
Manouras AJ, Kekis PB, Stamou KM et al. (2004) Laparoscopic placement of Oreopoulos-Zellerman catheters in CAPD patients. Peritoneal Dialysis International 24: 252–5	20 patients. Mean follow-up = 17 months	No intraoperative complications. One catheter removal because of peritonitis.	Larger studies are included.
Nijhuis PHA, Smulders JF, Jakimowicz JJ. (1996) Laparoscopic introduction of a continuous ambulatory peritoneal dialysis (CAPD) catheter by a two-puncture technique. *Surgical Endoscopy* 10: 676–9	19 patients. Mean follow-up = 8 months	No intraoperative complications Exit site infection = 21% (4/19) Deep tunnel infection and peritonitis = 5% (1/19) Outflow obstruction = 10% (2/19) Functioning catheter = 74% (14/19)	Larger studies with longer follow-up are included.
Poole GH, Tervit P. (2000) Laparoscopic Tenckhoff catheter insertion: a prospective study of a new technique. *Australian and New Zealand Journal of Surgery* 70: 371–3	49 patients. Mean follow-up = 6 months	12% overall failure of catheter. 8% early complication rate and 14% late complication rate 98% successful insertion	Larger studies with longer follow-up are included.
Wang J-Y, Hsieh J-S, Chen F-M et al. (1999) Secure placement of continuous ambulatory peritoneal dialysis catheters under laparoscopic assistance. *The American Surgery* 65: 247–9	18 patients. Median follow-up = 11 months	89% (16/18) catheters functioned well. One catheter removed because of peritonitis.	Larger studies with longer follow-up are included.
Wang J-Y, Chen F-M, Huang T-J, et al (2005) Laparoscopic assisted placement of peritoneal dialysis catheters for selected patients with previous abdominal operation. *Journal of Investigative Surgery* 18: 59–62.	20 patients. Follow-up = more than 30 days	Overall success rate of catheter function = 90% (18/20)	Larger studies with longer follow-up are included.
Watson DI, Paterson D, Bannister K. (1996) Secure placement of peritoneal dialysis catheters using a laparoscopic technique. *Surgical Laparoscopy & Endoscopy* 6: 35–7	19 patients. Median follow-up = 5 months	Suture fixation used 'No significant morbidity' 95% (18/19) catheters functioned well over the long term	Larger studies with longer follow-up are included.

Appendix B: Literature search for laparoscopic insertion of peritoneal dialysis catheter

Database	Date searched	Version searched
Cochrane Library	04/07/2006	Issue 2, 2006
CRD databases	04/07/2006	Issue 2, 2006
Embase	03/07/2006	1980 to 2006 Week 26
Medline	03/07/2006	1966 to June Week 1 2006
PreMedline	03/07/2006	June 30, 2006
CINAHL	04/07/2006	1982 to June Week 5 2006
British Library Inside Conferences	03/07/2006	-
NRR	03/07/2006	2006 Issue 2
Controlled Trials Registry	03/07/2006	-

The following search strategy was used to identify papers in Medline. A similar strategy was used to identify papers in other databases.

1 exp Laparoscopy/
2 exp Laparoscopes/
3 exp Surgical Procedures, Minimally Invasive/
4 Laparoscop$.tw.
5 endoscop$.tw.
6 percutan$.tw.
7 or/1-6
8 Catheterization/
9 Cathet$.tw.
10 Catheters, Indwelling/
11 LPCD.tw.
12 or/8-11
13 Peritoneal Dialysis/
14 peritoneal dialysis.tw.
15 peritoneal dialysis/ or peritoneal dialysis, continuous ambulatory/
16 CAPD.tw.
17 continuous ambulatory dialysis.tw.
18 continuous ambulatory peritoneal dialysis.tw.
19 IPD.tw.
20 (intermitt$ adj3 perit$).tw.
21 CCPD.tw.
22 (cycl$ adj3 periton$).tw.
23 or/13-22
24 7 and 12 and 23
25 Animals/
26 Humans/
27 25 not (25 and 26)
28 24 not 27