

**Use of indwelling pleural/peritoneal catheter in the
management of malignant ascites:
a retrospective study of 48 patients**

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Abstract**Introduction:**

Patients suffering from malignant ascites usually require repeated large volume paracentesis (LVP) for symptomatic relief. This often requires hospital admission and has inherent risks.

Aim:

To report the first Australian experience of placing tunneled indwelling peritoneal catheters (IPeC) for management of recurrent malignant ascites.

Methods:

A retrospective study was conducted of tunneled IPeC use in patients with symptomatic malignant ascites in four hospitals in Western Australia (from 2010-2018). Procedure data, success rate and safety profile were collected from a database.

Results:

Forty-eight patients (median age, 65 years; female 56%) underwent 51 peritoneal catheter insertion procedures that were performed mostly by pleural specialists. The majority of patients (96%) had prior LVP (median 2 drainages, interquartile range [IQR] 1–4) before IPeC insertion. The IPeC was inserted successfully under ultrasound guidance in all patients. The median length of hospital stay for IPeC insertion and initial ascites drainage was 2 days (IQR 2–3 days) and most patients (96%) did not require further paracentesis after IPeC placement. The majority (96%) of patients experienced relief from ascites symptoms after catheter insertion. Most IPeC-related

adverse events were self-limiting, including pain (in 25% cases), transient hypotension after initial fluid drainage (10%), peritoneal fluid leakage (10%), bacterial peritonitis (8%), fluid loculation (2%) and catheter dislodgement (2%). Six (12%) patients had IPeC removed. All patients with bacterial peritonitis responded to antibiotics and one required catheter removal.

Conclusions:

Use of tunneled IPeC improves symptoms and can minimise further invasive drainage procedures in patients with symptomatic malignant ascites. Placement of IPeC was associated with a low rate of adverse events, most of which could be managed conservatively.

Keywords:

Ascites, malignant ascites, indwelling peritoneal catheter, paracentesis, palliative care

(abstract word counts: 263 words)

Ethical approval

The study was approved by the Safety Quality and Performance Unit, Sir Charles Gairdner Hospital, Perth, Western Australia (Quality Improvement No: 27640)

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Introduction

Malignant ascites is an abnormal accumulation of fluid in the peritoneal cavity as a result of cancer¹. It occurs in a large number of cancer patients, especially those with gynaecological and gastrointestinal malignancies^{2,3}. The large volume of peritoneal fluid can produce significant pressure effects in the abdomen, causing symptoms such as bloating, pain, decreased appetite, nausea, vomiting and breathlessness⁴. These symptoms can severely impair the quality of life (QoL) of patients with malignant ascites⁵.

In patients with recurrent ascites that is resistant to chemotherapy, large volume paracentesis (LVP) is commonly employed to relieve symptoms^{5,6}. However, LVP only provides temporary relief, rather than definitive fluid control. Repeated LVPs are

often required for recurrence of ascites. Patients also have to endure increasing symptoms between drainages^{6,7}. LVP is invasive and repeated procedures represent cumulative risks of complications especially bleeding, peritonitis and bowel perforation^{8,9}. Patients with malignant ascites have limited lifespan and ideally, time spent in hospital for out-patient or in-patient LVP procedures should be minimised¹⁰. Therefore, an ambulatory management approach of malignant ascites for symptom control that reduces invasive drainages and minimises hospital stays is desirable.

Previous studies have examined the efficacy of ambulatory care of non-tunnelled indwelling peritoneal devices¹¹. These methods were complicated by high rates of catheter-related sepsis (43.3%) and mechanical dysfunction requiring catheter replacement or removal (26%)¹¹. Subsequently, several case series have adapted use of an indwelling pleural catheter (IPC) in malignant ascites wherein an IPC is inserted intra-peritoneally after tunneling (herein called indwelling peritoneal catheter, IPeC). The published efficacy and safety results of IPeC are promising with a reduced need of further LVP, an improvement of symptoms and QoL and a low risk of complications including infection (5.4%)¹¹⁻²¹. This is the first Australian report on the experience of placing an IPeC for management of recurrent malignant ascites.

Materials and methods

A retrospective study of IPeC treatment in patients with symptomatic malignant ascites (between January 2010 and October 2018) was performed in four tertiary hospitals in Western Australia (Sir Charles Gairdner Hospital, St John of God Midland

Public Hospital, Fiona Stanley Hospital and Royal Perth Hospital). All four hospitals have an established pleural specialist service directed by pleural-trained pulmonologists. Databases containing patient referral, drainage procedure record and catheter nursing care were reviewed. Patients with malignant ascites who received IPeC insertion were identified from these databases. Malignant ascites was defined by either positive peritoneal fluid cytology or malignant peritoneal involvement on imaging on a background of known metastatic malignancy. The study was approved by the Safety Quality and Performance Unit, Sir Charles Gairdner Hospital, Perth, Western Australia (Quality Improvement No: 27640).

Data collection

All available electronic and paper medical records of recruited patients were reviewed manually; these included physician assessment for indication of IPeC, record of IPeC insertion procedure and catheter drainage, and details of nursing care and chemotherapy treatment. Procedure records of LVP before and after IPeC insertion, patients' symptoms, diagnosis of malignancy, oncological treatment and date of death were reviewed. Details of treatment in private hospital or hospice settings were evaluated from discharge summaries and clinic correspondence, where available. Follow-up data until death or the date of data analysis (December 2018), whichever was earlier, were noted.

IPeC: patient selection; follow-up; and support service

The IPeC program including patient selection, catheter insertion and aftercare was directly managed by the same team of pleural specialists and nurses that ensured

continuity of care.

Patients with malignant ascites who were referred to the pleural specialists for IPeC were initially assessed clinically and sonographically regarding the feasibility of IPeC insertion. Major contraindications for IPeC placement included the presence of loculated ascites and/or peritoneal infection. Non-medical factors such as inability to self-care and poor performance status (Eastern Cooperative Oncology Group [ECOG] performance status 3 or 4), were considered relative contraindications.

A 16 French gauge, 40 cm long, fenestrated silicone catheter designed for indwelling pleural use (Rocket®) was adapted as IPeC in all patients. The catheter was tunneled subcutaneously before insertion into the peritoneal cavity by Seldinger technique (previously described by Lungren and Narayanan et al ^{15,21}). Bedside ultrasound was used to assess for adequate peritoneal fluid and identify the the optimal site for catheter insertion. The frequency of subsequent IPeC drainage was based on the rate of fluid re-accumulation and recurrence of symptoms. Community palliative care services were engaged, wherever appropriate, to provide IPeC drainage at home. In suitable cases, patients' carers were educated to perform home drainages.

The patients were usually reviewed in the Pleural clinic within 1 to 2 weeks after IPeC insertion and specifically assessed for ascites-related symptoms, catheter functioning, wound healing and complications (especially peritonitis), if any. Trained clinic nurses performed IPeC drainage and educated patients on catheter care and

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monitoring of potential complications. Bacterial culture of the peritoneal fluid in the clinic was routinely performed. Patients were encouraged to contact the Pleural Service if there were worsening of symptoms, concern of peritonitis or other mechanical problems regarding catheter drainage.

Definitions of events

The potential benefits of IPeC were specifically investigated. Length of hospital stay during the hospitalisation for IPeC insertion was calculated and the reasons for continuing hospital stay following initial fluid drainage were recorded. The need for LVP pre- and post-IPeC insertion was assessed, including the number of LVP episodes before and after IPeC insertion, and the duration between last LVP and IPeC insertion. Patients' functional status and ascites-related symptoms before and after IPeC insertion were noted from the medical records. Any documentation of change of symptoms was specifically noted.

Complications related directly to IPeC insertion and subsequent IPeC use were recorded. Complications were classified as early (within 24 hours of IPeC insertion) or late (>24 hours afterwards). Bleeding or oozing were considered as significant early complications if wound revision or repeated change of wound dressing materials were required. Hypotension was defined as a drop in systolic blood pressure (SBP) by more than 20 mmHg. Late complications included peritoneal infection, mechanical complications (e.g. catheter dislodgement, migration, leakage and blockage), persistent wound pain and catheter tract metastasis. Infective

peritonitis was diagnosed by the presence of a positive bacterial culture of the ascitic fluid, compatible clinical presentation, and raised blood inflammatory markers (white cell count and/or C-reactive protein).

The total number of days that a catheter remained in-situ was calculated for each patient. If the catheter had been removed, the reason for its removal was evaluated.

The primary cancer type and previous cancer treatment(s) were also recorded. The date of malignant ascites diagnosis was defined as the date of first positive peritoneal fluid cytology or detection of ascites with malignant peritoneal involvement on imaging, whichever occurred earlier.

Data analyses

Data of descriptive analyses are presented as percentage, median and interquartile range (IQR).

Results

Demographic characteristics (Table 1)

Forty-eight patients with malignant ascites who had 51 IPeCs inserted were identified. Their median age was 65 years (IQR 57 – 71), and 56% were females. Gynaecological cancers (31%) were the most common underlying malignancies, followed by mesothelioma (23%), gastrointestinal or pancreaticobiliary (21%) and breast (15%) cancers. 92% of patients had died at the time of census. The median durations from

diagnosis of malignant ascites to death and from IPeC insertion to death were 121 days (IQR 52 – 334) and 31 days (IQR 16 – 64), respectively.

Insertion procedures

IPeC insertion was performed as an in-patient in 98% of cases (76% as elective admissions). 92% of IPeC insertions were performed by pleural specialists experienced in the insertion of IPC for pleural effusions; the remaining IPeC placements were performed by interventional radiologists. Ultrasound was used to successfully guide all IPeC insertions with good initial drainages in all cases. The median length of hospital stay for IPeC insertion and initial drainage was 2 days (IQR 2 – 3).

Need for LVP before and after IPeC insertion

Most patients (n=46, 96%) had prior LVP (median 2 drainages, [IQR 1 – 4] [maximum = 8]) before IPeC insertion. Two (4%) patients with known malignant pleural mesothelioma had IPeC insertion as the first procedure after development of symptomatic malignant ascites. The median time between IPeC insertion and the first LVP and between IPeC insertion and the most recent LVP were 48 days (IQR 27 – 145) and 19 days (IQR 12 – 29), respectively. Most patients (96%) did not require further LVPs after IPeC insertion. Two patients required LVPs – in one patient, a single LVP was needed for interim relief whilst awaiting catheter replacement due to IPeC blockage; and in a second patient, multiple LVPs were required following removal of IPeC due to infection.

Aftercare

Most patients (96%) experienced subjective relief from ascites symptoms after IPeC insertion and reported improvements in breathlessness, discomfort from abdominal distension and abdominal pain. Objective measurement of performance status and QoL was not consistently documented. Half (18/37; 49%) of the patients with available drainage records had their IPeC drainage performed twice weekly.

Complications of IPeC (Table 2)

There was no acute major complication. Pain, requiring additional analgesia or medical review, was the most frequent complaint (in 14 cases [27%]) in the first 24 hours; pain was controlled in all cases by increasing analgesia. Hypotension occurred in five patients (10%) during the first drainage after IPeC insertion and was managed by intravenous fluid or albumin infusion.

Infective peritonitis

Six patients had positive peritoneal fluid bacterial cultures. Four were treated with intravenous antibiotics for true peritonitis; in one patient the IPeC was removed immediately after the peritonitis was diagnosed. The bacteriology and treatment outcomes are listed in table 3. Two patients were considered to have bacterial colonisation (by *Staphylococcus capitis* and *Staphylococcus cohnii*) rather than true infection due to absence of infective symptoms and systemic inflammatory response. No antibiotic treatment was given and the two patients remained well.

Catheter removal

Among the 51 IPeCs, six catheters were removed; the catheter remained in-situ for all patients for a median 31 days (IQR 16 – 81) (table 4). One patient had progressive reduction and eventual cessation of drainage output whilst receiving chemotherapy. Another patient developed spontaneous cessation of fluid output with a small residual loculated ascites. In the remaining four patients, the IPeC was removed because of catheter blockage, accidental dislodgement, bacterial peritonitis and concern regarding the position of catheter tip being lodged in the abdominal wall on CT imaging (despite good catheter outflow and no symptoms).

Discussion

This case series is the first reported Australian experience of management of recurrent malignant ascites using IPeC. Overall 48 patients underwent 51 IPeC insertions and their management was incorporated into the existing IPC aftercare programs at the participating centres. Patients required only a short stay in the hospital for the insertion procedure and subsequent ascites drainage could be managed in an ambulatory setting.

Patients with advanced cancer and malignant ascites often have severely impaired QoL; the goals of treatment are palliative and involve relief of symptoms with minimal interventions, hospital admissions and risks. IPeC can help to achieve these aims. IPeC insertion required only a short hospital stay and most (96%) of patients

did not require further LVP. Almost all patients (96%) experienced subjective improvement of ascites-related symptoms after IPeC drainage. The technique of IPeC placement with subcutaneous tunneling allows long-term ambulatory peritoneal drainage. The catheter can be removed if the fluid output ceased, as shown in our series.

There were no major complications in our study. Adverse effects were mostly temporary and self-limiting. Infection is always a concern to both physicians and patients when a peritoneal catheter is placed for an indefinite period. Our data were reassuring that bacterial peritonitis was uncommon (8%) and all cases were successfully managed with antibiotics. In one patient, the catheter was removed by the treating clinician immediately following the diagnosis of peritonitis; it was not due to failure of antibiotic therapy. This incidence is lower than that of non-tunneled peritoneal catheters ¹¹ and similar to that reported for IPCs in malignant pleural effusion ²².

Previous case series have focused on the insertion procedure itself and reported mainly on catheter-related complications ^{14,15,21}. For any implanted medical device, patient education and a follow-up program to monitor clinical response and trouble-shoot device complications is important yet there is little information regarding the ongoing care following IPeC insertion in patients with malignant ascites.

Like the use of any long-term implanted device, ongoing support including education on catheter care, regular medical review, community nursing support and access to expert advice (e.g. for troubleshooting) are essential for continuity of patient care and to ensure optimal outcomes with IPeC. Centres with a successful IPC program for management of pleural effusions have these essential after-care elements already established including patient/carer education, community liaison and back-up support from a specialist centre. Therefore, incorporating aftercare of patients with IPeC into established specialist pleural programs appears logical.

In this study, pleural pulmonologists performed the initial assessment and IPeC insertion in 92% of patients. Patients were then arranged for follow-up in the centres' pleural clinic for monitoring of IPeC drainage, education on catheter care and detection of catheter-related complications.

The pleural specialists who inserted the catheters in this case series were all experienced pulmonologists trained in managing IPCs in malignant pleural effusions. An integrated service between the tertiary specialist pleural clinic and community nursing support had already been established for some years. IPeC patients could be easily incorporated into this service with minimal need for additional infrastructure.

There are several limitations to this study. First, this is a retrospective study with its known associated disadvantages. However, our databases covered all eligible patients in the participating centres which would minimise selection bias. The

baseline demographics of this case series were similar to previously published case series, showing similar age range ^{16,18}, female predominance ¹³⁻¹⁵ and range of malignancies ²³. Second, the participating centres all had pleural specialist with training and experience in IPC management and a dedicated aftercare support service. Our results may not be directly extrapolated to all other centres. Third, the measurement of symptom improvement was subjective based on patient report. This may have under- or over-estimated symptom changes. An objective questionnaire-based assessment in future prospective works would better quantify and qualify the benefits. Fourth, this study lacked a controlled group of patients receiving LVP alone. The absolute benefits and complications of IPeC in malignant ascites can only be established by a randomised controlled trial. Finally, this audit spanned over 9 years and covered the development phase of IPeC service in the participating centres resulting in inclusion of only a small number of patients.

Conclusion

To conclude, the current study represents the first case series from Australia on IPeC use for symptomatic malignant ascites. The IPeC service was delivered as part of the existing local pleural IPC programs in the participating centres. Notwithstanding the limitations of a retrospective study, the use of IPeC in this setting appeared effective with an acceptable safety profile and deserves further evaluation in prospective trials.

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Table 1. Patient characteristics

Patients (n)	48
Age, years (median, IQR)	65 (57 – 71)
Female, n (%)	27 (56%)
Malignancy, n (%)	
Gynaecological	15 (31%)
Mesothelioma	11 (23%)
Breast	7 (15%)
Colorectal	4 (8%)
Biliary	3 (6%)
Pancreas	2 (4%)
Stomach	1 (2%)
Lung	1 (2%)
Nasopharyngeal	1 (2%)
Lymphoma	1 (2%)
Thymoma	1 (2%)
Liver	1 (2%)
LVP	
Number of patients who had LVPs prior to IPeC insertion , n (%)	46 (96%)
Number of patients who had LVPs after IPeC insertion , n (%)	2 (4%)
Median number of LVPs per patient before IPeC insertion (IQR)	2 (1 – 4)

Median time from first LVP to IPeC insertion, days (IQR)	48 (27 – 145)
Median time from last LVP to IPeC insertion, days (IQR)	19 (12 – 29)
Median time from IPeC insertion to death, days (IQR)	31 (16 – 64)
Median time of IPeC in-situ, days (IQR)	31 (16 – 81)

IPeC: indwelling peritoneal catheter; IQR: interquartile range; LVP: large volume paracentesis

Table 2. Complications related to IPeC insertion and subsequent care

Total number of IPeC inserted	51
Early complications (within 24 hours of IPeC insertion)	
Significant pain requiring review (by nurse or doctor) (%)	14 (27%)
Hypotension (%)	5 (10%)
Late complications (after 24 hours of IPeC insertion)	
Leakage from insertion site or valve system (%)	5 (10%)
Bacterial peritonitis (%)	4 (8%)
Catheter dislodgement (%)	1 (2%)
Persistent wound pain (%)	1 (2%)
Fluid loculation (%)	1 (2%)
Catheter blockage (%)	1 (2%)

IPeC: indwelling peritoneal catheter

Table 3. Bacteriology and treatment outcome of patients with bacterial peritonitis

Patients [†]	Bacteriology	Day of diagnosis after catheter insertion	Treatment outcome
1	<i>Staphylococcus aureus</i>	92	Responded to IV antibiotic
2	<i>Pseudomonas stutzeri</i>	81	Responded to IV antibiotic
3	<i>Enterococcus faecalis</i>	6	Responded to IV antibiotic
4 [‡]	<i>Enterococcus faecalis</i> <i>Staphylococcus capitis</i> <i>Staphylococcus</i> <i>haemolyticus</i>	3	Responded to IV antibiotic and catheter removal

[†] All these patients had infective symptoms and systemic inflammatory response, with positive bacterial culture from ascitic fluid.

[‡] Patient had accidental dislodgement of indwelling peritoneal catheter with persistent oozing from the wound. Catheter was replaced and this sample of ascitic fluid was taken shortly after catheter insertion. The infection may have been acquired at the time of dislodgement of first catheter. Same patient as patient 2 (second IPeC) in table 4.

IV: intravenous

Table 4. IPeC removal details

Patients	Events	Day of catheter removal
1	IPeC was blocked and remained non-functional despite instillation of urokinase through the catheter	31
2 (first IPeC)	IPeC was inserted and sutured by radiologist. Accidental dislodgement on day 6 with fluid oozing from the wound	6
2(second IPeC) [†]	IPeC was re-inserted by radiologist. Culture of ascitic fluid yielded a mixed growth of <i>Enterococcus faecalis</i> , <i>Staphylococcus capitis</i> and <i>Staphylococcus haemolyticus</i> . Commenced on intravenous antibiotic and IPeC was later removed	3
3	IPeC was inserted by radiologist with good output from the catheter and excellent symptomatic relief. Scheduled CT next day found the proximal catheter tip lodged within the anterior abdominal wall in the left lower quadrant. The catheter was removed by the attending palliative team physician and another IPeC re-inserted later by a pleural pulmonologist	2
4	Patient received chemotherapy for underlying malignancy with disease control and cessation of peritoneal fluid	153

	production. No loculation or residual ascites was found on ultrasound	
5	Progressive cessation of catheter output with only residual loculated ascites on imaging	105

CT: computerised tomography

[†] *Same patient as patient 4 in table 3.*