Original Article

Video-assisted thoracoscopic surgery for pulmonary aspergilloma

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ABSTRACT

Introduction: Surgical management of pulmonary aspergilloma in symptomatic patients offers a significant chance of cure. Video-assisted thoracic surgery is a valid alternative for properly selected cases. We herein report our experience with thoracoscopic management of pulmonary aspergilloma. **Patient and Methods:** This retrospective analysis was performed on 41 patients operated between 2012 to 2015. The patient records were thoroughly analyzed for demography, clinical presentation, computed tomography , the procedure performed , post-operative complications and course during 6 month's follow up. **Results:** Out of total 41 patients, 23 (56%) were treated by VATS and 18 (44%) by thoracotomy. Average intraoperative blood loss was 214 ml (±106) in VATS group and 461 ml (±167) in thoracotomy. Mean operative time was 162 (±14) minutes in VATS and 239 (±12) minutes in thoracotomy group. In VATS group, postoperative complications were found in 5 patients and in 11 patients in the thoracotomy group. Average duration of chest tube was 5.43 () days in VATS group and 8.94 () days in thoracotomy group. Average length of hospital stay was 5.04 in VATS group and 6.55 days in thoracotomy group. **Conclusions:** VATS for pulmonary aspergilloma, if applicable, may be a safe and efficacious option in experienced hands. Simple aspergilloma, in particular , is considered to be a good indication for VATS. Some cases of complex aspergilloma may also be amenable to VATS. However, the long term results need to be further analyzed using a larger study group.

KEY WORDS: Aspergilloma, pulmonary aspergillosis, thoracoscopic surgery, video-assisted thoracoscopic surgery

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INTRODUCTION

Pulmonary aspergilloma is a conglomeration of matted fungal hyphae, mucus, inflammatory cells, and altered blood elements which typically forms in a preexisting cavity of the lung, most commonly of tubercular origin.[1] Pulmonary aspergilloma could be simple aspergilloma (SA) or complex aspergilloma (CA) depending on the thickness of the wall of the cavity and presence or absence of the disease in the surrounding lung, pleura and rest of the lung [Figure 1].[2] Hemoptysis is one of most common symptoms ranging from minor to life-threatening episodes.

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Use of antifungal agents, whether systemic or intracavitary, has shown little success in "curing" aspergilloma.[3,4] A review of literature reveals no consistent evidence that aspergilloma responds to antifungal agents. Furthermore, these drugs rarely achieve the minimal inhibitory concentrations within the lung cavities.[5] Complete resection of aspergilloma with clear margins offers the most consistent chance of cure.[6,7] However, the mortality and morbidity reported with surgery has deterred treating physicians from utilizing the surgical option.

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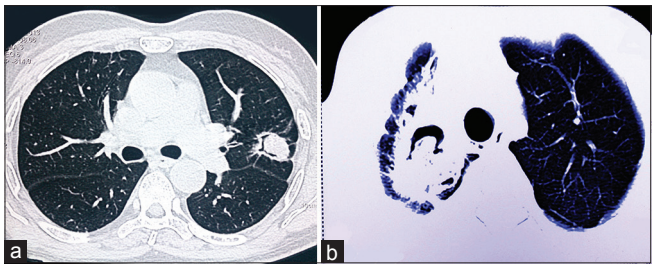

Figure 1: Computed tomographic image of (a) simple aspergilloma (b) complex aspergilloma

Of late, video-assisted thoracoscopic surgery (VATS) has been increasingly applied in the management of chest conditions, including aspergilloma.[8-10]

We report herein our experience with VATS in the management of 23 patients of aspergilloma and provide a descriptive analysis of cases operated by thoracotomy to highlight the current role of VATS in the management of aspergilloma.

PATIENTS AND METHODS

This retrospective analysis was performed on 41 patients operated for pulmonary aspergilloma, who underwent surgery at our center between March 2012 and July 2015. The patient records were analyzed for demography, clinical presentation, computed tomography (CT), indications and details of surgery, the procedure performed, postoperative complications, and course during 6 months follow-up.

All these patients who had undergone surgery were symptomatic despite medical management. Their preoperative CT scans were analyzed in detail and patients were classified as SA or CA. A detailed preoperative evaluation was done in all patients to assess fitness for pulmonary resection. The choice of VATS or thoracotomy was based on a preoperative assessment of disease on CT scan. All patients with SA and CA with localized lung parenchymal involvement and absence of extensive pleural thickening/calcification were taken up for VATS. Patients who had CA with pan lobar parenchymal involvement, hilar involvement, calcified lymph nodes near blood vessels, and extensive pleural thickening or calcification as seen on CT scan were taken up for thoracotomy.

All patients were operated only after optimization through a graded preoperative physiotherapy regime and nutritional build up. Patients were operated under general anesthesia with double lumen intubation to achieve single lung ventilation. They were all placed in lateral decubitus position. In thoracotomy group, standard posterolateral thoracotomy through 5th intercostal space was performed. In VATS, the chest cavity was assessed using a 5 mm telescope inserted through a disposable trocar. Whenever dense adhesions were encountered, open entry was used

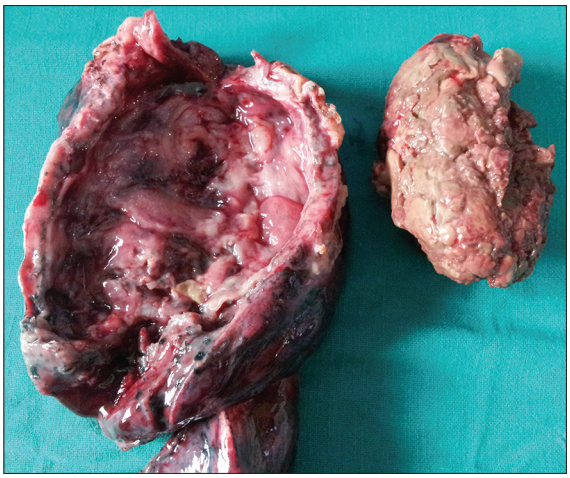

Figure 2: Postoperative specimen of resected lung showing the cavity and fungus ball (aspergilloma)

to gain access to the chest. Careful finger dissection was used to create the space between the lung tissue and the chest wall. After the entry of the first camera port, subsequent ports (2–3, 5 mm ports) were created under vision at appropriate spaces to carry on with the dissection. Sublobar, lobar, bilobar resection, or pneumonectomy, was performed as deemed necessary to completely resect aspergilloma as well as the entire diseased lung [Figure 2]. Every effort was made to avoid inadvertent opening of aspergilloma cavity during dissection to avoid any spillage as it predisposes to postoperative empyema. In VATS cases, the resected specimen was always placed in a bag and retrieved through one of the ports. Intraoperative variables like blood loss during surgery which was measured by sponge count (wet sponge weight minus the dry sponge weight) and calculating the loss in the suction after subtraction of irrigation fluid, average duration of surgery and conversion if any along with descriptive reasons behind the conversion, were noted. In the VATS group, intrapleural intercostal nerve block from the 3rd to the 10th space, in the paravertebral area was performed at the end of the procedure for pain relief while for patients with thoracotomy; epidural analgesia through continuous infusion through patient controlled analgesia pain pump was used. Two intercostal drains were placed in the apical and basal chest cavity. In all patients, the drains were connected to a digital suction device (THOPAZ, Medella) on the table itself. All patients were extubated at the end of the procedure and shifted to floor after overnight observation in the recovery room. Pain score in postoperative period was calculated according to visual analog score (VAS). It was recorded on postoperative day 1, 3, 7, and 30. The respiratory therapist played a crucial role in ensuring aggressive chest physiotherapy in all patients postoperatively. For chronically debilitated patient's nutritional support was continued in postoperative period also, orally or through nasogastric tube if patient's oral intake was poor despite our best efforts. Postoperative complications were recorded as wound infection,

inadequate lung expansion, prolonged air leak (>14 days). Other postoperative data as the duration of hospital stay (postoperative), duration of intercostal tube drainage, 30 days and 3 months mortality were noted. The patients were followed up in the outpatient department for a minimum of 6 months for any recurrence of hemoptysis or radiological abnormality.

Statistical analysis

Patient data were presented as either mean and range for quantitative variables or absolute and relative frequencies for qualitative variables.

RESULTS

A total of 41 patients of pulmonary aspergilloma were studied retrospectively under two groups: VATS (n = 23) and thoracotomy (n = 18).

In VATS group, 16 (69.5%) were males and seven (30.5%) were females. The average age of patients was 43 ± 16 years. In thoracotomy group, 12 (67%) were males and (33%) were females. Average age of patients was 39 ± 10 years [Table 1]. The most common presentation of patients was hemoptysis, 22 (95.6%) in VATS and 17 (94.4%) in thoracotomy group. Only one patient in each group had chronic cough with recurrent chest infections as chief complaint. There was a history of tuberculosis in 18 (78.2%) patients in VATS group and 15 (83.3%) in thoracotomy group, with all of them having received complete anti-tubercular therapy at least once in the past. Bronchiectasis was reported as the underlying cause in five (21.8%) patients in VATS group and three (16.6%) in thoracotomy group. The average duration of symptoms was 18.13 (±16.45) months in VATS group and 13.83 (±22.31) months in thoracotomy group. According to the CT findings, 14 (61%) patients were classified as SA and nine (39%) as CA in VATS group. In thoracotomy group, all 18 (100%) patients were CAs.

Out of total 41 patients, based on criteria mentioned above, 23 (56%) were started by VATS and 18 (44%) by thoracotomy. In 22 patients (95.65%), procedure was successfully completed by VATS, whereas one patient in the VATS group needed conversion to thoracotomy due to unclear hilar anatomy. The extent of lung resection in VATS and thoracotomy groups has been listed in Table 2. Average intraoperative blood loss was 214 ml (±106) in VATS group and 461 ml (±167) in thoracotomy. Average blood loss in patients who required blood transfusion was 633.333 ml. Intraoperative blood transfusion was given to seven (38.9%) patients in thoracotomy and only one (4.34%) patient in VATS group. Mean operative time was 162 (±14) min in VATS and 239 (±12) min in thoracotomy group. There was no postoperative reexploration or mortality in either group.

Table 1: Patient characteristics: Video-assisted thoracoscopic surgery and thoracotomy group

Characteristics	VATS (n=23), n (%)	Thoracotomy (n=18), n (%)
Male	16 (69.5)	12 (67)
Female	7 (30.5)	6 (33)
Age (years)	43±16	39±10
Simple aspergilloma	14 (61)	0
Complex aspergilloma	9 (39)	18 (100)
Duration of symptoms	18.13±16.45	13.83±22.31

VATS: Video-assisted thoracoscopic surgery

Table 2: Side, site, and procedure distribution: Video-assisted thoracoscopic surgery and thoracotomy group

Procedure	VATS	Thoracotomy
Right sided (n=26)	15	11
Wedge resection upper lobe	10	0
Wedge resection lower lobe	1	0
Upper lobectomy	3	5
Middle lobectomy	0	1
Lower lobectomy	1	0
Upper bilobectomy	0	4
Pneumonectomy	0	1
Left sided (n=15)	8	7
Wedge resection upper lobe	4	0
Wedge resection lower lobe	1	0
Lower lobectomy	3	7

VATS: Video-assisted thoracoscopic surgery

Table 3: Perioperative data: Video-assisted thoracoscopic surgery and thoracotomy group

Characteristics	VATS	Thoracotomy
Mean operative time (min)	162.13±14.17	239.44±12.089
Intraoperative blood loss (ml)	213.913±106.033	461.111±166.765
Intraoperative blood transfusion (units), n (%)	1 (4.34)	7 (38.9)
Length of hospital stay	3.78±1.92	6.55±3.50
Duration of chest tube drainage	5.43±4.53	8.94±5.04
Complications		
Wound infection	0	2
Prolonged air leak	2	3
Inadequate lung expansion	2	4
Cardiac arrhythmia	1	2
Total	5	11

There was no mortality or recurrence in this study. VATS: Video-assisted thoracoscopic surgery

Table 4: Visual analog pain scores: Video-assisted thoracoscopic surgery and Thoracotomy group

VAS score	VATS	Thoracotomy
POD 1	5.17±0.176	6.72±0.46
POD 3	2.26±0.46	5.61±0.50
POD 7	1.13±0.45	3.11±0.32
POD 30	0.08±0.28	2.11±0.47

VATS: Video-assisted thoracoscopic surgery, VAS: Visual analog score, POD: Postoperative day

In VATS group, postoperative complications [Table 3] were found in five patients, prolonged air leak in two, inadequate lung expansion in two, and cardiac arrhythmia in one.

In thoracotomy group, postoperative complications were found in 11 patients, postoperative surgical site infection in two, prolonged air leak in three, inadequate lung expansion in four, and cardiac arrhythmia in two. There was no postoperative empyema in either group. In VATS group, average VAS pain scores in either group have been listed in Table 4. Average duration of chest tube was 5.43 (±4.53) days in VATS group and 8.94 (±5.04) days in thoracotomy group. Average length of hospital stay was 5.04 (±4.44) in VATS group and 6.55 (±3.50) days in thoracotomy group.

All patients were followed up for a minimum duration of 6 months. There was no mortality or recurrence of symptoms in either group.

DISCUSSION

Due to the continued high incidence of tuberculosis, it is not uncommon to see patients of pulmonary aspergilloma.[11] In due course of time, number of these patients develop hemoptysis, sometimes massive or even life-threatening. In our country, most of these patients are managed conservatively with systemic or intracavitary antifungal agents, which have disappointing results. Even then many patients are not offered surgery as an option, because of a generally formed belief of high morbidity and mortality. Most of such assumptions are based on reports with thoracotomy which revealed significant morbidity and mortality rates of up to 43% for CA.[12] While there is no denying the fact that surgery does carry a significant risk of complications such as massive blood loss, bronchopleural fistula, postresection pleural space problems, empyema and death from respiratory failure,[13-18] there are also several reports of long-term better outcomes and survival after surgery than with medical therapy alone in symptomatic patients. Most recent reports reveal mortality rates of <6% and morbidity in the range of 20%–40%.[7] A recent study by Mohapatra *et al*. from our country concluded that though surgery for aspergilloma is considered to be risky; surgical excision can be done with acceptable morbidity and mortality to provide the patient complete cure and symptom-free survival which reiterates the conclusion drawn by Pratap *et al*. also from India.[19,20] One, therefore, needs to weigh the overall risk-benefit ratio carefully and select cases accordingly for consistently better outcomes which brings us to reviewing the indications of surgery. The risk of developing complications pushes the balance in favor of an invasive approach. In a report by Jewkes *et al*. the observed 5-year survival in surgical arm was 84% as opposed to 41% for nonoperated patients.[4] In a 39-year series of eighty patients, accordingly, Babatasi *et al*.[21] concluded that pulmonary resection was the best option whenever the diagnosis of aspergilloma has been confirmed, and the patient is a suitable candidate for the operation. While the issue of surgical treatment in symptomatic patients is less debatable, the same does not hold true for asymptomatic patients and a significant proportion of treating physicians will elect for conservative treatment of asymptomatic SA. However, one should keep in mind that nearly 20% of patients of aspergilloma develop invasive aspergillosis making surgery more difficult.[22] Others have found the risk of life-threatening hemoptysis to be similar in both symptomatic and previously asymptomatic patients.[13,23,24] Neither the size of the lesion nor the underlying lung disease is helpful in predicting bleeding.[4] This, together with the fact that medical therapy including systemic or intracavitary instillation of antifungal agents is mostly noncurative[25] with only anecdotal reports of partial success,[26,27] has promoted us to believe in surgical intervention even in asymptomatic SA patients with the rationale that intervening at a stage of disease when the aspergilloma is more limited may be more sound because many of such cases may just end up with sublobar resection which is less morbid. Similar conclusion was drawn by Muniappan *et al*.,[23] also such cases may be more amenable to VATS and therefore may have a significantly lesser morbidity. On the other hand, some surgical groups will offer surgery only in symptomatic patients on account of the risk of morbidity no matter how small the lesion is. Here, we would like to highlight that the decision to perform an anatomical lobe versus a nonanatomical wedge resection in a case of aspergilloma, is not dependent on the approach, i.e., VATS or open. It depends mainly on the lesion characteristics. Clear cut well demarcated peripheral lesion without surrounding parenchymal involvement (i.e. SA) can be managed by a wedge resection as in most of our VATS cases. On the other hand, if it is a centrally placed, large lesion or with significant surrounding parenchymal involvement (i.e., CA), then it is preferred to do an anatomical lobectomy/bilobectomy or pneumonectomy as the need may be. These anatomical lung resections can be performed by open and in selected cases even by VATS. It should be emphasized here that the reason to perform wedge resection in VATS was in no way related to the difficulty encountered during VATS such as adhesions and difficult hilum. Rather these were conscious decisions wherein the surgical goal from the beginning was to perform anon anatomical sublobar lung resection with the aim to preserve the normal healthy lung. Had the procedure been performed by open or needed a conversion, these cases would have still in all probability been managed by wedge resections. The aim here is to highlight the fact that these sublobar resections should not be considered as a compromised treatment modality in selected cases. Because of the saprophytic character of the organism, it is desirable to limit their section as much as possible so as not to decrease lung function, especially for small aspergilloma in peripheral location with healthy underlying lung.[28] Moreover, many of these patients are in a younger age group in whom lung preservation should always be attempted wherever feasible.

A careful evaluation of the risk/benefit ratio must be made when a surgical option is contemplated because of the high incidence of postoperative complications.

Thus, by and large surgical resection should be offered to all patients with good general condition who have aspergilloma (SA or CA) localized to a lobe in cases of SA or are monolateral in cases with multiple lesions. Even the Infectious Disease Society of America and European Society for Clinical Microbiology and Infectious Diseases/European Respiratory Society (ERS) guidelines recommend surgery for all eligible patients with aspergilloma, especially those with severe hemoptysis.[25,29]

Several studies show that wherever feasible VATS is a better approach than thoracotomy for a large number of thoracic surgical conditions including aspergilloma.[8-10] Potential perioperative benefits of the VATS approach compared with open thoracotomy include reduced incidences of prolonged air leaks, arrhythmias, pneumonia, pain and decreased inflammatory markers. The reduced postoperative complications combined with a significantly shorter duration of hospitalization have contributed to the increased cost-effectiveness also.[30] Whitson *et al*. in a systematic review of MEDLINE database involving 39 studies including 3256 thoracotomies and 3114 VATS cases, concluded that compared to thoracotomy, VATS was associated with statistically significant shorter chest tube duration and shorter length of hospital stay.[31] Cattaneo *et al*. in 2008 concluded that VATS approach in the elderly was associated with fewer and overall reduced severity of complications as well as a shorter hospital stay compared with thoracotomy.[32] A study by Flores *et al*. in 2009 concluded VATS was associated with fewer complications and shorter length of hospital stay.[33] The latest study in 2015 by Falcoz *et al*. studied 2721 patients from European Society of Thoracic Surgeons database and concluded VATS to be superior to thoracotomy in view of lesser complications.[34] Although inflammatory diseases were initially thought to be difficult for VATS due to fear of adhesions, fused fissures and unclear hilar anatomy, many reports have testified to successful application of VATS in these diseases also, including aspergilloma.[7-9,23,35]

The results of our study are in consonance with other reported literature experience that VATS is feasible and may be an effective and safe method of surgery for selected patients with aspergilloma. The indications for VATS in aspergilloma are: All patients with SA and selected patients with CA who do not havepanlobar involvement, hilar involvement, extensive pleural thickening, or calcification or calcified lymph nodes near pulmonary vessels. In the CA with any of these findings present on CT scan, thoracotomy is a better approach. Surgery for aspergilloma, especially VATS requires an experienced team, a point highlighted in the ERS guidelines also.[29] As a matter of fact, our current approach is to put the 5 mm telescope initially in most patients of aspergilloma, start the dissection as per established protocol and in the event of any difficulty or inability to make progress at any stage, convert to thoracotomy. It may be helpful to point out that due to improved visualization of the apical part of the cavity, the adhesiolysis may, in fact, be more safe and easy with VATS. Readiness for immediate thoracotomy is an essential component of any VATS approach as it may be needed for an emergency at any point of time. In our series, the average intraoperative blood loss, operative time, pain score, surgical site infection, and postoperative hospital stay were significantly lower in the VATS group. Similar observations were reported by others.[7,36] In our series, there was no perioperative mortality. There was no recurrence of aspergilloma in a follow-up period of 6 months in our series. This study has few limitations of being retrospective and having a smaller study group. It describes our experience with VATS for pulmonary aspergilloma in a small series of patients. The safety and efficacy of VATS for pulmonary aspergilloma needs to be further analyzed using a larger study group.

CONCLUSION

Surgery is the best option for fit patients with localized aspergilloma whether simple or complex. A careful assessment of the risk versus benefit ratio is however required for consistently good outcomes. VATS for pulmonary aspergilloma, if applicable, may be a safe and efficacious option in experienced hands. SA, in particular, is considered to be a good indication for VATS. Some cases of CA may also be amenable to VATS. However, the long-term results need to be further analyzed using a larger study group.

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Conflicts of interest
There are no conflicts of interest.

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