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AVATS: Awake Video Assisted Thoracic Surgery in Complex Thoracic Procedures

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Abstract

Background: Traditionally, video-assisted thoracic surgery (VATS) is performed under general anesthesia with selective ventilation and endotracheal intubation. In 2014, we published our experience with awake VATS performed under local anesthesia (AVATS) extending the benefits of VATS to those unable to tolerate general anesthesia and improve outcomes.

Method: Currently we reviewed a total of 494 AVATS procedures from June 2010 to January 2016, having added 201 new cases performed with AVATS to our original series. We have extended this technique to include more complex procedures, with results that surpass traditional open thoracotomies and traditional VATS under general anesthesia.

Results: Procedures such as pleural biopsies, wedge resections, decortications, pleurodesis, lobectomies, bullectomies and pericardial windows were previously reported with the AVATS technique in our original paper. We have analyzed our additional volume of these procedures using AVATS and have extended the AVATS technique to repair of esophageal perforations, bronchopleural fistulae, diaphragmatic laceration and chyle leak.

Conclusion: With proper patient selection and careful preoperative planning AVATS may be safely used to perform even complex thoracic surgery with equal or improved outcomes without compromise in safety.

Keywords: Awake VATS; Local sedation thoracoscopy

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Abbreviations

AVATS: Awake Video-Assisted Thoracic Surgery; VATS: Video-Assisted Thoracic Surgery; ALS: Average Length of Stay in Hospital

Background

As previously reported by us, it was possible to safely perform a wide range of thoracic procedures using AVATS with equal or improved outcomes compared to traditional VATS cases [1]. Using local anesthesia with sedation in VATS surgeries minimizes many risks and lets patients breathe spontaneously [2]. This allows for operation on patients with low lung function who cannot tolerate endotracheal intubation or are deemed high risk for general anesthesia surgical procedures [3]. It is particularly useful in patients whose general condition has deteriorated or is poor [4].

Many studies have already demonstrated several benefits of AVATS including improved outcomes, shorter operating room/anesthesia time, shorter length of hospital stays and lower costs [1,5,6]. Preservation of natural killer cell and lymphocyte count and one day after surgery, improved immune system function allows for more rapid recovery and quicker initiation of chemotherapy in patients with cancer [7].

Methods

We analyzed 494 patients who underwent awake thoracic surgery from June 2010 to January 2016. We previously reported a single surgeon experience using AVATS for wedge resections, lobectomies, decortications, pleural biopsies, pleurodesis, bullectomies and pericardial windows. We analyzed the additional volume of these cases and have reviewed results of extending the AVATS technique to even more complex thoracic procedures including repair of esophageal

Table 1: Procedures performed and average length of stay.

Cases	Number	ALS
Total	494	
Wedge Resections	134	1.3
Lobectomies	84	1.6
Chyle leak repair	1	2
Repair of perforated esophagus	2	6
Decortications	108 (16 with concurrent wedges)	2.1
Pleural Biopsies	53	1
Pleurodesis	89	1.3
Pericardial Windows	8	1.1
Bullectomies	12	1.5
Bronchopleural fistulae repair	2 (1 with concurrent wedge resection)	2
Diaphragm laceration repair	1	1

perforations, bronchopleural fistulae, diaphragmatic laceration and chyle leak. The procedures followed the guidelines of the internal hospital ethics committees. During the same time period, 265 classic VATS procedures and 134 open thoracotomies were also performed.

Results

This series reports an expanded single-surgeon, multi-center review of the AVATS technique. Institutional ethical approval and individual informed consent was obtained from all patients prior to surgery. In total, 494 thoracic surgeries were performed under local anesthesia with sedation (AVATS) between June 2010 and January 2016. Patients ranged from eighteen to ninety-one years of age, with a mean age of 69. No deaths occurred in the series. Of the 494 cases, one hundred thirty four were wedge resections, with an average length of hospital stay (ALS) of 1.3 days (Table 1). Most of these wedge resections were performed for diagnosis of small nodules not amenable for fine needle biopsy, diagnosis of processes such as pulmonary fibrosis, benign inflammatory/infectious processes, i.e. fungal masses, and resection of solitary metastatic melanoma or sarcoma.

Of the 108 decortications performed, all were A2 effusions (>50% involvement of the hemithorax. Twenty of these were for early phase empyema, 23 for intermediate phase, and 65 for organized/late phase empyema. Thirty six of these decortications were Category 3 (>50% hemithorax involvement with associated pleural peel/thickening and positive cultures or gram stain, pH, 7.2 and/or pleural glucose >60 mg/dl.) Seventy two of the decortications were Category 4 (associated with frank pus.) ALS for the 108 decortications (sixteen with concurrent wedge resection) was 2.1 days. Fifty three pleural biopsies had an ALS of 1 day.

Eighty nine mechanical and talc pleurodesis for recurrent effusions were performed with the AVATS technique, 78 of them malignant, having an ALS of 1.3 days. Eight pericardial windows were performed, with an ALS of 1.2 days. Eighty four patients had lobectomies for malignancies (18 left upper lobes, 22 left lower lobes, 18 right upper lobes, 4 right middle lobe, 20 right lower lobes and 2 left lower lobe with lingulectomy), with an ALS of 1.6 days.

Both esophageal perforation repairs were the result of Boerhaave Syndrome with tears of the left lateral distal esophagus diagnosed within 6 hours of perforation. Both patients were octogenarians with severe heart disease with ejection fractions of 18 and 13 percent

Table 2: Co-Morbidities.

Diabetes Mellitus	221 patients
COPD	134
Atrial Fibrillation	60
Hypertension	228
Chronic Liver failure	12
Chronic Renal Failure	46 (38 requiring chronic dialysis)
Coronary Artery Disease	129 (61 previous myocardial infarction)

respectively. Both also had severe emphysematous COPD with FEV1 of 0.6 and 0.7 respectively and were septic with hemodynamic compromise requiring vasopressors. Neither was felt to be suitable anesthetic risks. One of the patients was not considered a candidate forstenting due to location/extent of tear, while an attempted stent by gastroenterology failed in leak control in the other. Both families wished to pursue aggressive care measure. Both repairs were performed under local anesthesia with sedation using Dexmedetomidine. Anterolateral thoracoscopic approach with a single working incision on the anterior chest directly over tear site allowed for suture repair of tear, pedicle intercostal muscle flap placement to buttress repair and thorough lavage/decortication of left hemi thorax. Postoperatively, sepsis resolved in both patients by the second post-operative day with vasopressors being weaned off. Both had intact normal esophageal gastrografin/thin barium swallow studies on day 6 and initiated feeds without problems.

The patient with the diaphragmatic laceration as a result of trauma was repaired using a similar operative approach with simple suture repair. The patient with a chyle leak as a result of lymphoma failed both conservative medical/dietary measures and attempted thoracic duct embolization while continuing to have persistent high chest tube output. Preoperative lipophilic dye administration help locate the leak intraoperatively using AVATS to surgically clip the thoracic duct at T9 level. Chest tube chylous drainage immediately resolved and the patient was safely discharged on post-operative day and resumed chemotherapy.

One of the bronchopleural fistulae was a result of blunt trauma from a motor vehicle accident, while the other resulted from necrotizing pneumonia. After initial diagnosis with chest x-ray and urgent chest tube placement, both had persistent large air leaks. The location of injury for both was bronchoscopically visualized to be located in the distal right lower lobe bronchus. AVATS was used to surgically correct the former via suture ligation and the later with suture ligation with concurrent wedge resection. Intraoperatively the patient was asked to cough which help precisely locate the fistula prior to repair. Both had resolution of air leaks intra-operatively and chest tubes were successfully removed on second postoperative day. The patient with the pneumonia received a two week course of antibiotics via pic line at a skilled nursing facility. Both had normal one month and six month post-operative chest x-rays demonstrating full re-expansion.

Of the 494 patients, 82 required a one-day ICU stay. The remaining 412 patients went to the post-anesthesia care unit then to a telemetry floor, not requiring the ICU. Comorbidities (Table 2) included 221 patients with diabetes mellitus, 194 patients with chronic obstructive pulmonary disease, 60 with atrial fibrillation, and 228 with hypertension. Twelve patients had chronic liver failure, while 46 had renal failure (38 requiring chronic dialysis.) Many of the patients

had underlying cardiac issues with 129 patients having coronary artery disease, of which 61 had previous myocardial infarctions with compromised contractility and suppressed ejection fractions.

After delivery to the operating room, all patients had sedation using either Dexmedetomidine or Versed with mild narcotic support. As previously describe, the standard thoracotomy technique was altered to perform procedures in a modified supine position. In case emergent intubation would be required, this position would facilitate control of airway. The positioning of the patient was essentially supine with a small gel roll placed under the operative side to elevate the appropriate hemithorax. Incision and trocar placement varied depending on procedure performed/location of lesion. In general one single 10 mm. incision was used for the thoracoscope, and alongside the scope a grasper was placed through the same incision for manipulation of the lung. Secondary incisions were made based upon extent of procedure, but usual followed a standard VATS placement schematic.

Forty eight patients had central venous catheters placed, and no swan-ganz catheters were used. Arterial catheters were used in 71 of the lobectomies and 21 of the 108 decortications. In totally, 40 Foley urinary catheters were used, all removed within six hours of completion of the procedure. Of the 246 patients who had a lung resection, 203 had extremely poor pulmonary function with forced expiratory volumes 1 second less than 0.8 (FEV_1<0.8). One patient had FEV_1 = 0.58. Thoracoscopic procedures were then performed. Any site that had a resection had application of Progel lung sealant applied. Prior to closure, a 28 French chest tube was placed. Post-operatively, the average chest tube duration was 1.1 days, ranging from 6 hours to 3.5 days.

There were no deaths in the series. Overall, only thirty one complications were seen in the series. There were twenty two atrial fibrillationsin the lung resection patients and eight from decortication patients. One patient had intravenous site phlebitis. No patients had strokes or acute or delayed pneumothorax and there were no deep venous thrombosis, pulmonary emboli, urinary tract infections, pneumothoracies, pneumonia or readmission with 72month follow-up. We did not convert any patients to general anesthesia or intubate them during or after the procedures.

All patients were satisfactorily treated post-operatively with oral pain medication (Tylenol with Codeine) after one or two doses of intravenous morphine (2mg every 2 hours).Two hundred eighty six patients received intravenous or oral ketoralac. General patient satisfaction was high, with 97% of patients reporting a comfort index ≤ 1 on a scale of 0-10 with 0 being no pain and 10 being extreme pain. Three percent of patients reported a comfort index of 3-4.

Discussion

AVATS has been demonstrated to be a safe option for thoracic procedures with results rivalling and often exceeding thoracotomy or traditional VATS. Pleural procedures, wedge resections and lobectomies have been performed via AVATS with good results but there has been a paucity of reports regarding AVATS for more complex procedures [1,8,9]. We have shown previously how AVATS allows surgery to be a viable option in patients with severely compromised cardiopulmonary status who would otherwise be deemed inoperable from a general anesthetic risk [1,10]. Using careful preoperative planning helps determine the appropriate surgical approach and meticulous surgical technique, supplemented with Progel lung sealant application reduced air leak occurrence and duration of air leaks remained <24 hours, with nearly all resolving in under 10 hours.

Reported mortality rates in patients with malignancy or poor cardiopulmonary status are often shown to be highest and these patients may benefit most from the AVATS approach [1,10,11]. More experience with VATS techniques and better instrumentation help to optimize results.

Conclusions

We have extended our experience with AVATS in a variety of thoracic surgical cases with results comparable, if not better, than cases done under general anesthesia. Necessary equipment, personnel and patient positioning remains crucial before beginning the procedure in the event that emergent intubation is required. By eliminating the use of a general anesthetic, endotracheal intubation and single lung ventilation we shortened average hospital stay, provided quicker patient recovery, improved patient and referring physician satisfaction and presumably obtained cost savings. We have also been able to streamline the use of adjunctive central line, arterial catheter, and urinary catheter use helping to shorten total operating room time, while concurrently minimizing the risk of line related infections. With careful patient selection, detailed preoperative planning and calm, meticulous operative approach allows using the AVATS technique in even more complex thoracic cases.

References

1. Klijian AS, Gibbs M, Andonian NT. AVATS: Awake Video Assisted Thoracic Surgery–extended series report. J Cardiothorac Surg. 2014, 9: 149.
2. Katlic MR, Facktor MA. Video-Assisted thoracic surgery utilizing local anesthesia and sedation: 384 consecutive cases. Ann Thorac Surg. 2010; 90: 240-245.
3. Pompeo E. Awake thoracic surgery – is it worth the trouble? Semin Thorac Cardiovasc Surg. 2012; 24: 106-114.
4. Noda M, Okada Y, Maeda S, Kondo T. Successful thoracoscopic surgery for intractable pneumothorax after pneumonectomy under local and epidural anesthesia. J Thorac Cardiovasc Surg. 2011; 141: 1545-1547.
5. Pompeo E, Tacconi F, Mineo D, Mineo TC. The role of awake video-assisted thoracoscopic surgery in spontaneous pneumothorax. J Thorac Cardiovasc Surg. 2007; 133: 786-790.
6. Lesser TG. Laser application enables awake thoracoscopic resection of pulmonary nodules with minimal access. Surg Endosc. 2012; 26: 1181-1186.
7. VanniG, Tacconi F, Sellitri F, Ambroqi V, Mineo TC, Pompeo E. Impact of awake videothoracoscopic surgery on postoperative lymphocyte responses. Ann Thorac Surg. 2010; 90: 973-978.
8. Hazelrigg SR, Nunchuck SK, Lo Cicero III J, and the Video Assisted Thoracic Surgery Study Group Video assisted thoracic surgery study group data. Ann Thorac Surg. 1993; 56: 1039-1044.
9. Katlic MR. Video-assisted thoracic surgery utilizing local anesthesia and sedation. Eur J Cardiothorac Surg. 2006; 30: 529-532.
10. Jancovici R, Lang-Lazdunski L, Pons F, Cador L, Dujon A, Dahan M, et al. Complications of video-assisted thoracic surgery: a five-year experience. Ann Thorac Surg. 1996; 61: 533-537.
11. Yutaka Y, Katakura H, Kaneda S, Yamanaka A. Local anaesthetic thoracoscopy for intractable pneumothorax in a high risk patient. Interact Cardio Vasc Thorac Surg. 2012; 15: 330-331.