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Use of video assisted thoracoscopy for placement of indwelling pleural catheter

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Abstract

Malignant pleural effusions (MPEs) usually present from cancer growth causing excess fluid to gather between the pleura lining the lungs and chest cavity and often presents with shortness of breath. MPE portends a poor prognosis yielding an average survival of three to nine months. A clear consensus exists on the use of indwelling catheters in patients with poor performance status. Often, these catheters are placed percutaneously, which require a certain amount of fluid to be present in the pleural space and can lead to complications like misplacement and bleeding. We discussed the option of utilizing an indwelling pleural catheter placed with a video-assisted thoracoscopic (VATS) approach under sedation. Medical thoracoscopy was conducted with a rigid 10-millimeter 30-degree video thoracoscope and a single two-centimeter incision in the sixth intercostal space along the posterior axillary line. A stab incision was made approximately four centimeters medial from the access site to tunnel the indwelling pleural catheter. The use of VATS eliminated the requirement of a large amount of pleural fluid to be present and single lung ventilation. The direct visualization allows for precise placement of the catheter and the performance of additional procedures, including adhesiolysis, chemical pleurodesis, and a pleural biopsy for diagnostic purposes. The use of a VATS approach with sedation for the placement of a chronic indwelling catheter can be done effectively and safely and offers several advantages compared to the percutaneous approach, particularly the ability to visualize the exact placement of the catheter and perform a confirmatory pleural biopsy.

Keywords

vats; indwelling catheter; pleural biopsy; pleural effusions.

Abbreviations

MPE: malignant pleural effusion; IPC: indwelling pleural catheter; TPC: tunneled pleural catheter; VATS: video-assisted thoracoscopic surgery.

Introduction

Each year, about 150,000 individuals in the United States are affected by malignant pleural effusion (MPE), a condition in which cancer growth causes excess fluid to collect between pleura lining the outside of the lung and chest cavity and usually presents with shortness of breath [1]. MPE is most commonly found within 15% of patients diagnosed with advanced stages of malignant lung, breast, lymphoma, and ovarian cancers; more than 50% of these respective cancer cases result in malignant pleural effusion diagnoses [1]. As a symptom and by-product of late-stage cancers, most patients with malignant pleural effusion have an unfavorable prognosis and poor quality of life, with life expectancy ranging from about three to 12 months [1].

As such, the forefront of medical endeavors to manage malignant pleural effusion has been to relieve or treat symptoms of afflicted patients, rather than to prevent or cure these pleural effusions. A popular treatment for controlling fluid buildup has been thoracentesis, in which a needle is put in between the lungs and inner chest wall to remove fluid or air from around the lungs [2]. Specifically, pleurodesis has been utilized for decades against fluid buildup from malignant pleural effusion [1]. With this procedure, adhesion of the visceral and parietal pleura occurs via the injection of a sclerosant that mechanically or chemically induces inflammation between the pleural surfaces [1]. However, with these procedures, the effusion may reoccur; in pleurodesis, pleural effusion reoccurs in 10 to 40 percent of cases and the use of talc can lead to acute lung injury, a rare, but potentially life-threatening complication [1]. The recurrence of fluid around the lungs and chest cavity results in breathing issues, chest pain, cough, and the inability to lie flat [3]. As a result of recurrence, patients would be required to continually return for fluid drainage treatments [1]. More often than not, patients with effusions are already facing poor quality of life, which would only be worsened by the adverse effects of repeated thoracentesis procedures [1]. Thus, finding more effective drainage treatments or even treatments to cure or prevent pleural effusion would be beneficial for patients' quality of life and symptom control [1].

A meta-analysis study by Alraiyes et al. found that the placement of an indwelling pleural catheter (IPC) or tunneled pleural catheter (TPC) is an effective initial treatment for recurrent malignant pleural effusion [1]. Catheters offer a comparably minimally invasive approach for fluid drainage, even allowing for drainage of fluids at home without needing several appointments for follow-up thoracentesis and pleurodesis procedures [3]. Compared with chemical pleurodesis, the utilization of a pleural catheter has a comparable success rate and complication rate; however, it offers the unique advantages as a same-day surgical procedure, entailing shorter hospital stays and less need for further pleural intervention [1].

With the promise shown by IPCs, their use has understandably been increasing; yet, this trend has presented clinicians, researchers, and patients with novel complications related to the extended use and presence of IPCs [4-6]. A review conducted by Chalhoub et al. found that most complications related to long-term IPC usage are most commonly managed conservatively, while some cases do require the removal of the catheter entirely or even aggressive surgical interventions [4]. Pleural infection affects less than five percent of patients with IPCs or TPCs and is commonly and effectively combated by the usage of antibiotic treatment, without the need for catheter removal [7]. Pleural loculations, which limit drainage in approximately ten percent of patients, may develop, but can be addressed with intrapleural fibrinolytic therapy

[7,8]. Catheter tract metastasis can occur, but often respond to analgesics or external radiation therapy [7, 9,10]. Fibrin clots within the catheter lumen may result in blockage and mild chest pain following catheter insertion may occur, but can be alleviated with analgesic and drainage practice adjustment [7]. Long-term intermittent drainage can potentially lead to loss of nutrients, although data is limited to show any clinical impacts [7,11-12].

Despite progress in understanding, predicting, and treating IPC- and TPC- related complications, large gaps and heterogeneity in evidence-based research data on how to manage pleural catheter-related complications exist [4,7]. With the increasing usage of IPC and TPC as an effective therapy for pleural effusion, clinicians will also be forced to manage catheter-related complications. Further studies are needed to thoroughly guide clinicians on how to best avoid, recognize, and effectively treat these complications. These prospective studies should work to identify risk factors and the pathobiology of complications and report long-term outcomes of IPC and TPC utilization to optimize patient outcomes [7]. A study conducted by Thomas et al. compared video-assisted thoracoscopic surgery (VATS) talc insufflation with the placement of a TPC to assess which intervention best addressed the complications of malignant pleural effusions [8]. Researchers found that TPC placement resulted in significantly reduced postprocedural and ipsilateral reinterventions compared with VATS talc [13]. Additional studies on the treatment of recurrent pleural effusions have determined that VATS drainage coupled with the utilization of local anesthetics and intravenous sedation presented the most desired outcomes, showing its benefits as a modality for recurrent effusions [14]. Specifically, VATS was found to reduce chest wall trauma, preserve respiratory muscle function, and expedite recovery [15]. Especially concerning patients with poor prognosis with an advanced malignant pleural disease, these outcomes are extremely favorable for patients. In addition, VATS also allows clinicians to manipulate the pleural environment to control symptoms [15].

Regardless of these potential outcomes, a clear consensus exists on the use of indwelling catheters in patients with poor performance status, especially in patients whose malignant pleural effusion recurred after thoracentesis or pleurodesis, as it remains the best modality to control malignant and non-malignant pleural effusions with its effective, outpatient therapeutic ability and comparatively low complication rate [1,4]. However, these catheters are often placed percutaneously, which can lead to complications like misplacement and bleeding. Also, placement via the percutaneous approach requires a certain amount of fluid to be in the pleural space; otherwise, the intended procedure cannot be performed. With these implications in mind, we looked to investigate the option of an indwelling pleural catheter placed with a VATS approach under sedation.

Case Presentation

Methods

Medical thoracoscopy was conducted with a rigid thoracoscope. A 10-millimeter 30-degree video thoracoscope was used. Patients were placed in a semi-lateral decubitus position with conscious sedation using diazepam or benzodiazepine. The lateral area of the chest was sterilized and draped. Local anesthesia was given via 10 milliliters of 1% lidocaine to the selected intercostal space for entry. Thoracoscopy was performed with a single two-centimeter incision in the sixth intercostal space along the posterior axillary

line. A stab incision was made approximately four centimeters medial from the access site in order to tunnel the indwelling pleural catheter.

Results

We looked at our recent history of placing a long-term indwelling catheter via a VATS approach under sedation. Over the past year, we have performed this procedure on 30 patients. The mean age of patients was 81 years old. There were no major perioperative complications noted. There were no reports of bleeding, infection, or dislodgment. The mean length of stay after the procedure ranged from 1 to 5 days.

Discussion

The current treatments of MPEs are limited in their scope and applicability to afflicted patients. For the standard procedures to situate an IPC or TPC patients must have a certain amount of fluid present in the pleural space surrounding their lungs and chest cavity. In addition, standard IPC and TPC procedures result in a variety of post-operative effects and regimens, including weekly clinical visits for fluid drainage, the need for additional procedures, and even misalignment of an IPC or TPC with the pleural space to effectively drain fluid. As such, the use of a VATS approach under sedation for the placement of an IPC was found to be more effective and beneficial to afflicted patients. The use of VATS eliminates potential complications such as misplacement and bleeding, as surgeons can accurately visualize the pleural and surrounding spaces when placing IPCs in patients. In addition, this method with increased visualization allows clinicians to perform additional tests procedures on patient tissue. Most profoundly, clinicians can perform biopsies on pleural effusions to determine their pathology of recurrence, if needed.

Our findings align with conclusions stated by Thomas et al., as the utilization of the VATS did present the best patient outcomes. When coupled with the placement of a pleural catheter, which was previously found to be a better treatment for MPEs than talc in Thomas et al., the combination of both of these beneficial aspects of pleural effusion treatments allowed for our VATS IPC surgical technique to outperform alternative or standard surgical procedures concerning patient recovery and outcomes [8]. This data is not limited to certain patients; patients with a poor prognosis can also reap the benefits of the utilization of the VATS approach with sedation for the placement of an IPC for malignant pleural disease and treatment. Our findings also align with Luciano et al., as the usage of VATS allowed for researchers to influence and manipulate internal patient tissue and environments during the procedure; researchers were successfully also able to secure patient samples to perform biopsies on potential or confirmed recurrent pleural effusions [15].

Conclusion

The use of video thoracoscopy obviates the requirement of a large amount of pleural fluid to be present in order to perform the procedure. Direct visualization allows for precise placement of the catheter. In addition, one is able to perform any adjunctive procedure such as adhesiolysis or chemical pleurodesis. This approach also affords one the opportunity to obtain a pleural biopsy for diagnostic purposes. The catheter can be directly placed to a pleurovac if the patient is in the hospital or can be immediately capped and discharged home after the procedure. Single lung ventilation is not needed. Use of insufflation is optional, but useful if visualization is limited.

The utilization of a video-assisted thoracoscopic approach with sedation for the placement of a chronic indwelling catheter can be done effectively and safely. This technique offers several advantages compared to the percutaneous approach. Specifically, it offers the ability to visualize the exact placement of the catheter. Also, one can perform a confirmatory pleural biopsy if the pathology of the etiology of the recurrence of pleural effusion is still in question. Limited visualization via the VATS technique can be mitigated with the use of CO_2 insufflation.

Declarations

Guarantor Statement: VS and MC had full access to the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

Author Contributions: VS and MC had full access to the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. VS and MC contributed substantially to the study design, interpretation, and KR contributed substantially to the writing of the manuscript. VS and MC contributed substantially to the study design and statistical analyses.

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