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Role of VATS in Pleural Effusions with Unknown Etiology

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ABSTRACT

Background: *The cause of pleural effusion in some patients can not be found even after biochemical, bacteriologic and cytological examinations of the pleural fluid and closed needle biopsy of the pleura. In this group of patients the next diagnostic step would be an open pleural biopsy through a limited thoracotomy or video-assisted thoracoscopic surgery (VATS), the latter procedure has replaced the former in many centers due to its advantages.*

Materials and Methods: *In order to evaluate these advantages, 59 patients with undiagnosed pleural effusion were operated on through either limited thoracotomy or thoracoscopy form April 1998 to September 2000, in a prospective clinical trial. There were 40 males and 19 females in the age range of 10 to 89 yrs. There was no significant statistical difference between the two groups in terms of sex and age.*

Results: *There was no statistical difference between the two groups in terms of diagnostic accuracy, postoperative pain, hospitalization, morbidity and mortality.*

Conclusion: *Based on these results and minimal scar, VATS is a safe diagnostic procedure in this group of patients replacing limited thoracotomy.* ***(Tanaffos 2004; 3(12): 25-33)***

Key words: *Pleural Effusion, Thoracoscopy, Diagnosis*

INTRODUCTION

About 30 to 40 percent of patients with pleural effusion remain undiagnosed even after biochemical, bacteriologic and cytological examinations of the pleural fluid and closed needle biopsy of the pleura (1-13).

In many centers in Iran, an open pleural biopsy through a limited thoracotomy is the next diagnostic step. Nowadays, VATS has replaced the open pleural biopsy in most parts of the world.

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Various advantages of this procedure have been mentioned by different authors, which are summarized in table 1 (14-22).

Quick recovery of the patients to the preoperative status might be due to minimal pain present at surgical site. This might be due to avoiding large surgical incision and rib spreaders.

These concepts can be proved to be true if in a controlled study minimal postoperative pain is shown along with equal diagnostic results of VATS in comparison with limited thoracotomy. Considering the difficulties in precise evaluation of the pain as a

subjective sign, a few articles have compared the pain in VATS procedure with thoracotomy (23, 26).

Table 1. Advantages of VATS procedure in comparison with limited thoracotomy.

1. Minimal surgical scar
2. Having sufficient access with no need for large surgical incision
3. Quick recovery of the patients to the preoperative status.
4. Less pain
5. Shorter hospitalization?
6. Fewer complications?
7. Less mortality and morbidity?
8. Feasibility of performing pleural biopsy with local anesthesia in severely sick patients.
9. Being cost effective?

Several other articles have been published in regard to evaluating other advantages of VATS procedure. (1, 5, 9, 11, 14, 25, 27). Among them, some articles have reached completely opposite conclusion and controversial results.

Therefore, we placed a question mark in front of these kinds of statements. To answer these controversies, we examined the two procedures of VATS and limited thoracotomy in patients with pleural effusion with unknown etiology.

PATIENTS AND METHODS

From April 1998 to September 2000, 60 consecutive patients with pleural effusion in which biochemical, bacteriologic and cytological examinations of the pleural fluid and closed needle biopsy were unable to make the diagnosis were studied.

These patients were considered for pleural biopsy and after adequate preparations for general anesthesia and thoracotomy were taken to the operating room.

After the patients condition was felt to be favorable for surgery by the anesthesiologist, they were placed randomly in either VATS or limited thoracotomy group. Anesthesia by double lumen endotracheal tube was not necessary in limited thoracotomy group. Patient was placed in lateral position and limited thoracotomy of the appropriate space was performed and biopsy was obtained.

Because of the need for complete collapse of the lung we had to use double lumen endotracheal tube in VATS group.

After intubation, the patient was placed in lateral position. The entrance port was at the site of lesion in localized ones (such as loculated).

In other cases, by performing a 1-2 cms incision in the 6^{th} or 7^{th} intercostal space at the mid-axillary line, the skin, muscles, and pleura were incised.

Then, by entering the finger into the pleural space we make sure that the lung is not adherent to the parietal pleura and is collapsed. After entering the camera through this space, the next trocar was entered under direct vision into the proper space, getting the biopsies from all suspicious areas by biopsy forceps.

In some cases in which the pathologist did not report any specific lesion, patients were followed for 6 months.

If no new lesion appeared in this interval, the non-specific pathological response was considered as a definitive diagnosis. Comparison of the quantitative data was performed by two sided t-test and the qualitative data by chi-square test.

RESULTS

In one case out of 60 patients, it was postoperatively noticed that what was randomly selected as thoracotomy was mistakenly read as VATS. Therefore, this patient was excluded from the study.

Out of 59 patients, 30 individuals underwent thoracotomy and 29 underwent VATS. There were

40 males and 19 females.

Table-2 demonstrates the sex distribution of patients in the two groups.

Patients were in the age range of 10 to 86 yrs with the mean age of 55±17.5 yrs.

Sixty percent of the patients were over 50 yrs of age (Figure-1). The mean age and its standard deviation in the two groups are shown in table-3.

Metastatic adenocarcinoma in 14 cases, malignant mesothelioma in 12 cases, and nonspecific inflammation in 10 cases were reported. Table-4 demonstrates the frequency of diagnoses in 59 patients. There were 6 cases of diagnostic failures in the VATS group.

In one case of fibrinoleukocytic exaudates and microbial colonies pathologic report, thoracotomy was recommended to the patient, but was refused. Nine months later the patient underwent a thoracotomy and lung resection and the pathologic report was moderately differentiated squamous cell carcinoma. In the second case the pathologic report was nonspecific chronic inflammation. After 6 months of follow-up, because of recurrent pleural effusion, a limited thoracotomy was performed which showed a malignant mesothelioma.

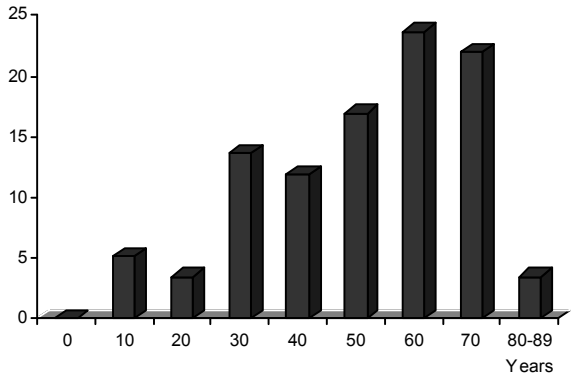

Figure 1. Histogram of the relative frequency and distribution of age in the 59 patients.

Table 2. Sex distribution of patients.

Surgical procedure	Male	Female	Total
VATS	19	11	30
Limited thoracotomy	21	8	29

P= 0.46

Table 3. Mean and standard deviation of age in the 59 patients in regard to the type of surgical procedure.

Surgical procedure	Mean	Standard deviation
VATS	54.4	16.4
Thoracotomy	55.8	18.9

P= 0.774

Table 4. Frequency of diagnoses in 59 patients.

Diagnosis	Count
Metastatic adenocarcinoma	14
Malignant mesothelioma	12
Chronic nonspecific inflammation	10
TB	5
Reactive mesothelial hyperplasia & mild chronic inflammation	4
Malignant meso/ Metastatic adeno	4
Severe inflammation and fibrosis	2
Mixed histiocytosis & mesothelial nodules	1
Metastatic anaplastic giant cell carcinoma compatible with choriocarcinoma	1
Marked lymphocytosis, no TB, no malignancy	1
Malignant small round cell tumor	1
Inflammatory pseudotumor, Actinomycosis	1
Granulation tissue	1
Fibrinoleukocytic exaudates and microbial colonies	1
Aortic aneurysm	1

In 3 patients, VATS turned to thoracotomy because of severe adhesions in pleural space in two cases. In the third case the cause of the bloody fluid in the pleural space was obscure and this space seemed to be normal as it could be evaluated by VATS. After thoracotomy and complete release of the lung from mediastinal structures, aneurysm of the descending aorta was diagnosed.

In a patient suffering from mediastinal tumor, access and biopsy could not be performed because of the severe adhesion of the lung to the tumoral site; therefore, the patient underwent thoracotomy. The pathologic report of this patient was lymphoma.

In thoracotomy group, there were 2 cases of diagnostic failures. In both cases, the pleura was intact at the site of thoracotomy. To obviate a comprehensive diagnostic thoracotomy in these patients VATS was performed, which was diagnostic in both cases.

Table 5. The rate of diagnostic accuracy in 59 patients in regard to the type of surgical procedure.

Surgical procedures	Diagnosed	Undiagnosed	Total
VATS	21	6	27
Thoracotomy	26	2	28

P=0.14

Table-6 indicates the amount of injectable narcotics used in two groups.

Table 6. Mean and standard deviation of the amount of injectable narcotic pain relievers.

Surgical procedure	Mean	Standard deviation	N
VATS	52.0	62.4	27
Thoracotomy	61.9	107.1	27

P=0.648

In the VATS group, a case of cardiac block developed during anesthesia which did not cause any complication.

In the thoracotomy group, there were 3 complications, including 2 cases of rib fracture and one case of reinsertion of the chest tube.

The rate of complications in thoracotomy and VATS groups did not show any significant difference (table 7).

Table 7. Evaluation of the complication rate in two groups

Surgical procedure	With complication	Without complication	N
VATS	1	26	27
Thoracotomy	3	24	27

P= 0.61

There was only one case of death in 26 days after surgery, which was not related to the operation but the result of metastatic progression of the disease.

Therefore, the rate of mortality in both groups is regarded as zero.

Table-8 shows the hospitalization of patients in both groups.

Table 8. Hospitalization (days) in two groups.

Surgical procedure	Mean	Standard deviation	N
VATS	5.19	2.34	27
Thoracotomy	5.26	2.90	27

P= .0.918

DISCUSSION

Thoracoscopy has gradually replaced the open pleural biopsy in most parts of the world since its invention in 1910 (2, 4, 9, 13, 28-31).

This procedure gradually replaced thoracotomy in other chest diseases as well (11, 32-39).

The undeniable advantage of this procedure is its insignificant scar.

In this procedure if there is no adhesion between the visceral and parietal pleura the whole pleural space will be visible (23, 24).

Since it is not possible to see the whole pleural space in limited thoracotomy, at least theoretically, diagnostic ability of VATS is more than limited thoracotomy.

In this study, there is no statistically significant difference between the two groups in regard to the rate of diagnostic accuracy. The most important factor which limits the use of VATS is presence of adhesions in pleural space, which makes its use practically impossible.

In this study, 3 out of 6 cases of diagnostic failures in VATS group were due to pleural adhesions. All 3 patients underwent thoracotomy immediately and the diagnoses were made. Therefore, even in these cases, no excess cost or any further action was imposed to the patient.

Another case of diagnostic failure in VATS group was the presence of an aneurysm of descending aorta in a patient suffering from bloody pleural effusion.This patient was among the first patients who were operated by thoracoscopy and diagnostic failure could be due to surgeons' inadequate ability during learning curve.

The remaining 2 cases of diagnostic failures in VATS group were patients whose pathologic report showed benign pleural lesions. Follow ups of these two patients showed a malignant disease. The first patient in this group was a candidate for thoracotomy due to a clinical suspicion with the diagnosis of fibrinoleukocyte exaudate and microbial colonies, but refused surgery. Nine months later the patient underwent thoracotomy in another center and was diagnosed as SCC. No data about the pleural involvement was found. Therefore, it is not possible to judge the pleural condition in the previous 9 months. The second patient with the diagnosis of nonspecific chronic inflammation underwent a thoracotomy after 7 months. This time the pathologic diagnosis was malignant mesothelioma. Considering the histopathologic characterstics of mesothelioma and its clinical course there is always a possibility for the similar cases to happen. It is noteworthy to mention the two diagnostic failures in limited thoracotomy group as well. In these patients pleura was intact at the surgical site. To access the other sites it was necessary to perform a full thoracotomy. Performing thoracoscopy obviated the need for a full thoracotomy in those 2 patients.

According to the above mentioned facts VATS procedure can be in the same level as limited thoracotomy regarding diagnostic ability.

In regard to postoperative pain, making a conclusion is more complex. Considering the fact that the quantitative evaluation of postoperative pain is not possible, we considered the mean rate of injectable narcotics as a reflection of severity of pain. On the other hand, pain depends on various interventional factors such as sex, age, social and mental conditions (14, 15, 20, 24, 25, 26).

There was no significant statistical difference between the mean age and the sex ratio in the 2 groups. Therefore, the effect of these two factors can be considered negligible. Also, by random selection of patients in the 2 groups, the effect of variables of nationality and level of education were excluded from the treatment response.

Considering the limitations, this study did not show any significant difference in regard to the narcotic use in the two groups and postoperative pain.

It is obvious that one of the essential causes of pain after thoracotomy, is the use of retractor which is placed between the two ribs to access the pleural

space (40).There is no need to use a rib retractor in VATS procedure. Less pain in VATS procedure which is reported in some studies can be due to this fact. If we pay more attention to the number and amount of narcotic use after the operation, another fact will be disclosed.

The standard deviation in the thoracotomy group was approximately 2 times greater than the alternative group.

This shows the wide distribution of pain spectrum in this group. It seems that specific and limited manipulation of ribs and pleura in VATS group and unlimited manipulation in limited thoracotomy group were responsible for this difference. In most limited thoracotomy cases, there is a need to use rib retractor and separate the ribs in different extents which can account for the severity of pain distribution in this group.

Regarding the complications, it is obvious that the rib fracture had a low potential possibility to happen in the VATS group. The mortality rate was zero in both groups. These two procedures were similar and in the same level in regard to the rate of complications and mortality.

Some authors have reported a shorter hospitalization period in the VATS group comparing with the thoracotomy group. In these studies comparisons were made for lung biopsy, pulmonary bullous disease and/ or resection of mediastinal tumors (1, 5, 9, 11, 14, 25, 27).

The hospitalization period in our study did not show any difference in the two groups. Although, it must be mentioned that discharging the patients in our study depended on their chest tube removal. According to the frequency of tissue diagnoses (table 4), it is obvious that the determining factor for the appropriate time of chest tube removal and discharging the patient is the underlying disease, and the surgical procedure has a minimal role in this regard. Finally we can say that if we replace limited thoracotomy by VATS procedure the hospitalization period does not increase.

Another advantage of VATS procedure is that it can be performed with some modifications in severely sick patients who can not tolerate a general anesthesia. The pleural space can be seen through a hole made in the chest wall under local anesthesia, and the biopsy can be taken through the same hole.

This procedure was performed in 2 patients who did not have the inclusion criteria because of poor general condition, being successful in both cases.

Therefore, limited thoracotomy can be confidently replaced by VATS in patients with pleural effusions with unknown cause in regard to diagnostic ability, post operative pain, complications, mortality, hospitalization, and esthetic results.

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