

# **Role of Video Assisted Thoracoscopy Surgery for the management of spontaneous pneumothorax**

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## **Abstract:**

Video Assisted Thoracoscopic Surgery (VATS) have promising role in the management of spontaneous pneumothorax not only in young patients (pt) with apical blebs but also in elder pt having emphysema.

## **Objective:**

To evaluate the out come of VATS as compare to conservative and open Thoracotomy for the management of spontaneous pneumothorax and to evaluate various parameters in terms of results.

## **Materials and Methods:**

A literature review was performed using Springer link, Bmj, Journal of MAS and major general search engines like Google, MSN, Hiwire press and Yahoo etc. The following search terms were used VATS, spontaneous pneumothorax, cost effeteness of VATS uniport versus three port, etc. Criteria for selection of literature were the number of cases [excluded if less than 20], methods of analysis [statistical or non statistical], operative procedure [only universally accepted procedures were selected] and the institution where the study was done

## **Key Words:**

Spontaneous pneumothorax, Thoracoscopy, open Thoracotomy, Video-assisted thoracic surgery (VATS)

## **Introduction:**

Video assisted laparoscopic surgery (VATS) is emerging as an alternative technique in the evaluation and treatment of spontaneous pneumothorax (PN). VATS has been reported effective in treating PN. Open Thoracotomy remains the criterion standard therapy for recurrent or persistent pneumothorax , however due to development of VATS and proper vision in side the thoracic cavity along with minimal hospital stay , less post op analgesia , early mobilization etc , it may be consider safe alternative to open Thoracotomy. Our purpose of study is to evaluate role of Video assisted thoracoscopic surgery (VATS) in spontaneous pneumothorax over Thoracotomy and to assess various parameters in terms of morbidity, cost, recurrences, learning curve etc.

## **Spontaneous pneumothorax:**

Pneumothorax is caused by entry of air in to plural pockets either via air ways and lungs or via iatrogenic or traumatic injury, resulting in to collapse of lung.

Spontaneous pneumothorax (SP) is divided in to primary SP (PSP) and secondary (SSP).

In primary SP no identifiable cause is found while SSP is associated with preexisting pulmonary disease.

## **Pathophysiology and clinical manifestation**

### **(1) Primary pneumothorax:**

This condition more commonly seen in young male between 30 to 40 age group.. Diagnosis usually made in case of sudden onset of chest pain and /or dyspnoea.

- Dyspnoea is rare complaints in PSN as compare to SSP.

Smoking appears to single most important risk factor with life time risk of developing PN is 12% compare with 1% in non smoking (1/2). Pathophysiology of PSP is unknown however ruptured bulla in the apical lobe are the most frequent cause of PSP non randomized study suggest that bullectomy without pleurodesis or pleurectomy does not prevent recurrence as effectively as combining two technique. (3/4)

## **(2) Secondary spontaneous pneumothorax (SSP).**

The underlying etiology could be COPD, TB, AIDS, cystic fibrosis, sarcoidosi ,etc. Symptoms of SSP presents with sudden onset of dyspnoea or respiratory insufficiency and it can be life threatening due to underlying preexisting lung disease. In case of spontaneous haemo- pneumothorax, caused by rupture of vessels in side the adhesion, additional circulatory symptoms may worsen respiratory symptoms. Emergency treatment is essential by wide bore needle or chest tube drainage. Randomized control trial have shown that simple aspiration is equally effective as tradition chest tube with immediate success rate of 80 %.( 5/6).

### **Objective of treatment:**

#### **(1) Re expansion of lung:**

Achieved by chest tube drainage followed by negative suction pressure of -20 cm of water

#### **(2) Repair of leakage:**

Usually requires surgery that includes stapling, suturing glue etc

#### **(3) Prevention of recurrence:**

Can Achieved by obliterating the plural space by creating adhesions between parietal and visceral pleura. Pleurodesis may be achieved by surgically, mechanically or pharmacologically.

### **Management of spontaneous pneumothorax:**

Small PSP requires no treatment except close observation for several days.

However after a first recurrence the like hood of subsequent recurrence increases progressively up to 62% for a second and 83% for third episode. (7)

Surgical treatment of SP is the last therapeutic resort for SP that could not be treated by lesser procedure such as observation, needle aspiration, and chest tube or by Thoracoscopy.

### **Indication:**

- (1) Recurrent ipsilateral or contralateral pneumothorax
- (2) Pneumothorax with persistent air leak (more then 3 weeks)
- (3) B/l synchronous pneumothorax
- (4) Pneumothorax occur in person whose profession resulted in exposure to atmospheric pressure changes like pilot, scuba divers (8)
- (5) All cases of first recurrence of SSP

### **Postero lateral Thoracotomy:**

With the pt under GA using single lung ventilation, a postero lateral Thoracotomy incision made through fifth intercostals space. The ribs are spread enough to allow a partial pleurectomy to be performed from level of fifth ribs. Intra thoracic procedure consists of excision of blebs, usually by stapling, electro coagulation or laser. Treatment of lung lesion is associated with some pleural procedure either pleurectomy (upper 1/3 rd to half of pleural cavity), mechanical abrasion.

Incision is closed in layers using absorbable sutures. Two drains are kept through separate incision and placed on negative suction of 20 cm of water.

After the operation pt is extubated in operation room and transfer to ICU. Intercostals drainage removed when the lungs are fully expanded with no residual leak. Pt discharge from hospital when he is mobile and on oral analgesic .

Axillary Thoracotomy is relatively less invasive then postero lateral Thoracotomy and can be associated with less morbidity.

## **Video assisted thoracoscopic surgery**

### **Relative contra indication;**

- (1) Recurrent PSP after surgical treatment
- (2) History of ipsilateral pleural disease

### **Anesthetic consideration:**

General anesthesia with double lumen endotracheal intubation is used for separate ventilation of lungs. Correct positioning of ETT is a must and can be checked by bronchoscopy. Intra pleural CO<sub>2</sub> is not necessary. For primary spontaneous pneumothorax the anesthesia is not a big problem but for secondary spontaneous pneumothorax, because of underlying lung pathology, anesthesia poses a major challenge.

Cases in which the patient is very old or has extreme underlying lung pathology, VATS can be done under epidural and local anesthesia. (9)

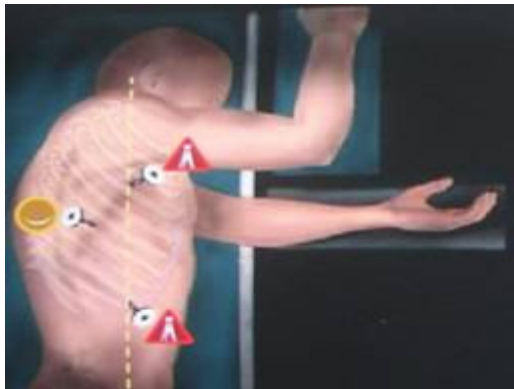
### **Position of patient:**

Patient placed on Lateral position, same for posterior Thoracotomy, ipsilateral arm is positioned horizontally to keep the extra working space for the instrument.



### **Incision and port placement**

Optical trocar placed paravertebral and the instruments trochar are placed at 3rd and 9th intercostals space on anterior Axillary line.

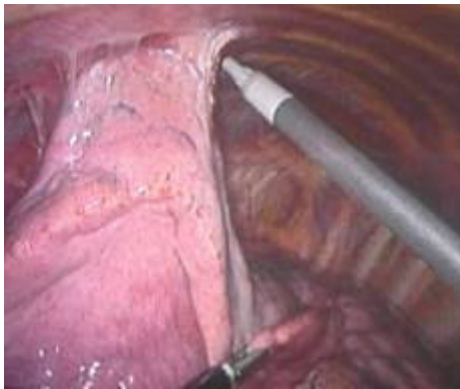


A 7 mm Thoracoscope is available is less traumatic for the paravertibral space. Needle scope VATS have been showing further less trauma as compare to conventional VATS. . (17)

### **Instruments:**

Because of rigid thoracic wall the maneuverability of instruments are limited so more freedom in side the thoracoscopic cavity can be achieved by angled curved instruments

### **Exploration:**



Blunt atraumatic instruments should be used for manipulations of the lung tissue. Through adhesiolysis should be done to achieve good operative field, haemostasis is secured by diathermy for any adhesion bands, 70 to 80 % of pt having PP have sub pleural bullae (10). Care should be taken while dissecting apical adhesions because of the proximity of subclavian vessels. During inspection gentle lung insufflations of air makes collapse bullae at the surface. In 1/3rd of the pt, the only independent predictive factor of recurrence of SP was the failure to identify and resects blebs at operation (11)

### **Resection:**

Single small bullae are resected using two endoloops combined with addition suture to prevent slipping.

### **Endoscopic stapler**

Large bullae with wide parenchymal base are resected with linier Endoscopic stapler, it should be perform ensuring that full staple line is in continuity to prevent air leak. Division of inferior pulmonary ligament is not usually necessary, unless a very large apical bleb or bullae is seen. (20)

If no bullae or air leak is seen then the procedure can be completed by wedge resection combined with a partial pleurectomy.

### **Pleurodesis:**

It is done to prevent the rate of recurrence following repair of air leak .the pathophysiologic principal is create adhesion by apposing the lung to chest wall is by secretion of fibrins from the chest wall in to pleural space .

Pleurodesis can be achieved by,

(1) **Mechanical mean** by rolled up Marlex mesh or a piece of gauze.



(2) **Chemical pleurodesis** by talc, or silver nitrite, talc pleurodesis remains the most inexpensive and most effective agent (13)



(3) **Thermal pleurodesis** by using electro cautery, laser or argon beam.

Pleurodesis can be achieved by pleurectomy, the parietal pleura is detached from endothoracic fascia and it is performed between the first and fifth space.

#### **End of procedure**

The area of adhesiolysis and port sites are inspected for bleeding and haemostasis.

Reinsufflate the lungs.

Insert two chest tubes (24 and 26 fr) through Axillary and inferior ports and keep under -20 cm of water.

#### **Other methods for managing blebs**



(1) **Endoloop ligation**- it can be done by pre tied commercial loops , accidental slipping during ligation during lung expansion can be prevented by placing double or triple loops around each bullae(14- cost analysis)

(2) **Endoscopic suturing**: To minimize cost of the stapler, Endoscopic suturing can be applied by using polypropylene.

(3) **Argon beam coagulator**: there is more chance of post op air leak as well as recurrence (15)

### **Post operative course:**

In most of the pt lung functions returns to normal within six weeks for PVC and FEV1

### **Complications:**

(1) **Mortality** for primary SP the mortality is approaching to zero. pt with secondary SP are usually elder having underlying lung pathology so mortality is expectable.

(2) **Bleeding**: It may occur through internal thoracic artery, generally it requires no conversion as it can be deal by VATS

(3) **Trochar injury**: It can be avoided by dissecting the trochar channel with scissor under digital control and by using blunt trochar

### **Certain important considerations:**

#### **Recurrence after VATS**

Earlier repots of recurrence was mainly due to failure of method of treatment like endoloops, clipping. The reported incidence was as high as 22 %( 16) this is high when we compare with open Thoracotomy. The only important predictive factor of recurrence of SP was the failure to identify and resect a bleb at operation(104). Also when bullae was radio logically diagnosed pre -operatively recurrence tends to occur post operatively (18)

The recurrence rate is low after combining stapling and pleurodesis. Talc pleurodesis have shown lower recurrence rate (19) one study concluded that video-assisted thoracoscopic treatment of spontaneous pneumothorax by wedge resection and pleurectomy has a recurrence-free rate of 93.8% (7) and is therefore an effective treatment for all forms of spontaneous pneumothorax.

A non randomized study suggests that bullectomy without pleurodesis or pleurectomy does not prevent recurrence as effectively as combining two techniques. (3/4))

Argon beam coagulator has more chance of post op air leak as well as recurrence (15))

The relation ship between recurrence and various factors includes age, preoperative procedure, radiological bulla diagnosis, operative time, no of bulla or blebs, location of bulla post operation air leak and duration of post op drainage.(33)(38)

#### **Chronic pain at the port site**

It is observed at port site, especially after pleurectomy. Some author routinely prefers one port for thoracoscope and other instruments are put directly through skin incision. Needle port also reduces port site neuralgic pain(17)(21)

Neuralgia was significantly reduced after adaptation of uniport technique, however learning curve of uniport is higher (16) (22)

Post op morbidity and cosmesis

VATS seems to be superior to Thoracotomy in terms of low morbidity, low invasiveness and cosmetic issue (23) Single-stage bilateral VATS in the supine position has shown itself to be an excellent approach for the treatment of bilateral bullous lesions, combining both efficacy and low morbidity.

## **Post op narcotic consumption**

It is less in compare to open Thoracotomy (24)

## **Post op pulmonary exchange**

Randomized study conducted over 38 pt have shown that bullectomy via vats was less deleterious to pulmonary exchange. Thoracotomy cause worsening of gas exchange due to incisional pain, atelectasis and chest wall deformity. (25)

## **Cost analysis**

For developing country, the cost of VATS procedure is a major concern especially the price of endostappler and disposable instruments (26)

A retrospective study conducted over 50 pts analyzing cost and hospital stay with PSP, there were no difference in operative timing between VATS and Axillary Thoracotomy, but the length of hospital stay was higher in Thoracotomy group, as compare to VATS, however early return to work has added benefits over cost . so it can be concluded that VATS was a cost effective and better tolerable procedure for the t/t of PPN compare to Thoracotomy(40)

Use of paper taps for port site closure also reduces cost of therapy. (39)

## **Post operation drainage:**

Post operative drainage time is significantly reduced in VATS in comparison to that of open Thoracotomy, also if it increase in vats then it will have deleterious effect on recurrence.(6)

## **Learning curve:**

Learning curve for VATS is same that for any other laparoscopic procedure , however uniport VATS have shown demonstrable learning curve for significant efficacy., (34)

## **Discussion:**

There are many ways of treatment of the SP, its Pathophysiology remains unknown however PSP is strongly related to smoking (1). Since the early 1990, there has been preference of VATS over Thoracotomy. For first episode of PSP, there are no doubts that observation and simple aspiration are established first line therapy (34/36). Technically VATS is more challenging and the learning curve is relatively high, particularly for uniport VATS recurrence is important consideration in VATS(34) .It seems good to combine bullectomy or blebectomy with stapler combined with pleurodesis to reduce the rate of recurrence (12, 14, 20). Other method like endoloops, clips or suturing is cost effective but recurrence rate is high (28). Recurrence of VATS is comparable to open thoracotomy and some study has shown higher than Thoracotomy (28, 30, 36). Bilateral VATS is a safe procedure in the treatment of simultaneous and nosimultaneous bilateral SP. This avoids the need for subsequent operations (31). Open Thoracotomy is detrimental to lung tissue in terms of gas exchange ,VATS have shown no detrimental effects and pulmonary function returns to normal within few days (25).Cost containment is main issue ,particularly to developing country in terms of staple cost ,setup and instrument cost(26,40). Although VATS is associated with fewer scars, however long term neuralgia at port site pose special problem. This can be avoided by placing working port directly through skin incision or uniport technique (16, 21, 22). Lastly over all morbidity, use of analgesia, post operative drainage and hospital stay have considerably reduced using VATS over Thoracotomy (23, 25).

## **Conclusion:**

The outcome of vats is good in comparison to conservative treatment and equivocal to Thoracotomy for the management of recurrence and primary PN. In terms of low morbidity, low invasiveness, low analgesia, and cosmetic issue VATS is superior to open Thoracotomy VATS is standard in recurrence and should be consider for treatment at the first episode.

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