Symptomatic Fluid Drainage: Tunneled Peritoneal and Pleural Catheters

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Abstract

Keywords

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Malignant ascites and pleural effusion are significant contributors to patient symptoms such as shortness of breath, abdominal distension, and nausea in the setting of cancer. There are numerous methods employed to control such symptoms such as serial drainages, pleurodesis, and tunneled drainage catheters. Tunneled drainage catheters are a safe, effective, and a minimally invasive procedure to palliate the symptoms of malignant ascites and pleural effusion.

Objectives: Upon completion of this article, the reader will be able to describe the clinical impact of malignant ascites or pleural effusion and how a tunneled drainage catheter can be used to palliate symptoms.

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Background: Malignant Ascites

Ascites is a common manifestation of end-stage malignancy. It is defined as excess fluid buildup in the lining of the

abdomen and abdominal organs, secondary to peritoneal tumor infiltration, portal venous compression from liver metastases, lymphangitic carcinomatosis, lymphatic obstruction, or a combination of these factors.^{1,2} Malignant ascites may develop in as many as 50% of patients with cancer with increased frequency in certain tumor types such as ovarian, colon, pancreas, and liver.^{1,3} Progression of malignant ascites is associated with deterioration in quality of life (QOL) and a poor prognosis.⁴ Symptoms include abdominal distension and discomfort, shortness of breath, decreased appetite, fatigue, nausea, pain, decreased mobility, and increased extremity edema. Worsening of symptoms is a common reason for terminally ill patients and family members to opt for comfort measures only. It is estimated that ascites accounts for 6% of hospice admissions.⁵ Improvement of ascites-related symptoms can improve performance status and overall patient's sense of well-being.⁶

There is no standard management protocol for malignant ascites, which is typically refractory to basic treatment measures. Palliative options include diuretic therapy, repeated large volume paracentesis (LVP), peritoneovenous

shunt placement, and tunneled peritoneal catheter placement.⁷⁻⁹ Malignant ascites is difficult to stabilize using diuretic drugs and often limited by electrolyte status. There is only weak evidence for diuretic efficacy, with less than 45% of patients demonstrating a meaningful response based on the literature. Repeated LVP is a simple procedure that provides symptom relief for a few days, but symptoms inevitably return. For malignant ascites, patients typically require a LVP every 10 to 14 days.¹⁰⁻¹² This requirement leads to a significant amount of time spent getting repeat paracentesis for the patient and work time loss for caregivers.

Background: Malignant Pleural Effusions

Malignant pleural effusion is a common source of distress in advanced stage cancer patients and can be a consequence of almost all cancer types, though more commonly associated with lung, breast, ovarian, and gastrointestinal tract malignancies.¹³ It is estimated that there are 250,000 new cases of malignant pleural effusion in the United States every year.¹⁴ The presence of a malignant pleural effusion is a poor prognostic indicator and a cause of considerable distress, predominantly from debilitating dyspnea for advanced cancer patients. The etiology for development of malignant pleural effusions is complex and occurs when the balance of production outweighs removal, secondary to alterations in lymphatic drainage, inflammation, or production.¹⁵ Malignant pleural effusion can be managed through repeat thoracentesis, pleurodesis, tunneled catheter placement, or video-assisted thoracoscopic surgery (VATS). Thoracentesis reduces symptoms only temporarily and has to be repeated once symptoms return which may be as soon as 2 to 3 days. Pleurodesis can permanently control the accumulation of effusion, but success rates have been reported to range from 60 to 100% and requires a hospital admission for a chest tube insertion and a 4- to 5-day hospital stay.¹⁶⁻¹⁸ VATS is effective in controlling pleural effusions, but requires patients to tolerate one-lung ventilation and general anesthesia. It also has a 10% mortality and high rate of morbidity such as air leaks.¹⁹

Tunneled Drainage Catheters

Interventional radiologists have the ability to perform the minimally invasive image-guided placement of tunneled peritoneal drainage catheters (►Fig. 1) and pleural drainage catheters (►Fig. 2).^{20,21} Interventional radiologists typically place tunneled drainage catheters under both ultrasound and fluoroscopic guidance. A suitable site for access into the peritoneal or pleural space is identified with ultrasound which is then used to guide needle access through which a wire is placed. A subcutaneous tunnel is then created, and after serial dilation over wire and a placement peel-away sheath, the catheter can be placed into the appropriate space through the sheath.^{22,23} The technical success rate of placing a tunneled drainage catheter nears 100%.²⁴ The majority of tunneled drainage catheter placement can be done in an outpatient setting. Though reported complication rates are low, there is a risk of catheter malfunction necessitating

repeat office visits and procedures, and also risk of infection, such as exit site cellulitis, peritonitis, or empyema.²⁵⁻²⁷ Complication rates of tunneled peritoneal catheters are similar to complication rates experienced with repeated LVP.²⁰ Catheter malfunction does not necessarily require removal or replacement of the tunneled catheter, as thrombolytic instillation has been shown to be a safe and effective method to restore function of a tunneled pleural catheter.²⁸ There are few contraindications to placing a tunneled catheter, including peritoneal cavity infection, coagulopathy, and in the setting of multiloculated ascites where drainage of a single loculation is unlikely to provide symptomatic relief for the patient.^{24,29,30}

Evidence in Support of Tunneled Peritoneal Drainage Catheters

Studies suggest that peritoneal tunneled catheter placement promotes patient convenience and comfort.^{26,31-34} One study by Monsky et al reported high overall QOL, convenience, and improvement in symptoms with this approach.²⁷ Patients report relief of ascites-related symptoms such as nausea, diarrhea, bloating, and abdominal discomfort 2 to 6 weeks after tunneled drainage catheter placement.²⁴ Patients can be trained to drain ascitic or pleural fluid on their own, reducing the number of trips to the hospital and allowing patients to have greater freedom. Patients have reported satisfaction with ease of catheter usage, no procedural-related pain, and ability to drain fluid before becoming symptomatic from large volume ascites.²⁰ There are significantly less emergency department visits, admissions, and days of hospital stay to manage ascites-related complications such as abdominal discomfort, distension, or pain after a patient has a tunneled catheter placed compared with the period before catheter placement.³⁵ Home-based drainage has been shown to be safe with significant reduction in number of paracentesis and diuretic requirements without adverse effects on kidney function, serum albumin, and serum sodium.³⁶ However, some patients may find drainage tubes exiting their abdomen to be inconvenient and unpalatable. To date, most studies have mainly focused on technical success rate and complications of tunneled drainage catheter placement, with limited available information evaluating changes in standardized QOL assessments.

Although most tunneled catheters are placed for symptomatic relief by volume reduction, there is a subset of patients who may also benefit from added palliation with intraperitoneal administration of chemotherapy to mitigate the source of ascites. A study showed that the tunneled drainage catheter could safely be used for intraperitoneal chemotherapy instillation, as there was no difference in infection rate of a tunneled drainage catheter when it was also used for instillation therapy compared with just drainage alone.³⁷

Evidence in Support of Tunneled Pleural Drainage Catheters

Similar to peritoneal tunneled catheter placement, tunneled pleural catheter placement also promotes patient convenience and comfort.^{18,25,38} Alternative treatment options exist

Fig. 1 Image-guided peritoneal catheter placement in an 85-year-old man with pancreatic carcinoma complicated by recurrent ascites. (a) Ultrasound image demonstrating pocket of ascites suitable for access for drainage. (b) Direct ultrasound visualization of access needle into the fluid pocket. (c) Fluoroscopic image demonstrating wire placed through access needle draped along the peritoneal gutter. (d) Fluoroscopic image demonstrating final tunneled peritoneal catheter tracking along the peritoneal gutter.

for the management of recurrent malignant pleural effusions including repeat thoracentesis and pleurodesis. A randomized control study of 106 patients across seven medical centers evaluating the efficacy of tunneled pleural catheters as compared with talc pleurodesis demonstrated no statistical difference in efficacy in relieving dyspnea between the two modalities.¹⁸ A propensity-matched comparison of pleurodesis versus tunneled drainage catheter placement over a 6-year period in 60 patients revealed that tunneled drainage catheter placement had significantly shorter hospital stays, lower rates of operative morbidity, and shorter

interval to systemic therapy compared with talc pleurodesis while palliation of symptoms were similar.³⁹ In a retrospective analysis of 109 patients with malignant pleural effusion comparing VATS pleurodesis with tunneled drainage catheter placement, the authors found that patients with tunneled drainage catheters had significantly reduced rates of repeat intervention for pleural effusion and length of stay without any difference in complication rates.⁴⁰ In another retrospective analysis of 63 patients who underwent tunneled pleural drainage catheter placement for failed pleurodesis, there was clinical improvement of dyspnea in

Fig. 2 Image-guided pleural catheter placement in a 66-year-old woman with metastatic breast carcinoma complicated by recurrent pleural effusion. (a) Ultrasound image demonstrating pocket of complex pleural fluid suitable for access for drainage. (b) Direct ultrasound visualization of access needle into the fluid pocket. (c) Fluoroscopic image of final tunneled pleural catheter tracking superiorly. Multiple studies have demonstrated significantly reduced rates of repeat intervention for pleural effusion and length of stay associated with tunneled pleural catheters as compared with pleurodesis.^{39,40}

95% of patients, suggesting that tunneled catheters have a clear advantage for symptom relief in this refractory subset of patients.⁴¹ Interestingly, a subset of these patients (16%) also underwent “autopleurodesis” with durable resolution of the pleural effusion. A randomized clinical trial determined that patients with malignant pleural effusion instructed to aggressively drain every day versus every other day after placement of a tunneled drainage catheter had a significantly higher rate of “autopleurodesis” (47%) in the aggressive arm than the every-other-day drainage arm (24%). The same study also found that the mean time to “autopleurodesis” was significantly shorter with aggressive drainage.⁴² A tunneled pleural catheter can help manage the symptoms and may lead to permanent control of pleural effusion and subsequent removal of the catheter.

Placement of a tunneled drainage catheter is not exclusive of chemical pleurodesis. Combination therapy for malignant pleural effusions has been studied which combines the advantage of tunneled catheter placement reducing hospital stay and instillation of a sclerosant to increase the pleurodesis rate. A study by Reddy et al describes 30 patients with high rates of pleurodesis (92%), shorter hospital stays, and reduced length of indwelling tunneled catheter when a combination of talc pleurodesis and tunneled catheter placement procedures was performed compared with pleurodesis alone.⁴³ Although in this study, the catheter was placed surgically, image-guided placement with chemical pleurodesis would likely yield the same results.

Cost-Effectiveness

While not directly related to the symptomatic relief experienced by the patient, from a health care policy perspective, placement of tunneled drainage catheters can be a more cost-

effective way to manage symptoms. Using Medicare rates from 2013, it was determined that placement of a tunneled drainage catheter would become less costly once a patient received 9 to 10 paracenteses assuming 5 L was removed per session with a paracentesis performed every 10 days.⁴⁴ This cost was solely based on the payer's perspective, but if time cost of the patient and any caregivers is taken into account, the point at which a tunneled drainage catheter is more cost-effective would likely be even less than 9 to 10 paracenteses. It would be reasonable to offer a tunneled drainage catheter placement to any patient who has a disease prognosis and expected number of paracentesis greater than 10.

Conclusion

In summary, both malignant ascites and pleural effusions serve as a common source of significant morbidity in advanced cancer patients. There is no current standard of care with either repeat paracentesis or tunneled peritoneal catheter placement serving as two common treatment options for malignant ascites. For pleural effusions, there are also several treatment options including repeat thoracentesis, pleurodesis, or tunneled pleural catheter placement. Interventional radiologists can offer image-guided tunneled peritoneal and pleural catheter placement as safe and effective treatment options for symptomatic malignant ascites or pleural effusions. Currently, tunneled peritoneal and pleural catheters fill a much needed role in the treatment of cancer patients with symptomatic fluid burden. Clinical experience with these minimal invasive treatment options is promising from both patient QOL and cost-effectiveness standpoints; however, large-scale studies are necessary for further validation of their utility as compared with alternative therapies.

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