CHEST

Basic and Advanced Pleural Procedures

Coding and Professional Fees Update for Pulmonologists

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There is an evolution of pleural procedures that involve broadened clinical indication and expanded scope that include advanced diagnostic, therapeutic, and palliative procedures. Finance and clinical professionals have been challenged to understand the indication and coding complexities that accompany these procedures. This article describes the utility of pleural procedures, the appropriate current procedural terminology coding, and necessary modifiers. Coding pearls that help close the knowledge gap between basic and advanced procedures aim to address coding confusion that is prevalent with pleural procedures and the risk of payment denials, potential underpayment, and documentation audits. CHEST 2020; 158(6):2517-2523

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Pleural effusions commonly are encountered in both outpatient and hospital settings. They can be caused by many disease processes that range from infection to malignancy to other inflammatory issues to fluid balance issues. The types of pleural effusion are categorized based on the composition (transudate vs exudate), size, imaging appearance (simple vs complicated) and underlying cause. Malignant pleural effusion is a commonly encountered complication of advanced malignancy. The incidence of malignant pleural effusion is estimated to be >150,000 cases/year with many cancer types involved of which lung cancer, breast cancer, and lymphoma are the most common.[1] Overall median survival after diagnosis ranges from 3 to 12 months and is dependent on the type of underlying malignancy, tumor characteristics, the extent of disease, comorbidities, and the composition of pleural effusion.[2-6] Basic pleural procedures such as ultrasound scans and thoracentesis are usually the first step in diagnosis or palliation. Medical thoracoscopy or video-assisted thoracoscopic surgery (VATS), chest tubes, and other interventions often are required for persistent or recurrent pleural effusions. In addition to the knowledge of clinical utility of pleural procedures, it is important to become familiar with and understand current procedural terminology (CPT)[7] coding, necessary modifiers, and associated work relative value unit (wRVU).[7,8]

Chest Ultrasonography

Ultrasonography has a higher sensitivity in the detection of pleural effusion than chest radiography as a screening tool.[9,10] This aids in the assessment of the

ABBREVIATIONS: CPT = current procedural terminology; VATS = video-assisted thoracoscopic surgery; wRVU = work relative value unit

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thickness of the lining of the pleura and, when pleural malignancy is suspected, can identify pleural metastases. Immediate preprocedural ultrasonography has become the standard of care to help to identify the appropriate site for drainage, to avoid septations, and to decrease the rate of complications.[11-16]

Coding Pearls

For ultrasound imaging of the pleural space to determine that there is resolution of fluid or that there is no pneumothorax and that is not associated with another procedure, the code 76604 for chest scan only is used. If ultrasound guidance is used to guide a catheter or needle insertion or for guiding the thoracoscopy entry site, the code 75989 is used along with the procedure code. The use of ultrasound or other image guidance (ie, fluoroscopy, CT scanning) codes apply to the other procedures in the article, unless otherwise stated. In each case, append a 26 modifier if the ultrasound unit is supplied by the facility so as to separate one's professional billing from the facility's reimbursement. Note that an ultrasound image from the procedure must be saved in some form, printed or digital, to bill for the service.

Thoracentesis

Thoracentesis is the most basic of pleural procedures. Pleural effusions are common and may require sampling or even complete drainage for diagnosis and therapeutic purposes. It is performed with a needle or catheter that is placed into the desired pleural space with fluid removed by gravity, hand pumping, or vacuum. Ultrasound examination may be performed immediately before the procedure for direct guidance and to ensure that the appropriate entry point is identified and marked. Pleural fluid aspiration is carried out with the use of aseptic precautions. There is no increased risk of bleeding due to mild-to-moderate coagulopathy and thrombocytopenia. Studies have also shown no increase in the risk of bleeding with uncorrected coagulopathy and other bleeding risks such as clopidogrel use, renal disease, and thrombocytopenia.[17,18]

Coding Pearls

The key to coding for this procedure is that the needle or catheter is removed at the end of the procedure. Further, the codes used account for whether ultrasound guidance is used. The code of 32554 is appropriate when there is no ultrasound guidance; the code 32555 is appropriate when ultrasound guidance is used. Note that ultrasound guidance has been included or "bundled" into the code so that, when used, it is not billed separately. In the occasional situation when ultrasound guidance prior to drainage determines that there is insufficient fluid for drainage and only ultrasound imaging is done, the code 76604 for chest scan only is used (append a 26 modifier if the ultrasound unit is supplied by the facility so as to separate one's professional component from the total reimbursement).

Blind Closed Pleural Biopsy

When pleural fluid evaluation is not diagnostic in a patient with suspected malignant pleural effusion or pleural TB, a pleural biopsy is considered. A blind closed pleural biopsy is performed with the use of an Abrams or Cope needle. Blind closed pleural biopsies have relatively low sensitivity due to the lower yield at early stage, distribution of tumor, and possibly operator inexperience.[1] Despite the limitations, practitioners around the world continue to perform the procedure because it requires limited experience and the cost of equipment, team, and resources is lower than medical thoracoscopy.[19]

Coding Pearls

Sampling of the pleura was done historically as a closed pleural biopsy with the use of a Cope or Abrams needle. Although this is less frequently done, the code 32400 is used. Image guidance codes are applied as described in the "Chest Ultrasonography" section, if used.

Chest Tubes

Chest tubes are used when the pleural space needs ongoing evacuation of air or fluid. These are distinct from thoracentesis in that the tube or catheter is inserted into the pleural space and left in place. These fall into three categories. The classic chest tube/tube thoracostomy procedure involves an incision and introduction of an instrument or even a finger into the pleural space to assist placement of the tube. This is considered the most invasive and is valued as such. The code 32551 is used. Image guidance codes are applied as described in the "Chest Ultrasonography" section. The option of inserting a tube over a wire is less valued because it is considered less invasive. It is considered a catheter rather than a tube and has two associated codes. The code 32556 is used if the procedure is done without image guidance; the code 32557 is used if image guidance is part of the procedure. Again, the image guidance is "bundled" if it is part of the procedure and not billed separately.

Removal of these tubes is not separately billable and is simply part of the evaluation and management work done on the day of removal.

Indwelling Pleural Catheters

Indwelling Pleural Catheter Placement

Indwelling pleural catheters are used for chronic drainage. They are tunneled catheters that allow repeated access to pleural drainage. They are used most often for the management of symptomatic malignant pleural effusions but have been used for benign underlying conditions as well. There are two distinct codes for this procedure, one for insertion and one for removal. The code 32550 is used for insertion of the catheter. Image guidance codes are applied as described in the "Chest Ultrasonography" section if used. The physician who places these should be aware of the insurance coverage for the home supplies required, which may vary by carrier and impact the home care options or ability of the patient to comply.

Indwelling Pleural Catheter Removal

When indwelling catheters were first introduced, the assumption was that they would be in place indefinitely as a palliative measure. Subsequently, the realization was that the catheters were sometimes removed and often removed by a different provider than the one who had placed the tube; therefore, a removal code was developed for catheter removal, 32552.

Medical Thoracoscopy

Medical thoracoscopy (also known as pleuroscopy) was popularized in 1910 by a Swedish internist, Hans Christian Jacobaeus.[20,21] The evolution of medical thoracoscopy into VATS has allowed for an even greater range of therapeutic solutions. Medical thoracoscopy differs in some ways from VATS in that it is performed in an endoscopy room or OR, typically with local anesthesia and/or moderate sedation and single port and by a pulmonologist or surgeon. Both medical thoracoscopy and VATS allow for direct visualization and biopsy of suspicious pleural abnormalities, such as nodularity, masses, and thickening. Due to lower than accepted diagnostic rates for blind closed pleural biopsy, with or without pleural fluid cytologic evidence, a visualized directed pleural biopsy via medical thoracoscopy or VATS may be needed.[22] Medical thoracoscopy with local anesthetic has low of complication and mortality rates, despite the invasiveness of the procedure. Mortality rate related to medical thoracoscopy alone is approximately 0.34%, as reported by Rahman et al,[22] and may be linked to complications associated with talc. Major complications that included empyema, hemorrhage, port site tumor growth, bronchopleural fistula, postoperative pneumothorax or air leak, and pneumonia were reported in 1.8% of cases.[23] Thoracoscopy is an invaluable diagnostic tool for the diagnosis of pleural mesothelioma, especially considering the even lower diagnostic rate of pleural fluid cytologic evidence alone (26% to 32%).[21,24,25]

Coding Pearls

The following selection codes relate to the more common of the minimally invasive procedures. The code 32601 for diagnostic thoracoscopy is used to evaluate the pleural space, lungs, pericardial sac, or mediastinum, but there is no biopsy. A diagnostic thoracoscopy with a biopsy uses the code 32609. If pleurodesis is done as part of the procedure, the code 32650 is used. Partial decortication performed during thoracoscopy uses the code 32651; if there is removal of a foreign body or fibrin deposits, the code 32653 is used.

The codes 32650, 32651, and 32653 are categorized as "surgical" rather than "diagnostic" procedures. Diagnostic thoracoscopy has a 0-day global period; whereas, surgical thoracoscopy has a 90-day global period. That is, subsequent care for the diagnostic procedures, whether related to the procedure or not, is separately billable immediately after the procedure, whereas subsequent care for the surgical patients related to the procedure is inherent or "bundled" into the reimbursement for the procedure and is not separately billable for 90 days. This includes management of an indwelling pleural catheter placed during the same "surgical" thoracoscopy.

Pleurodesis

Pleurodesis is the fusion of the parietal and visceral pleura, which leads to obliteration of the pleural space and prevents accumulation of pleural effusion. The exact mechanism of pleurodesis is unclear, but it is suspected to be due to inflammation/ fibrosis via transforming growth factor beta.[26]

Coding Pearls

Chemical pleurodesis, the instillation of a substance via a tube into the pleural space in an attempt to obliterate all or some of the space to prevent recurrence of fluid, is coded as 32560. This code is used regardless of the

TABLE 1] Basic and Advanced Pleural Procedure Codes

Current Procedural Terminology Code	Code Description	wRVU
32554	Thoracentesis, needle or catheter, aspiration of the pleural space; without imaging guidance	1.82
32555	Thoracentesis, needle or catheter, aspiration of the pleural space; with imaging guidance	2.27
32556	Pleural drainage, percutaneous, with insertion of indwelling catheter; without imaging guidance	2.50
32557	Pleural drainage, percutaneous, with insertion of indwelling catheter; with imaging guidance	3.12
32551	Tube thoracostomy, includes connection to drainage system (eg, water seal), when performed, open (separate procedure)	3.04
32550	Insertion of indwelling tunneled pleural catheter with cuff	3.92
32552	Removal of indwelling tunneled pleural catheter with cuff	2.53
32601	Thoracoscopy, diagnostic (separate procedure); lungs, pericardial sac, mediastinal or pleural space, without biopsy	5.50
32609	Thoracoscopy; with biopsy(ies) of pleura	4.58
32650	Thoracoscopy, surgical; with pleurodesis (eg, mechanical or chemical)	10.83
32651	Thoracoscopy, surgical; with partial pulmonary decortication	18.78
32653	Thoracoscopy, surgical; with removal of intrapleural foreign body or fibrin deposit	18.17
32561	Instillation(s), via chest tube/catheter, agent for fibrinolysis (eg, fibrinolytic agent for break up of multiloculated effusion); initial day	1.39
32562	Instillation(s), via chest tube/catheter, agent for fibrinolysis (eg, fibrinolytic agent for break up of multiloculated effusion); subsequent day	1.24
32400	Biopsy, pleura, percutaneous needle	1.76

wRVU = work relative value unit.

chemical used. If a pleural tube or catheter is placed on the same day, modifier 51 is used to indicate the separate procedure. If done as part of a thoracoscopy, it is coded as 32650 and becomes a "surgical" thoracoscopy with a global period.

Pleurolysis

At times, there is a need to break up loculations in the pleural space to improve drainage, especially in a setting of complicated parapneumonic effusion, empyema, or clogged indwelling pleural catheter.

Coding Pearls

On the initial day of instillation of a fibrinolytic agent, the code 32561 is used. On each subsequent day of fibrinolytic agent instillation, the code 32562 is used. A 25 modifier is appended to an evaluation and management encounter on the same day, indicating a distinct same-day procedure. Note, although fibrinolysis protocols call for twice-a-day agent instillation, the code can be billed only once per calendar day.

Table 1 provides the CPT code descriptors for basic and advanced pleural procedures and their associated wRVUs

Other Coding Aspects

Global Surgical Package

The global surgical package, also called global surgery, includes all the necessary services normally furnished by a surgeon before, during, and after a procedure. Medicare payment for a surgical procedure includes the preoperative, intraoperative, and postoperative services that are performed routinely by the surgeon or by members of the same group with the same specialty. Physicians in the same group practice who are in the same specialty must bill and be paid as though they were a single physician.[27]

There are three types of global surgical packages based on the number of postoperative days: (1) The 0-day postoperative period (endoscopies and some minor procedures) has no preoperative period and no postoperative days; the visit on the day of procedure is generally not payable as a separate service; (2) the 10-day postoperative period (other minor procedures) has no preoperative period; the visit on the day of the procedure is generally not payable as a separate service, and the total global period is 11 days (count the day of the surgery and the 10 days immediately after the day of

TABLE 2] Global Surgery Package[27]

CPT Code	Code Description	Global Period
32601	Thoracoscopy, diagnostic (separate procedure); lungs, pericardial sac, mediastinal or pleural space, without biopsy	000
32609	Thoracoscopy; with biopsy(ies) of pleura	000
32650	Thoracoscopy, surgical; with pleurodesis (eg, mechanical or chemical)	090
32651	Thoracoscopy, surgical; with partial pulmonary decortication	090
32653	Thoracoscopy, surgical; with removal of intrapleural foreign body or fibrin deposit	090
Medicare includes the following services in the global surgery payment when provided in addition to the surgery:		
Preoperative visits after the decision is made to operate		
Intraoperative services that are normally a usual and necessary part of a surgical procedure		
All additional medical or surgical services required of the surgeon during the postoperative period of the surgery because of complications that do not require additional trips to the operating room.		
Follow-up visits during the postoperative period of the surgery that are related to recovery from the surgery		
Postsurgical pain management by the surgeon		
Supplies, except for those identified as exclusions		
Miscellaneous services, such as dressing changes, local incision care, removal of operative pack, removal of cutaneous sutures and staples, lines, wires, tubes, drains, casts, and splints; insertion, irrigation, and removal of urinary catheters, routine peripheral IV lines, nasogastric and rectal tubes; and changes and removal of tracheostomy tubes		
The following services are not included in the global surgical payment and may be billed and paid for separately:		
Initial consultation or evaluation of the problem by the surgeon to determine the need for major surgeries. This is billed separately using the modifier "-57" (Decision for Surgery). This visit may be billed separately only for major surgical procedures.		
Treatment for postoperative complications that require a return trip to the OR. An OR, for this purpose, is defined as a place of service specifically equipped and staffed for the sole purpose of performing procedures. The term includes a cardiac catheterization suite, a laser suite, and an endoscopy suite. It does not include a patient's room, a minor treatment room, a recovery room, or an ICU (unless the patient's condition was so critical that there would be insufficient time for transportation to an OR).		
If a less extensive procedure fails and a more extensive procedure is required, the second procedure is payable separately.		

the surgery); and (3) the 90-day postoperative period (major procedures) has 1 preoperative day included; the day of the procedure is generally not payable as a separate service, and the total global period is 92 days (count 1 day before the day).

Codes with "000" are endoscopies or some minor surgical procedures (zero day postoperative period). Codes with "010" are other minor procedures (10-day postoperative period). Codes with "090" are major surgeries (90-day postoperative period). Table 2 lists thoracoscopy procedures performed by pulmonologists where the global surgical package would be considered, services that are included in the global surgery package and the services that can be billed separately.

Modifiers

Attention needs to be paid to the use of appropriate modifiers. When a procedure is performed on the same day as an evaluation and management encounter, a 25 modifier is appended to the evaluation and management encounter, thereby demonstrating a distinct service separate from the procedure.

Example: A consultation is performed on a inpatient for dyspnea. The patient has multiple comorbidities, and a moderately complex consultation is done (evaluation and management CPT code 99254). As part of the evaluation, it is decided that there is a pleural effusion that needs drainage the same day. With the use of ultrasound guidance, a thoracentesis is performed by the same provider (code 32555). When you have an evaluation and management encounter and a procedure on the same day, append modifier 25 to the evaluation and management code (99254-25 and 32555).

Modifiers 51 and 59 both are used when multiple services are performed during a single encounter, but they serve different purposes. Although modifier 51 and 59 both apply to additional procedures performed on the same date of service as the primary procedure, modifier 51 differs from modifier 59 in that it applies to

TABLE 3] Moderate Sedation Codes and Modifiers

Current Procedural Terminology Code	Description	wRVU
99152	Moderate sedation services provided by the same physician or other qualified health care professional performing the diagnostic or therapeutic service that the sedation supports, requiring the presence of an independent trained observer to assist in the monitoring of the patient's level of consciousness and physiological status; initial 15 minutes of intraservice time, patient age ≥5 years	0.25
99153	Moderate sedation services provided by the same physician or other qualified health care professional performing the diagnostic or therapeutic service that the sedation supports, requiring the presence of an independent trained observer to assist in the monitoring of the patient's level of consciousness and physiological status; each additional 15 minutes intraservice time (List separately in addition to code for primary service)	N/A[a]
Modifiers		
26	Modifier applied to 76604, 75989 if facility-owned ultrasound equipment used	
25	Modifier applied to same day "Evaluation and Management"	
51	Modifier for "Additional Procedures" done at same time	
59	Modifier for "Distinct Procedural Service"	

N/A = not applicable. See Table 1 legend for expansion of other abbreviation.
[a]Note that the physician wRVU of 0.25 is for the first 15 minutes, and the subsequent intervals are only practice expense.

procedures that may be expected more commonly to be performed during the same session.

If the procedure is done as part of multiple procedures at the same time or day, a 51 modifier is used to note the distinct procedure, which indicates that multiple procedures were performed at the same session. That is, it applies to different procedures performed at the same session (example: thoracentesis and bronchoscopy on the same day).

Modifier 59 is used for a distinct procedural service. Modifier 59 indicates that a procedure is separate and distinct from another procedure on the same date of service. Typically, this modifier is applied to a procedure code that ordinarily is not paid separately from the first procedure but should be paid per the specifics of the situation. Example: Modifier 59 is applied when separate biopsies are performed on different anatomic sites or lesions during the same procedure or separate incision or different session

The 26 modifier is used when one needs to separate out the professional from the facility-based technical component of a procedure. Examples used in this section are of ultrasound imaging where clinical decisions are interpreted and made based on the image; however, the facility owns the equipment.

Modifier 22 is used for a procedure that is more complex than typical and represents substantially increased time to perform the service. It rarely is reimbursed and is carrier-dependent.

Modifier 50 is used for bilateral procedures that are not described inherently as bilateral. This would apply to bilateral indwelling pleural catheter and bilateral chest tubes as examples. Table 3 provides the CPT code descriptors for moderate sedation and common modifiers used for pleural procedures and their associated wRVUs

Moderate Sedation

If moderate sedation is used for any pleural procedure and is administered under the direction of the operator or by a member of the operator's practice, there are time-based codes applied. For patients ≥5 years old, the first 15 minutes of sedation is coded as 99152. A minimum time of 10 minutes must be reached to use this code. For each additional 15 minutes (a minimum of 8 minutes), the code 99153 is used. Note that the physician wRVU of 0.25 is for the first 15 minutes, and the subsequent intervals are only practice expense. Further, the time is from the first infusion of sedation to the end of 1:1 operator presence and may overlap but is not the same as procedure time. These codes do not apply if the sedation is administered by a practitioner from a separate group or specialty (ie, anesthesiologist).

Conclusion

Although the clinical utility of pleural procedures is accepted more widely, the coding remains confusing due

to procedure complexity and updated coding requirements. The range of procedures discussed may be performed as stand-alone procedures but more commonly are performed along with advanced pulmonary or interventional pulmonary procedures. With improved technology, efficiency, and efficacy of performing multiple procedures in the same setting, it becomes critical to thoroughly understand the clinical, coding, and financial implications of these procedures. Appropriately optimizing facility and physician reimbursement is integral to the assimilation of pleural procedures into comprehensive pulmonary and oncology programs.

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References

1. American Thoracic Society. Management of malignant pleural effusions. *Am J Respir Crit Care Med*. 2000;162(5):1987-2001.
2. Roberts ME, Neville E, Berrisford RG, Antunes G, Ali NJ; Group BTS Pleural Disease Guideline Group. Management of a malignant pleural effusion: British Thoracic Society Pleural Disease Guideline 2010. *Thorax*. 2010;65(suppl2):ii32-ii40.
3. Burrows CM, Mathews WC, Colt HG. Predicting survival in patients with recurrent symptomatic malignant pleural effusions: an assessment of the prognostic values of physiologic, morphologic, and quality of life measures of extent of disease. *Chest*. 2000;117(1):73-78.
4. Bielsa S, Salud A, Martinez M, et al. Prognostic significance of pleural fluid data in patients with malignant effusion. *Eur J Intern Med*. 2008;19(5):334-339.
5. Pilling JE, Dusmet ME, Ladas G, Goldstraw P. Prognostic factors for survival after surgical palliation of malignant pleural effusion. *J Thorac Oncol*. 2010;5(10):1544-1550.
6. Clive AO, Kahan BC, Hooper CE, et al. Predicting survival in malignant pleural effusion: development and validation of the LENT prognostic score. *Thorax*. 2014;69(12):1098-1104.
7. (AMA) AMA. CPT® (Current Procedural Terminology). In: *https://www.ama-assn.org/amaone/cpt-current-procedural-terminology*. *Accessed May 13, 2020.*
8. (AMA) AMA. RVS Update Committee (RUC): RBRVS overview. https://www.ama-assn.org/about/rvs-update-committee-ruc/rbrvs-overview. Accessed May 31, 2020.
9. Yousefifard M, Baikpour M, Ghelichkhani P, et al. Screening performance characteristic of ultrasonography and radiography in detection of pleural effusion; a meta-analysis. *Emergency*. 2016;4(1):1-10.
10. Eibenberger KL, Dock WI, Ammann ME, Dorffner R, Hormann MF, Grabenwoger F. Quantification of pleural effusions: sonography versus radiography. *Radiology*. 1994;191(3):681-684.
11. Diacon AH, Brutsche MH, Soler M. Accuracy of pleural puncture sites: a prospective comparison of clinical examination with ultrasound. *Chest*. 2003;123(2):436-441.
12. Raptopoulos V, Davis LM, Lee G, Umali C, Lew R, Irwin RS. Factors affecting the development of pneumothorax associated with thoracentesis. *AJR Am J Roentgenol*. 1991;156(5):917-920.
13. Gordon CE, Feller-Kopman D, Balk EM, Smetana GW. Pneumothorax following thoracentesis: a systematic review and meta-analysis. *Arch Intern Med*. 2010;170(4):332-339.
14. Barnes TW, Morgenthaler TI, Olson EJ, Hesley GK, Decker PA, Ryu JH. Sonographically guided thoracentesis and rate of pneumothorax. *J Clin Ultrasound*. 2005;33(9):442-446.
15. Sachdeva A, Shepherd RW, Lee HJ. Thoracentesis and thoracic ultrasound: state of the art in 2013. *Clin Chest Med*. 2013;34(1):1-9.
16. Cantey EP, Walter JM, Corbridge T, Barsuk JH. Complications of thoracentesis: incidence, risk factors, and strategies for prevention. *Curr Opin Pulm Med*. 2016;22(4):378-385.
17. Puchalski JT, Argento AC, Murphy TE, Araujo KL, Pisani MA. The safety of thoracentesis in patients with uncorrected bleeding risk. *Ann Am Thorac Soc*. 2013;10(4):336-341.
18. Zalt MB, Bechara RI, Parks C, Berkowitz DM. Effect of routine clopidogrel use on bleeding complications after ultrasound-guided thoracentesis. *J Bronchology Interv Pulmonol*. 2012;19(4):284-287.
19. Baumann MH. Closed pleural biopsy: not dead yet! *Chest*. 2006;129(6):1398-1400.
20. Shojaee S, Lee HJ. Thoracoscopy: medical versus surgical-in the management of pleural diseases. *J Thorac Dis*. 2015;7(suppl4):S339-S351.
21. Desai NR, Lee HJ. Diagnosis and management of malignant pleural effusions: state of the art in 2017. *J Thorac Dis*. 2017;9(suppl10):S1111-S1122.
22. Rahman NM, Ali NJ, Brown G, et al. Local anaesthetic thoracoscopy: British Thoracic Society Pleural Disease Guideline 2010. *Thorax*. 2010;65(suppl2):ii54-ii60.
23. Dresler CM, Olak J, Herndon JE 2nd, et al. Phase III intergroup study of talc poudrage vs talc slurry sclerosis for malignant pleural effusion. *Chest*. 2005;127(3):909-915.
24. Hooper C, Lee YC, Maskell N; Group BTS Pleural Disease Guideline Group. Investigation of a unilateral pleural effusion in adults: British Thoracic Society Pleural Disease Guideline 2010. *Thorax*. 2010;65(suppl2):ii4-ii17.
25. Renshaw AA, Dean BR, Antman KH, Sugarbaker DJ, Cibas ES. The role of cytologic evaluation of pleural fluid in the diagnosis of malignant mesothelioma. *Chest*. 1997;111(1):106-109.
26. Shojaee S, Voelkel N, Farkas L, de Wit M, Lee HJ. Transforming growth factor-beta1 rise in pleural fluid after tunneled pleural catheter placement: pilot study. *J Bronchology Interv Pulmonol*. 2013;20(4):304-308.
27. CMS. Global Surgery Booklet. https://www.cms.gov/Regulations-and-Guidance/Guidance/Manuals/Downloads/clm104c12.pdf; 2018. Accessed May 30, 2020.