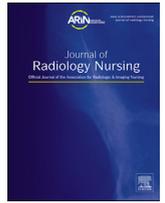




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## Malignant Ascites: An Overview of Management With Tunneled Peritoneal Drainage Catheters



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Malignant ascites is a common and debilitating condition. Treatment options favoring palliative approach are preferred. A discussion of tunneled peritoneal catheters as a management option is included in the following review.

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### Introduction

Refractory ascites is known by multiple names including intractable or resistant ascites (Fleming et al., 2009). The accumulation of peritoneal fluid can be due to malignant or nonmalignant causes. Malignancy only causes ~10% of cases of ascites where most cases are due to cirrhosis (Enck, 2012; Rosenberg, 2006).

In the setting of malignancy, most cases (~50%) are caused by invasion of the peritoneum (Enck, 2002, 2012; Rosenberg, 2006; Rosenberg et al., 2004). The remaining cases are due to liver invasion with portal venous compression or a combination peritoneal and liver involvement (Enck, 2002, 2012; Rosenberg, 2006; Rosenberg et al., 2004). The least common cause is lymphatic invasion resulting in a buildup of chyle (Enck, 2002, 2012; Rosenberg, 2006; Rosenberg et al., 2004).

Patients with advanced ovarian, breast, endometrial, colon, stomach, pancreas, and lung cancer commonly have malignant ascites. For example, approximately 30% of patients with ovarian cancer have malignant ascites at time of diagnosis (Enck, 2002). Less common causes include lymphoma, prostate cancer, multiple myeloma, and mesothelioma (Enck, 2002). Approximately 20% of patients may have cancers of unknown origin (Becker et al., 2006; Enck, 2012).

There are many contributing factors to the pathology of the disease. Peritoneal invasion may cause obstruction of the lymphatic channels, preventing the absorption of intraperitoneal fluid and protein (Enck, 2012). The unabsorbed fluid has a high protein content, resulting in increased vascular permeability and further

fluid collection in the peritoneal cavity. When obstruction is severe, the circulating blood volume decreases, activating the renin-angiotensin-aldosterone system and resulting in sodium retention (Becker and Blum, 2012; Becker et al., 2006; Enck, 2012).

### Clinical presentation

Increased abdominal fluid from malignant ascites causes increased abdominal pressure. This buildup results in symptoms such as pain, nausea, early satiety, and dyspnea. The bulk from the abdominal distention can decrease mobility, increase fatigue, and induce problems with body image. All these factors negatively impact a patient's quality of life (Fleming et al., 2009).

On examination, the extent of abdominal distention is visible. Palpation can elicit a fluid wave (So and Schiedermaier, 2000). The amount of fluid can be deceptive as abdominal distention is a nonspecific finding that can be caused by bowel gas, stool from constipation, or even bulky tumors.

### Diagnostic workup

Imaging can confirm clinical suspicion. Peritoneal fluid can be identified on cross-sectional imaging such as computed tomography (CT) scan, fluid-sensitive sequences on Magnetic Resonance Imaging, or even the noncontrast CT component of positron emission tomography–CT. Ultrasound (US) evaluation of the abdomen has unique features in that the nature, amount, location, and ability to be drained can be assessed. Ascites may be simple or complex depending on the appreciation of loculations or debris. Abdominal US examination classically evaluates all 4 quadrants of the

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abdomen. Ascites becomes visible when volume approaches above 500 mL (Hanbidge et al., 2003).

Imaging findings such as omental involvement of tumor can be suggestive of malignant ascites. The diagnosis is made by cytological evaluation of the fluid. This requires a diagnostic paracentesis, which may be performed by palpation or with imaging guidance (commonly US). The latter is preferred when performed by the radiology team.

Fluid analysis includes sending the specimen for cytology, obtaining culture and sensitivity, cell count, and albumin concentration. The serum-ascites albumin gradient (SAAG) is obtained by subtracting the ascitic value of albumin from the serum value (Fleming et al., 2009). If the gradient is greater than 1.1 g/dL (indicating high SAAG ascites), the patient is more likely to respond to medical therapy, such as diuretics (Fleming et al., 2009). Ascites secondary to peritoneal carcinomatosis usually has a low SAAG and does not respond well to diuretics.

## Management

### Diuretics

A survey of practices in 1998 by Lee et al. showed that diuretic use and paracentesis were commonly used to manage malignant ascites (Becker et al., 2006; Lee et al., 1998). Data on method of diuretic use and efficacy are controversial (Becker et al., 2006). Efficacy has been reported as high as 43%, especially when SAAG is elevated (Becker et al., 2006).

Different combinations of salt restriction, aldosterone-inhibiting diuretics, and loop diuretics have been reported. A common aldosterone-inhibiting diuretic is spironolactone. Common loop diuretics are furosemide and bumetanide. Adverse events are usually reversible and include renal dysfunction and hypotension.

### Paracentesis

Paracentesis is the manual drainage of the peritoneal fluid from a percutaneous access. The procedure is commonly performed under US guidance to identify the best site to access the peritoneal cavity. This is followed by sterile preparation of the area. US guidance is then used to anesthetize the tract with local anesthesia and advance a 5-F Yueh needle (Cook Medical, Bloomington, IN). The inner needle is removed, whereas the outer sheath remains in the cavity. The sheath is connected either to Vacutainer bottles (Franklin Lakes, NJ) or wall suction and fluid is removed. The procedure is performed on an outpatient basis. It ranges between 20 and 60 minutes in length depending on the amount of fluid present.

Studies have shown between 87 and 100% symptom relief after drainage of malignant ascites (Becker et al., 2006). The duration of relief when reported is short, for example, in one study, the mean duration was 10.4 days (Becker et al., 2006; Ross et al., 1989). The decision to repeat the procedure is dependent on the reaccumulation rate of the malignant ascites and severity of symptoms.

Complications, although uncommon, include pain, nausea, infection or bacterial peritonitis, electrolyte and fluid imbalance manifested as hypotension and/or renal failure, loculation formation, and visceral injury (Becker et al., 2006; Rosenberg et al., 2004). In a study where 109 paracenteses were performed on 43 patients, complication rates were reported at 2.6% (predominantly hypotension) (Ross et al., 1989). Although a straightforward, often outpatient procedure, mortality rates have been reported but are exceptionally rare (Ross et al., 1989; Stokes, 2007).

### Tunneled Peritoneal Catheters

Tunneled peritoneal catheters are used almost exclusively for treatment of malignant ascites in patients who would otherwise need frequent hospital visits for paracentesis. The catheter is connected to a small bottle with a gentle vacuum that can remove the fluid. The proximal end of the catheter has a valve that prevents leakage of fluid or air until the patient is ready to drain the ascites. Drainage can be done by the patient, home nurse, or family member.

Before placement, educational material and videos are reviewed with the patient and their caregivers. The placement of tunneled peritoneal catheters is performed using imaging guidance (usually US). The beginning steps are similar to performing a paracentesis. A location 6–10 cm below the costal margin, lateral to midline, and above the waist line (such that the catheter does not reside under belt) is chosen (CareFusion, 2011; Systems, 2012). US or CT guidance is used to ensure the access is away from critical structures, peritoneal implants, or loculations (Systems, 2012). Using standard aseptic technique, an area covering from inferior to the costal margin to the umbilicus is prepped. Antibiotics may be administered. Local anesthesia (1% lidocaine) is injected at the site of drainage and along the proposed tract for tunneling, approximately 5–8 cm cranial and medial to the site of drainage (CareFusion, 2011; Systems, 2012). Conscious sedation is recommended to ensure the patient can tolerate placement (Narayanan et al., 2014). Access to the peritoneal space may be made with the introducers provided in placement kits, but often 19 G Yueh needle/catheter (Cook Medical, Bloomington, IN) is preferred (Narayanan et al., 2014). On fluid return, the outer sheath is advanced into the peritoneal space. A guidewire is advanced into the peritoneal cavity. Using fluoroscopic guidance, this may be manipulated into more dependent portions of the pelvis if desired. A small incision is made in the cranial tunneled catheter site and drainage insertion site (along the wire). The fenestrated portion of the catheter is attached to the metallic tunneler, which is advanced subcutaneously to the drainage site incision until the Dacron cuff is pulled into the tunnel approximately 1 cm from insertion site (CareFusion, 2011; Systems, 2012). The Aspira system (Salt Lake City, UT) allows a retrograde tunneling approach as well (Systems, 2012). The metallic tunnel is removed, leaving the fenestrated catheter free. The Yueh sheath is then removed over the wire without losing access, and after serial dilation, the peel-away introducer is advanced into the peritoneal space. The dilator and wire are removed, and the catheter is advanced into the space, with care to avoid spillage of ascites. The PleurX system (McGaw Park, IL) provides an inner stiffener to plug fenestrations temporarily (CareFusion, 2011). Both catheters may be advanced over a wire for more precise placement. The peel away is then removed. The incisions are closed with sutures, which may be reinforced by Dermabond (Ethicon, Inc, Somerville, NJ). Ascites may be drained immediately. Dressing according to respective care kits is placed.

**Table 1**

Sample SAAG calculation and examples of high and low SAAG (Longo et al.)

SAAG = serum albumin concentration—ascitic fluid albumin	
SAAG $\leq$ 1.1 g/dL	SAAG $\geq$ 1.1 g/dL
Biliary leak	Cirrhosis
Pancreatitis	Liver metastases
Nephrotic syndrome	Heart failure
Peritoneal carcinomatosis	IVC obstruction
Example: Serum albumin = 4.4 g/dL, Ascitic albumin = 3.0 g/dL	
SAAG = 4.4 g/dL–3.0 g/dL = 1.4 g/dL	

SAAG = serum-ascites albumin gradient; IVC = inferior vena cava.

**Table 2**  
Overview of complications

Procedure	# Of patients	# Of procedures	Bacterial peritonitis	Loculations	Catheter site infection	WBC abnormalities	Incision site hernia	Leakage of ascitic fluid	Total complication rate
Large volume paracentesis (Rosenberg et al., 2004)	67	392	3	2	0	0	0	0	7.66%
PleurX (Rosenberg et al., 2004)	40	–	0	1	1	0	0	1	7.50%
PleurX (Narayanan et al., 2014)	38	–	0	0	2	3	0	2	18.42%
PleurX (Tapping et al., 2012)	28	–	0	0	5	0	1	1	25%

WBC = white blood cell.

### Complications with tunneled peritoneal catheters

Potential complications of tunneled peritoneal catheter placement and use include laceration of liver or bowel, hypotension/circulatory collapse, serum protein loss, ascites leakage, peritonitis, wound infection, tumor growth in the catheter tunnel, and loculations of the peritoneal space (CareFusion, 2011; Narayanan et al., 2014; Rosenberg et al., 2004; Systems, 2012). Complication rates may be higher than repeat large-volume paracentesis (see Table 1), but patients with peritoneal catheters benefit from fewer trips to the hospital for repeat drainage (Narayanan et al., 2014). Although large volume paracentesis has been associated with a decrease in serum protein levels, this complication is less common with peritoneal catheters because of more frequent, smaller volume drainage of ascitic fluid and can be further mitigated by supplementation with a high-protein diet.

Many of the complications may be managed in the clinic setting. Leakage often responds to more frequent drainage to allow healing around the catheter or purse string suture placement (Tapping et al., 2012). Infection may respond to antibiotic therapy; however, any sign of tunnel infection such as pus from incision should prompt catheter removal. Clogged catheter may require exchange. Regardless, close communication with interventional team can help with catheter care and maintenance (Table 2).

### Patient benefits

For patients with cancer, experiencing malignant ascites can be overwhelming. When ascites is significant, the abdominal pressure can be debilitating, impacting quality of life. The presenting symptoms of abdominal pressure, associated shortness of breath and physical inconvenience related to the ascites, affect the patient's ability to complete activities of daily routine. Undergoing a paracentesis drainage procedure, as described earlier, can offer short-term symptom relief; however, depending on severity and rate of reaccumulation, patients may have to undergo paracentesis 1–2 times a week for symptom relief. This is an inconvenience on patients who already must deal with multiple hospital trips for appointments, treatments, and so forth, to manage their cancer condition.

The placement of an indwelling drainage catheter for management of refractory malignant ascites provides patients a long-term solution. Benefits of undergoing placement of an indwelling drainage catheter include greater flexibility with time and convenience, greater control of symptom relief, and reduction in number of procedures (White and Carolan-Rees, 2012). The option of an indwelling drainage catheter offers patients control over their symptoms, allowing for drainage of fluid to take place at home and outside of the hospital setting.

### Clinical considerations and patient education

Education is paramount in ensuring improved outcomes while minimizing risks and complications for patients undergoing tunneled peritoneal catheter placement for the management of malignant ascites. Preprocedure considerations include obtaining and reviewing the most recent laboratory values, such as the white blood cell count, platelets, and coagulation profile. In addition, patients who are on anticoagulation medication need to be advised to hold their medication for an indicated number of days to minimize the risk of bleeding. Routinely, the procedure is performed under moderate sedation with an anxiolytic and opioid analgesic. Patients are instructed to avoid eating or drinking anything for at least 6 hours before the procedure. The preprocedure telephone call to the patient by the radiology nurse is an opportunity to provide education on preparations, NPO status, and necessary blood work. In contrast, postprocedure education is specific to wound site care, frequency of dressing changes, and fluid drainage. Patients are advised to contact their IR health care team should questions arise on the care and management of the catheter.

### Case study

A 60-year-old woman presented to the interventional department for abdominal distention, shortness of breath, and abdominal pain. She was diagnosed 4 years before initial visit with ovarian cancer and underwent total abdominal hysterectomy and bilateral salpingo-oophorectomy. In the prior few months, she had undergone 4 paracenteses and in the most recent visit her symptoms were so severe that she proceeded to the emergency department. The gynecology oncology service referred the patient for tunneled peritoneal catheter palliation. Previous cytology fluid analysis showed that the cellblock contained malignant cells, consistent with previous diagnosis of high-grade serous ovarian carcinoma. She tolerated the procedure well, requiring only fentanyl 100 mcg and midazolam 1 mg for intravenous sedation. After watching the instructional video, her family was able to take her home. Over the next 3 months, she controlled the symptoms at home, draining approximately 2 L every week. No further emergency visits were required for ascites. The catheter did not malfunction. After 3 months, she requested to enter hospice care.

### Conclusion

Malignant ascites causes substantial burden on patients already dealing with significant emotional and physical stress. Placement of a tunneled catheter can provide relief of symptoms with a convenience that is not attainable by other methods, such as paracentesis. Use of tunneled peritoneal catheters has a low risk of complications and should be considered in patients suffering from recurrent malignant ascites.

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