

Non-vascular applications for vascular devices

Salomao Faintuch, M.D.

Interventional Radiology
Beth Israel Deaconess Medical Center
Harvard Medical School,
Boston, MA

Introduction

- Oncology patients
- Alternative routes for treatment
- Palliative care
- Different techniques
- Special attention to complication management

Indications

- Intraperitoneal therapy
- Peritoneal accesses for ascites drainage
- Intrathecal catheters for analgesia

Intraperitoneal therapy

- Administration of fluids for oncology patients with limited vascular access
- Antineoplastic drug delivery

Intraperitoneal fluid administration

- Case reports
- Crystalloids administration in TPN
- Fluids in children with severe gastroenteritis and ileostomy diarrhea

Antineoplastic drug delivery

- Investigative trials- ovarian cancer
- Clinical practice for more that 40 years- control of malignant ascites
- **Goal:** Increase the exposure of cancer cells within the peritoneal cavity to the drug while minimizing potential toxic effects to internal organs

Intraperitoneal catheter outcomes in a phase III trial of intravenous versus intraperitoneal chemotherapy in optimal stage III ovarian and primary peritoneal cancer: A Gynecologic Oncology Group study

Joan L. Walker ^{1*}, Deborah K. Armstrong ², Helen Q. Huang ³, Jeffrey Fowler ⁴, Kenneth Webster ⁵, Robert A. Burger ⁶, Daniel Clarke-Pearson ⁸

- Catheter choice, timing of insertion, and how surgical treatment of ovarian cancer influences the successful completion of intraperitoneal chemotherapy require further study

J.L. Walker et al. / Gynecologic Oncology 100 (2006) 27–32

Intraperitoneal catheter insertion

Table 5
Complications of IP access devices

	Piccatt [14] fenestrated (n = 143)		Davidson [10] Port-A-Cath (n = 227)		Mishji [17] venous device (n = 301)		GOG 172 [3] (n = 205)	
	No.	%	No.	%	No.	%	No.	%
Port complications	6	11.1	40	17.6	30	10	40	19.5
Inflow obstruction	3	2	20	8.8	19	6.3	18	8.8
Infection	12	8	12	5.3	11	3.7	21	10.2
Bowel injury	2	1.4	8	3.5	0	0	4	2

THE NEW ENGLAND JOURNAL OF MEDICINE

ORIGINAL ARTICLE

Intraperitoneal Cisplatin and Paclitaxel in Ovarian Cancer

- intraperitoneal chemotherapy has a clinical advantage in the treatment of ovarian cancer.
- these results should encourage the use of intraperitoneal chemotherapy in patients with advanced ovarian cancer.

N Engl J Med. 2006 Jan 5;354(1):34-43

Malignant ascites

- common complication end stage malignancies
- symptoms associated: abdominal distension, SOB, fatigue, nausea, pain, lower extremity edema
- significant compromised daily activities

Peritoneal accesses for ascites drainage

- Historic background:
 - » concerns about complications
 - » catheter malposition
 - » Infection
 - » catheter occlusion
- New technologies:
 - » Tunneled catheters- 2001
 - » Abdominal ports- 2001

Peritoneal accesses for ascites drainage

- Rationale: quality of life, avoidance of repeated visits to hospital
- High patency
- Low complications

Tunneled Peritoneal Catheter Placement Under Sonographic and Fluoroscopic Guidance in the Palliative Treatment of Malignant Ascites

- Recurrent, symptomatic ascites in 24 patients with malignant disease, who presented with at least four therapeutic paracenteses in a 4-week period
- Percutaneous tunneled catheter placement
- polymeric silicone peritoneal catheter

O'Neill, M. J. et al. Am. J. Roentgenol. 2001;177:615-618



Technique

- Pre-procedure orders:
 - » Cefazolin IV
 - » NPO 6 hours(IV conscious sedation)
- US guided puncture w/ 18-gauge sheathed needle
- Fluoro- guided 0.038-Amplatz guidewire coiled in the peritoneum
- 16-French peel-away sheath over the wire into the peritoneal cavity

Technique

- Peritoneal catheter needs to be prepared for passage through the peel-away sheath over the Amplatz guidewire
- coaxial placement system :
 - » preloaded onto a 120-cm, 5-French catheter
 - » assembly was lubricated with a small amount of sterile gel
- System is fed through the lumen of the peritoneal catheter until the tip of the Davis catheter protruded out the end of the dialysis catheter

Technique- Tunneling

- Lateral-to-medial direction and 2% lidocaine mixed with sodium bicarbonate used as anesthetic.
- Plastic tunneling device passed from the initial catheter access point along the subcutaneous tissues into the anesthetized abdominal wall and small exit skin incision was made at the 12-cm mark
- Catheter attached to the backside of the tunneling device and pulled through the subcutaneous tunnel
- The two cuffs remain buried in the tunnel, approx. 1-2 cm from skin incision site

Outpatient Catheter Care

- At discharge:
 - hospice care through the Visiting Nursing Services.
 - specific instructions on wound care, catheter flushing, and fluid drainage.
- Continuous drainage was accomplished by attaching the catheters to a large drainage bag by connecting the tubing with a three-way stopcock for irrigation access.
- Intermittent drainage was established by clamping the catheter:
 - access the catheter under sterile conditions
 - connecting tubing and vacuum bottles emptying 2-3 L of fluid at a time to maintain the patient's comfort.

Results and outcomes

- Successful insertion in all patients with immediate and complete relief of symptoms
- The average time : 43 min.
- The mean life span after catheter placement was 7.2 weeks (range, 1-14 weeks).
- Twenty (83%) of the 24 patients were treated at home with hospice care and did not require further catheter manipulation, IV antibiotics, or repeated therapeutic paracentesis.
- Twenty-three (96%) of the 24 patients died with functioning catheters.

Complications

- One patient's catheter was removed because he developed tunnel infection, which was treated with therapeutic paracentesis until he died.
- No immediate complications from the intermittent drainage treatment were noted.
- 17% complication incidence—three minor and one major.
- symptomatic bacterial peritonitis with positive ascites cultures at 22, 25, 28, and 33 days postplacement. (two cases were treated at home with IV antibiotics, and two required hospitalization)
- All four patients who developed bacterial peritonitis were discharged home with the intermittent drainage method.

Conclusions

Tunneled peritoneal dialysis placement is a safe, effective, and minimally invasive option for palliative treatment of large-volume malignant ascites in patients with end-stage malignancies.

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Placement of a Permanent Tunneled Peritoneal Drainage Catheter for Palliation of Malignant Ascites: A Simplified Percutaneous Approach

- Simple, minimally invasive method of palliative drainage of symptomatic malignant ascites, which allows patients to avoid repeated trips to the hospital for paracentesis.
- 29 patients with symptomatic malignant ascites underwent percutaneous placement of a tunneled multiple-side-hole Tenckhoff catheter:
 - ✓ modified Seldinger technique
 - ✓ curved and straight coaxial needles
 - ✓ does not require an incision

Journal of Vascular and Interventional Radiology 13:379-383 (2002)



Tenckhoff catheter

- is a multiple-side-hole, 15-F, 42-cm, soft silicon rubber catheter with an end hole and a removable hub
- It has two Dacron cuffs that hold the catheter in place



Technique

- Pre-procedure orders:
 - » Cefazolin IV + hydration
 - » NPO 6 hours(IV conscious sedation)
- US is used to mark the skin at a point suitable for entering the peritoneal cavity:
 - » near the midline, inferior and to the right of the umbilicus
 - » pocket of ascites is chosen which appears free of tumor and bowel

Technique

- Indelible ink is used to draw a line on the skin 15 cm in length indicating the course of the planned subcutaneous tunnel
- Infiltrated with local anesthetic (buffered 1% lidocaine).

Technique

- An 18-gauge spinal needle is placed into the subcutaneous tissue of the abdominal wall
- 22-gauge Chiba needle is given a distal curve ► inserted through the spinal needle ► advanced into the peritoneal cavity
- External manual compression

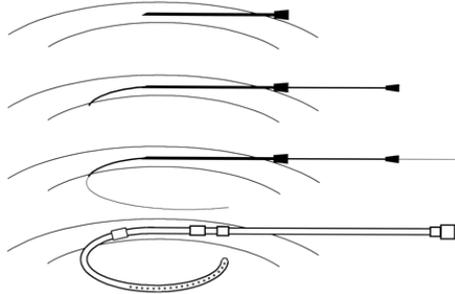
Percutaneous placement of the Tenckhoff catheter



Technique

- 0.018-inch guide wire is advanced through the 22-gauge needle
- Tract dilation to 20 F
- Tenckhoff catheter and lubricated stiffening catheter ► advanced over an 0.035-inch guide wire
- The guide wire and stiffening catheter are removed
- Catheter in its final position

Percutaneous placement of the Tenckhoff catheter



Post procedure management

- The catheter is connected to a urine bag and used immediately to drain all the ascites.
- Initial drainage will generally range from 1 to 5 L and will take approximately 30 minutes.
- The patient and caretakers are instructed on the use of the catheter and the importance of maintaining sterility.
- Subsequently, the patient may use the catheter as often as needed by removing the cap and, without allowing the hub to contact anything, draining it directly into a sink, toilet, jar, pot, or other container.
- Vacuum bottles are not required.

Outpatient care

- The catheter hub is cleaned with rubbing alcohol before recapping (replaced once every week)
- No routine flushing of the catheter
- Patients are asked to estimate and record the drainage volume and encouraged to drink oral electrolyte replacement solution equivalent in volume to the amount drained each day
- Call the radiology nurse with questions or problems

Results and outcomes

- Technical success was achieved in all 29 patients.
- All tolerated the procedure well and were satisfied with the convenience and comfort of the permanent catheter.
- There were no major complications.
- 27/29 patients had catheters which were still in place and functioning well with satisfactory control of ascites at the time of death

Complications

- Five minor complications
- 2 accidentally removal of catheter
- Abdominal wall cellulitis several days after catheter placement, which was successfully treated on an outpatient basis with oral cephalexin. Subsequently, we gave all patients preprocedural antibiotic prophylaxis (cefazolin) and did not encounter any more cases of infection.
- Persistent leakage around the catheter (placing the catheter to continuous gravity drainage rather than intermittent drainage)
- Poorly draining catheter removed and a new one placed 6 days after the initial procedure.

Conclusions

In terminally ill patients with cancer who can be expected to need repeated paracenteses, our minimally invasive method of placing the Tenckhoff catheter for palliative drainage of malignant ascites is a simple, effective, and well-tolerated technique which allows them to leave the hospital quickly and can be performed easily by any radiologist with basic interventional skills.

Summary

Tunneled peritoneal catheter

- Simple and safe techniques
- Good outcomes reported in the literature- few studies
- Requires strict sterile management for out patient care
- Possibility of accidental removal of the catheter

Brief Reports

Use of Subcutaneous Venous Access Ports to Treat Refractory Ascites

- To assess the feasibility of peritoneal ports for management of patients with cirrhotic refractory ascites
- 10 ports were placed in nine patients for frequent outpatient paracentesis

Journal of Vascular and Interventional Radiology 12:1343-1346 (2001)



Technique

- Pre-procedure orders:
 - » Cefazolin IV
 - » IV conscious sedation
 - » Local lidocaine anesthesia
- 3.5-MHz US transducer :
 - » right lower quadrant of the abdomen lateral to the expected course of the inferior epigastric vessels
 - » large volume of ascites without loculations
 - » Avoidance of excessive fat at the site of port reservoir placement

Technique

- Venous access port (6- or 8-F magnetic resonance imaging implantable ports; Bard Access Systems, Salt Lake City, UT)
- modified by cutting small extra side holes into the proximal segment in a spiral fashion

Technique

- 20.5-cm, 5.5-F One Step fluid drainage catheter (Electro-catheter, Rahway, NJ) advanced under US guidance into the largest pocket of ascites in the pelvis
- Stylet removed-drainage of ascites - stopcock placed
- 3-cm skin incision and port pocket performed 2-4 cm from the peritoneal entry site
- Subcutaneous tunnel created

Outpatient care

- 7/9 patients had peritoneal ports accessed as outpatients by a registered nurse in the gastroenterology suite on a monthly to weekly basis, depending on each patient's symptoms
- Visiting nurses performed drainage in patient at home and in one in a rehabilitation facility
- Peritoneal drainage session was concluded when drainage through the needle ceased

Outpatient care

- Nurses recorded frequent vital signs, pre- and post-treatments weights, and total time and volume of ascites drained during each session
- Most patients received 25–50 g intravenous albumen replacement therapy (based on 8 g/L of ascites removed) according to their hepatologist's orders

Results and Outcomes

- Successful in all nine patients
- Average procedure time -60 min.
- 7 patients received 8-F port reservoir and 2 patients received the smaller 6-F port
- During 4–45 weeks, all patients had 2–12 liters of ascites drained at each weekly to monthly session
- 8/9 ports were still patent when removed or lost to follow-up

Complications

- 3 episodes of bacterial peritonitis:
 - » Ascites leak
 - » Poor wound healing
 - » Sepsis- positive blood cultures
- 2 ascites leaks with gaps in port incision
- 1 fibrin sleeve
- 1 blood-tinged ascites
- 1 periport ascites pocket
- 2 unrelated deaths at the end of study

Conclusions

- High infection rate of 33%- 2 ascites leaks at port incision
- Port pockets must have closely spaced sutures
- Late removal of skin nonabsorbable sutures from port incision 10–14 days after port placement
- Minimizing peritoneal skin tract dilation before advancement of the final peritoneal port catheter

Peritoneal Ports for Treatment of Intractable Ascites

Michael A. Savin, MD, Matthias J. Kirsch, MD, William J. Romano, MD, Steven K. Wang, MD, Paul J. Arpasi, MD, and Charito D. Mazon, RN, BSN

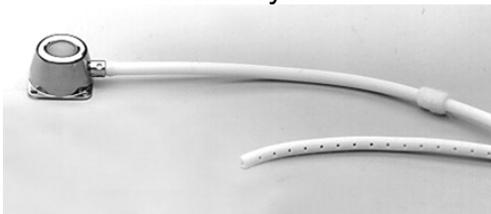
•27 patients with symptomatic large-volume ascites underwent percutaneous placement of an implantable peritoneal access system designed to permit repeated access

•Port-a-Cath peritoneal implantable access system (Smiths Medical, St. Paul, MN) was used in all cases

Journal of Vascular and Interventional Radiology 16:363-368 (2005)



Port-a-Cath peritoneal implantable access system



- Portal base is 2.52 cm and height is 1.52 cm
- Polyurethane and is 15 F (5 mm) in outer diameter and has a 2.6-mm inner diameter with multiple side holes along the intraperitoneal portion
- Cuff for the portion in the tunnel

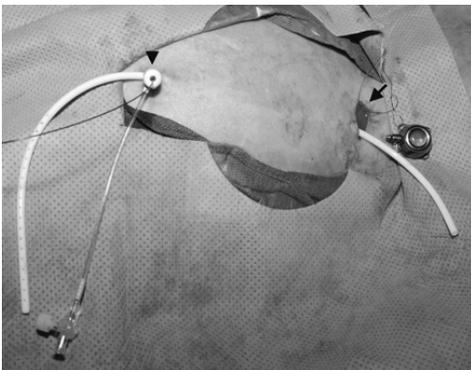
(Smiths Medical, St. Paul, MN)

Technique

- Pre-procedure orders:
 - » Cefazolin IV
 - » IV conscious sedation
 - » Local lidocaine anesthesia
- 3.5-MHz US transducer :
 - » right lower quadrant of the abdomen lateral to the expected course of the inferior epigastric vessels
 - » large volume of ascites without loculations
- Port site located over a bone to allow for easy needle access:
 - » over the inferior aspect of the lower ribs in the anterior midclavicular line
 - » over the ilium just inferior and posterior to the anterior superior iliac spine

Technique

- Ascites access:
 - » 18-gauge needle passed through the subcutaneous tissues in a zigzag course
 - » spontaneous drainage of ascites – passage of 0.035-inch-guide wire
 - » partial paracentesis performed with a multiple-side hole drainage catheter or a sheath
- Port pocket:
 - » over the anterolateral lower ribs through a 3-cm skin incision
 - » initially loosely sutured to the deep subcutaneous tissue with two nonabsorbable sutures without knotting
- Tunnel creation
 - » created between the pocket and the ascites entrance site with use of a metal tunneler
 - » catheter is affixed to the tunneler and pulled through the tunnel



Technique

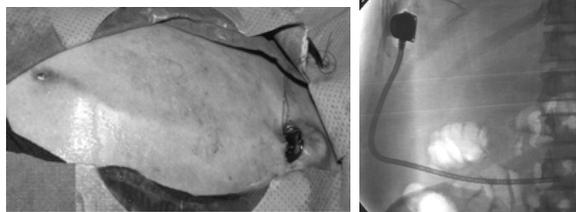
Port placement

- Catheter is cut to length and secured to the port connector fitting
- Port is placed in the pocket and then secured by tying the previously placed sutures
- Over the guide wire, serial dilation is performed, followed by placement of a 16-F peel-away sheath into the peritoneal cavity
- Catheter is then advanced through the peel-away sheath into the ascites and the peel-away sheath is removed

Technique

Port placement

- Adequate function is confirmed by aspirating the port
- Port site is closed with two layers of subcutaneous absorbable sutures (2–0 Vicryl deep and 4–0 Vicryl superficial)
- Ascites access site is closed with subcutaneous absorbable suture and dermal nonabsorbable suture
- Port is accessed with a 19-gauge Huber needle and port aspiration
- Flushed with 20 mL of heparinized saline solution (100 IU/mL)



Outpatient care

- Visiting nurse care, usually through hospice who were instructed in wound and catheter care and fluid drainage
- The frequency of home visits was usually 1–2 times per week and was tailored to symptom recurrence
- monitored orthostatic vital signs and temperature as well as amount and character of ascites aspirated

Outpatient care

- Technique for port access =central venous chest ports
- Sterile technique: alcohol wipes and povidone iodine swabs
- Large-bore Huber needle (19 gauge) :higher flow and shorten aspiration time
- Needle connected to vacuum bottles
- Max. aspiration vol. of 3 L (avoid volume depletion)
- Orthostatic systolic BP< than 20 mm Hg- port aspiration is postponed
- Port flushed with 20 mL of heparinized saline solution (2,000 IU heparin) after use

Immediate results

- 100% successful insertion with removal of all ascites
- All patients had immediate and complete relief of symptoms
- No immediate major complications
- One minor complication: hematoma at the port placement site in a patient with pancreatic carcinoma.

Long-term results

- (96%) showed maintained relief of symptoms until death or the end study
- 25 /27 patients (92%) were treated successfully without further catheter manipulation, antibiotic therapy, or repeat paracentesis

Long-term results

- One patient -clinical failure:
 - » port placed the day after paracentesis and loculated ascites was not recognized at the time of placement
 - » required additional paracenteses to maintain symptom relief- declined placement of a second port
- One patient had two major delayed complications:
 - » persistent leakage at the port site
 - » development of intractable leakage at the port site- port removal after 80 days
 - » second port placed: bacterial peritonitis and death (multiple organ failure)

Conclusion

- Peritoneal ports appear to be a safe, effective treatment option for intractable ascites, particularly those resulting from malignancy.
- Initial success rate was 100%
- Long term- patency rate was 100%
- Success rate was 96%
- Major complication rate was 4%.

Can an abdominal port placed for ascitic drainage be used also for intraperitoneal chemotherapy???

Percutaneous Placement of Peritoneal Port-Catheter in Patients with Malignant Ascites

Orhan Ozkan, Devrim Akinci, Rahsan Gocmen, Barbaros Cil, Mustafa Ozmen, Okan Akhan
 Department of Radiology, Hacettepe University School of Medicine, Sıhhiye, Ankara 06100, Turkey

- Radiologically placed peritoneal port-catheter in palliation of malignant ascites
- Seven patients (age range: 39–71 years; mean: 53 years)

Table 1. Summary of patients and placed peritoneal port-catheters

Patient	Age	Sex	Diagnosis	Port type	Port day
1	71	M	Mesothelioma	14F	550
2	63	M	Mesothelioma	9F	60
3	39	F	Metastatic adenocarcinoma	14F	69
4	38	F	Ovarian carcinoma	14F	73
5	42	F	Ovarian carcinoma	14F	265
6	59	F	Leiomyosarcoma	14F	8
7	61	F	Endometrial carcinoma	14F	15

CardioVascular and Interventional Radiology (2007) 30:232-236



Fig. 1. A 14F peritoneal access system.



Fig. 2. Pocket, tunnel, and peritoneal entry sites. The port pocket was prepared over the anterolateral lower ribs (arrow). The port-catheter connected to the tunneler was pulled through the tunnel (curved arrow). Capped dilator at the ascites entry site (white arrow).

IP chemotherapy

- In addition to ascites drainage, two patients (29%) with malignant mesothelioma patients received intraperitoneal chemotherapy (50 mg cisplatin) through the port-catheter without any difficulty

Summary
Abdominal ports

- Safe and effective treatment option for intractable ascites
- Choice of port: venous or peritoneal ports
- Visiting nurses can perform drainage and monitor patients in their homes
- Port aspiration can be performed in some cases by patients or family members without nursing assistance

Summary
Abdominal ports

- Attention to technique: suture and skin incision
- Avoidance of leak is paramount
- Majority of complications result from infectious complications - ascites leak
- In comparison with tunneled peritoneal catheters with external components, the complication rate appears to be lower
