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Thoracoscopy under local anesthesia for patients with a high cardiopulmonary risk index

Yüksek kardiyopulmoner risk indeksine sahip hastalarda lokal anestezi ile uygulanan torakoskopi

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Background: In this study, we aimed to investigate the efficacy of thoracoscopy performed under local anesthesia and sedation for the diagnosis and treatment of patients with a high cardiopulmonary risk index.

Methods: Between January 2007 and October 2010, 32 patients (22 males, 10 females; mean age 63.6 years; range 36 to 89 years) with a high cardiopulmonary risk index who underwent thoracoscopy under local anesthesia and sedation at Pamukkale University, School of Medicine, Department of Thoracic Surgery were included. Risk assessment was performed using the cardiopulmonary risk index. All procedures were performed in the operating room.

Results: The cardiopulmonary risk index points of the patients ranged from 7 to 37 (mean 13.6). None of the patients underwent general anesthesia, indotracheal intubation, or epidural or intercostal blockage. Pleural biopsy/effusion drainage, either with or without talc pleurodesis, was performed in fifteen patients, six had drainage and debridement of empyema, and four had a biopsy of a mediastinal lymph node. In addition, three patients had a partial pleurectomy for secondary pneumothorax, one underwent a biopsy of a mediastinal mass, and one had a hematoma removed. Furthermore, a foreign body was extracted from one patient, and a wedge resection for the diagnosis of multiple lung nodules was performed on another. None of the patients required a thoracotomy. Morbidity was observed in three patients (9%), but no mortality was seen.

Conclusion: Thoracoscopy performed under local anesthesia and sedation is a safe and effective, even for patients in poor general condition.

Key words: Local anesthesia; medical thoracoscopy; pleural effusion; video-assisted thoracoscopy.

Amaç: Bu çalışmada, yüksek kardiyopulmoner risk indeksine sahip olan hastaların tanı ve tedavisinde lokal anestezi ve sedasyon ile uygulanan torakoskopinin etkinliği araştırıldı.

Çalışma planı: Ocak 2007 ve Ocak 2010 tarihleri arasında Pamukkale Üniversitesi Tıp Fakültesi Göğüs Cerrahisi Anabilim Dalı'nda yüksek kardiyopulmoner riske sahip olan ve lokal anestezi ve sedasyon ile torakoskopi uygulanan 32 hasta (22 erkek, 10 kadın; ort. yaş 63.6 yıl; dağılım 36-89 yıl) çalışmaya dahil edildi. Risk değerlendirmesi kardiyopulmoner risk indeksi ile yapıldı. Tüm işlemler ameliyathanede gerçekleştirildi.

Bulgular: Hastaların kardiyopulmoner risk indeks puanı 7-37 (ortalama 13.6) arasında değişiyor idi. Hiçbir hastaya genel anestezi, endotrakeal entübasyon veya epidural ya da interkostal blokaj uygulanmadı. Hastaların 15'ine talk kullanılarak yapılan plöredez ile birlikte ya da tek başına plevral biyopsi/efüzyon drenajı, altısına ampiyem drenajı ve debridmanı, dördüne mediastinal lenf nodu biyopsisi uygulandı. Buna ilaveten üç hastaya sekonder pnömotoraks nedeni ile parsiyel plörektomi, birine mediastinal kitle nedeni ile biyopsi, birine ise hematom çıkarılması uygulandı. Ayrıca bir hastaya yabancı cisim çıkarılması ve bir diğerine multipl akciğer nodüllerinin tanısı için kama rezeksiyon endikasyonu ile torakoskopi uygulandı. Hastaların hiçbirinde torakotomi gerekmedi. Morbidite üç hastada (%9) gözlendi, fakat hiçbir hastada mortalite görülmedi.

Sonuç: Torakoskopi, lokal anestezi ve sedasyon eşliğinde, genel durumu kötü hastalarda bile güvenli ve etkilidir.

Anahtar sözcükler: Lokal anestezi; medikal torakoskopi; plevral efüzyon; video yardımlı torakoskopi.

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Thoracoscopy was primarily introduced as a diagnostic procedure and was used in the pneumothorax treatment of tuberculosis between 1910 and 1955.[1] In the early 1960s, it was used mainly by pneumologists in Europe.[2] In the early 1990s, following the tremendous advances in endoscopy technology, thoracoscopy was rediscovered by thoracic surgeons.[3]

The use of this procedure for the evaluation and treatment of pleural disease has been recognized for many years.[2] In addition, thoracoscopy is a useful method for the staging of lung cancer and diffuse malignant mesothelioma and is an alternative to a thoracotomy for the definitive management of empyema or hemothorax.[3] The recent development of wide-angle, video-optical endoscopic equipment has expanded the role of this minimally invasive surgical approach, and it is now being utilized for a wide variety of thoracic surgical problems.[4] Biopsies and drainage procedures are easily performed, especially via a video-endoscope with a biopsy forceps channel.

Video-assisted thoracoscopic surgery (VATS) performed under local anesthesia has often been utilized for the treatment of pleural diseases.[5] In 1987, Rusch and Mountain[6] used multiple intercostal blocks and a standard mediastinoscope for the diagnosis and treatment of pleural problems in 46 patients. Today, most of the procedures are easily performed through an intercostal blockade accompanied by sedation. The fields of the application for local anesthetic video-assisted thoracoscopy could be broadened, especially by thoracic surgeons.[7] Indications that might be included, in addition to the diagnosis of pleural diseases and talc pleurodesis, are lung and mediastinal lymph node biopsies and the diagnosis and treatment of empyema.

We investigated the efficiency and safety of thoracoscopy performed without intubation and general anesthesia in the diagnosis and treatment of patients in poor general condition defined on the basis of cardiopulmonary risk (CPR) evaluation.

PATIENTS AND METHODS

Thirty-two patients (22 males, 10 females; mean age 63.6 years; range 36 to 89 years) with a high cardiopulmonary risk index for whom thoracoscopy under local anesthesia and sedation was performed at Pamukkale University Medical School, Department of Thoracic Surgery between January 15th, 2007 and January 15th, 2010 were included in this study. The age, sex, cardiopulmonary risk points, indications for thoracoscopy, accompanying disease, number of ports applied, the side of thoracoscopy, and hospitalization time were recorded. The final diagnoses were obtained, and the complications were recorded.

At the same time, 133 patients underwent the VATS procedure under general anesthesia in our department. In 75 of those patients, the indications for VATS were similar to those of our study population, and 58 patients underwent a sympathectomy. Seven patients had CPR points of less than seven, and they underwent thoracoscopy under local anesthesia. These patients were not included in this study.

The patients at high risk for general anesthesia were selected for thoracoscopy under local anesthesia and sedation. No patient was excluded on the basis of age or comorbidity. A risk analysis of the patients was defined as a modification of the cardiopulmonary risk index score with a scale of 0 to 10 [cardiac risk index score (0-4) plus pulmonary risk index score (0-6)].[8] That composite index was used for risk assessment in the lung resection patients, and a CPR index score equal to or more than four was found to have a 22-fold increased risk for developing complications.[8] In our study population, the patients whose CPR index score was three or more were defined as high risk for a thoracoscopic procedure under general anesthesia. That score was equal to seven or more CPR points in our study.

Selection and exclusion criteria: Patients with high CPR points (≥7) were selected for thoracoscopy under local anesthesia on the basis of the need for any of the following indications: a mediastinal biopsy, removal of a foreign body, drainage of a hemothorax, a pleural biopsy, drainage of empyema, pleurodesis in massive pleural effusions, and a wedge biopsy for diffuse lung disease.

Patients with a forced expiratory volume in one second (FEV_1)/forced vital capacity (FVC) of less than 70% (one of the points in the score of the pulmonary risk assessment) were defined as having chronic obstructive pulmonary disease (COPD).

Ultrasonography was performed to identify the entry location for those patients who were believed to have loculated pleural effusion.

Technique: Patients were sedated with an individualized dose of 0.01 mg/kg midazolam. Fentanyl sedation was performed in the last 10 patients because of its superior analgesic characteristics. Supplemental oxygen was administered at 4 L/min via an oronasal mask, and the oxygen saturation, electrocardiogram results, and blood pressure were monitored. Three patients who were not able to tolerate the lateral decubitus position had their surgery in a semi-sitting position with their arms abducted.

Following the infiltration of 2% prilocaine into the skin and subcutaneous tissue, a single 2 cm incision was made at the entry port site placed in the intercostal space. The entry port site was determined according to the indication. A needle aspiration was performed for pleural effusion, followed by a small incision, and a blunt dissection with scissors was used to make the entry of the trocar easier. All of the pleural fluid was aspirated before visualization of the pleural space. Essentially, we used a rigid thoracoscope (0° telescope, Karl Storz, Germany) via a 7 mm trocar (with an obturator and a cannula). A separate channel was available to apply the forceps or the aspirator. Except in conditions such as multiloculated empyema, one port was sufficient for massive pleural effusion, with endoscopic instruments being passed through the thoracoport. If a significant amount of pleural fluid had not been present at the thoracoscopy application site, artificial pneumothorax could have been induced during thoracoscopy. The related lung had been collapsed under the influence of the atmospheric pressure after the insertion of the trocar.

Thoracoscopy indications were divided into three parts

a) Pleural disease: Thoracoscopy was performed in patients admitted with pleural effusion who were not diagnosed to have a specific pathology despite repeated thoracenteses and who exhibited recurrent effusion. One port was generally sufficient for introducing the forceps, sterile catheter, or an aspiration cannula through the thoracoscope in massive pleural effusion. In case of multiloculated empyema, a second or third port, either with or without a trocar, allowed for the introduction of other instruments to disrupt the adhesions. For pleurodesis of malignant effusions, dry asbestos-free talc was insufflated through a flexible suction catheter with a pneumatic atomizer. Pleurodesis was performed with talc slurry (5 g) applied via tube thoracostomy on the patients who showed a definite malignant histopathology after the operation.

b) Lung biopsy: Three incisions allowed for the introduction of a telescope via a trocar, grasping ring forceps, and an endoscopic stapling device. Finger palpation was performed as needed. Pleural adhesions were divided bluntly or with scissors or a cautery, if needed.

c) Other diseases: Biopsies were performed for a mediastinal mass or mediastinal lymph nodes. They were also used for the removal of a foreign body as well as a partial pleurectomy for secondary pneumothorax.

The chest tube was removed in the ward when appropriate. The criteria for drain removal were observation of re-expansion on the chest roentgenogram, daily drainage of 100 mL or less, and absence of air leak in the underwater drainage system.

RESULTS

The CPR points of the patients varied between 7 and 37 (mean 13.6), and they were also analyzed separately according to the diagnoses (Table 1).

Table 1. Cardiopulmonary risk points according to the indications for thoracoscopy

CPR (points)	Effusion	Empyema	Hydropneumothorax	Lymphadenopathy	Hemothorax	Mediastinal lesion	Lung nodules	Foreign body
	n	n	n	n	n	n	n	n
7				1				
8	1	3	1		1			1
9	2		1				1	
10	1			1				
12	2	1		1				
13	1							
14	2			1				
15	1	1						
16	1							
17	1							
18			1					
19	1							
23	1							
27		1				1		
37	1							
Total (n=32)	15	6	3	4	1	1	1	1

CPR points: Cardiopulmonary risk points.

Table 2. The accompanying diseases according to the indications of thoracoscopy*

	COPD	Obesity	Cardiovascular factors†	Other systemic diseases‡	Pneumonectomy	SVCS
Effusion	7	2	11	3	2	1
Empyema	2	1	4	4	–	–
Hydropneumothorax	3	–	3	1	–	–
Lymphadenopathy	1	1	4	2	–	–
Hemothorax	1	–	1	–	–	–
Mediastinal lesion	1	1	1	1	–	–
Lung nodules	1	–	1	–	–	–
Foreign body	1	–	1	–	–	–

COPD: Chronic obstructive pulmonary disease; SVCS: Superior vena cava syndrome; * There may be more than one accompanying disease; † Coronary artery disease, congestive heart failure, arrhythmia, hypertension, acute myocardial infarction, patients older than 70, and pulmonary arterial hypertension; ‡ Chronic renal failure, diabetes mellitus, thyroid disease, liver disease, anemia, and hypoalbuminemi.

The indications for thoracoscopy under local anesthesia were as follows: pleural biopsies/effusion drainage with or without talc pleurodesis (n=15), drainage and debridement of empyema (n=6), biopsies for mediastinal lymph node (n=4), partial pleurectomies for secondary pneumothorax (n=3), biopsies for mediastinal mass (n=1), evacuation of chronic hemothorax (n=1), removal of a foreign body (n=1), and wedge resection for the diagnosis of multiple lung nodules (n=1).

The accompanying diseases are shown in Table 2. Seventeen patients (53%) were diagnosed with COPD, and in many patients, there were multiple accompanying diseases.

A single port was inserted in 26 patients for drainage with/without talc slurry or a biopsy and a partial pleurectomy. Two ports were used in four patients (for a mediastinal lymph node biopsy, removal of a foreign body, partial decortication, and a biopsy of a mediastinal mass). Three ports were used in two patients (for multiple nodules in the lung and for subacute empyema). Left-sided thoracoscopy was performed on 19 patients while right-sided thoracoscopy was performed on 13 patients.

The mean hospitalization time was 12.6 days (range 3-35 days). Chest tubes were removed after a mean of five days (range, 1-10 days).

The results of cytology examinations were benign in 12 patients and malignant for three of the 15 patients with pleural effusion. Six patients with empyema and one patient with hemothorax were diagnosed with fibrinous pleuritis. The biopsy results for the mediastinal mass were reported as seminoma. A mediastinal lymph node biopsy and a lung biopsy indicated adenocarcinoma metastasis in five patients. The results are shown in Table 3.

Neither conversion to thoracotomy nor intubation was required in any of the cases. No mortalities were observed, and morbidity was observed in three patients (9%). One patient developed hemorrhagic drainage (650 mL/24 h) due to port-related lung damage. In two patients, chest pain due to mediastinal flutter and hypotension were observed under the influence of atmospheric pressure after the trocar entrance. However, the vital signs of the patients improved following the brief aspiration of the positive air and the application of the aspiration catheter in a controlled way into the pleural cavity. In one patient who underwent a partial pleurectomy due to secondary pneumothorax, collapse was observed. Expansion was provided by negative aspiration treatment. The costophrenic angle was obliterated until the eighth postoperative day in a patient with benign effusion.

DISCUSSION

Video-assisted thoracoscopic surgery is nevertheless an invasive procedure because general anesthesia and selective double lumen intubation are necessary. This should be avoided, if possible, in very sick patients.[9] Some procedures can be performed by thoracoscopy under local anesthesia to avoid the risks of general anesthesia.

Table 3. Final diagnoses of the patients

Pathological findings	n
Benign cytology	12
Fibrous pleuritis	7
Metastasis of adenocarcinoma	5
Pneumothorax; nonspecific pleuritis	3
Malignant effusion	3
Seminoma	1
Foreign body	1
Total	32

The risk of postoperative pulmonary complications in patients using long-acting neuromuscular blockers was three times greater than in those using short-acting ones.[10,11] The main cause for this is that the blockage effect of long-acting agents lasts throughout the postoperative period, and this leads to postoperative hypoventilation. However, thoracoscopy under local anesthesia for patients at high risk has advantages, such as the absence of a need for muscle relaxants and the completion of the processes over a short period of time. We used fentanyl for sedation during the thoracoscopic procedures since it has both analgesic and sedative effects and is well tolerated by high-risk patients. Conscious sedation was preferred to minimize the cardiac stress factor which can occur during surgical procedures under local anesthesia. The risk and benefit balance should be considered for each patient individually.

The creation of unilateral pneumothorax in cases of thoracoscopy generally does not pose a problem because the lung is chronically collapsed from effusion or empyema in many patients. Besides, the ipsilateral lung receives less ventilation and less perfusion in the patient in a lateral position, resulting in less physiologic shunting than it would normally be expected. Even patients with severe generalized interstitial lung disease tolerated lung biopsy procedures. Chhajed et al.[12] showed that hypoventilation occurs with this technique, with the mean $PaCO_2$ rising from 13 to 52.3 mmHg (range 37-77 mmHg) and a mean fall in oxygen saturation of 4.6% (range 1-14%). Nezu et al.[13] found that there was little decrease in oxygen saturation.

Video-assisted thoracoscopy is generally performed using two ports at many centers, however we were able to accomplish it by using a single port, especially for pleural biopsy, drainage, and pleurodesis. Performing many processes through a single port was possible because both a biopsy channel and an optic channel were used simultaneously during thoracoscopy.

Thoracoscopy provided effective pleurodesis in 78-82% of patients[14] with a morbidity rate of 3-26% and a mortality rate of less than 1%.[15,16] The procedure has a 90-100% sensitivity for malignant pleural effusions.[16] In a study of 102 patients who underwent thoracoscopy under local anesthesia, hemodynamic compromise or persistent air leak requiring a thoracotomy was reported in 1.9% of the patients, and minor complications were reported in 7.5%.[17] Page et al.[18] reported complications in 9.1% of 121 patients after thoracoscopy performed under general anesthesia. The absence of major surgical complications suggests that thoracoscopy is a favorable choice for these patients. Although limited by the small number of patients, our results show that thoracoscopy performed on high-risk patients is both safe and effective. Open-chest surgical intervention for "bail-out" was never required, and no procedure-related deaths occurred. Three patients (9%) developed complications, but these were controlled with simple interventions.

In conclusion, thoracoscopy under local anesthesia and sedation is well tolerated, safe, and valuable for an increasing number of indications. In patients with poor general health, this procedure eliminates the deleterious aspects of general anesthesia and endotracheal intubation.

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