Awake anaesthesia for major thoracic surgical procedures: an observational study

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Abstract

Objective: Major thoracic surgical procedures are rarely performed under awake anaesthesia. The purpose of this study is to review the experience of a tertiary center in major thoracic surgical procedures done under awake anaesthesia. Methods: This single center, single operator, retrospective review of cases of thoracic surgery were done under awake anaesthesia, which included all patients operated on from September 2002 to September 2006. Patients were pre-medicated with intravenous fentanyl 50 μg and midazolam 3 mg. Thoracic epidural anaesthesia was done either between T1–T3 and T4–T6 depending on the type of procedure. The block level was verified using warm–cold discrimination. In addition, stellate ganglion block was performed in some patients to achieve cough control. The following data were documented: patients’ demographics, the type and approach of procedure, operative time, intraoperative complications, conversion to general anaesthesia, mortality, the need for intensive care unit (ICU) admission and postoperative hospital length of stay. Results: A total of 79 cases were performed over the study period. The mean age was 37 ± 18 years (59% male). Twenty-five patients (32%) underwent thymectomy, 11 patients (13%) lung resection and 8 patients (11%) sympathectomy. The most common approach was thoracoscopy in 61 patients (77%), followed by thoracotomy in 11 patients (14%) and median sternotomy in 3 patients (4%). The median postoperative hospital stay was 1.5 days, with 33% of cases discharged on the same day of operation (day surgery). Only five patients (6%) required ICU admission; three of these patients in 2002 did not need ICU, but epidural policy at that time mandated ICU admission — only 2/79 (2.5% required ICU). One patient died as a result of his underlying metastatic hepatocellular carcinoma 9 days postoperatively. Another patient was converted early to general anaesthesia prior to pneumonectomy after discovery of left upper lobe involvement and he died 3 months later. There was no anaesthesia related mortality. Conclusions: We conclude that major thoracic procedure can be safely performed under awake anaesthesia. The technique avoids general anaesthesia and endotracheal intubation, reduces postoperative hospital stay and minimizes intensive care unit admission. This study strongly suggests awake anaesthesia can improve outcomes and reduce cost. A proper multi-center trial to further evaluate this technique is needed.

Keywords: Epidural analgesia; General anaesthesia; Anaesthesia recovery period; Thymectomy; Thoracic surgical procedures; Thoracic surgery; Video-assisted thoracic surgery

1. Introduction

Thoracic ‘peridural’ anaesthesia was first described in 1952 by Crawford et al. [1]. Thoracic epidural analgesia is used as an adjunct to general anaesthesia in thoracic surgery. However, thoracic epidural blockade has been rarely utilized as a sole method to provide anaesthesia for major thoracic procedures [2]. This may be due to the perceived need for general anaesthesia in thoracic surgery to facilitate lung deflation, double lumen tube insertion and to avoid cough. In addition, needle placement for epidural blockade is more difficult in the thoracic region with increased risk of dural puncture and subsequent spinal cord injury in the thoracic compared to the lumbar area.¹ This is due to the fact that in the thoracic region, the spinal cord is very close to the dura, which in turn is close to the ligamentum flavum.¹

Epidural anaesthesia provides bilateral dermatomal sensory and motor blockade. The level and extent of blockade is evaluated using warm–cold discrimination. Epidural anaesthesia also provides superior postoperative pain control. Local anaesthesia and opioids are combined together to provide optimum results with minimal side effects.¹

Performing thoracic surgery under awake anaesthesia has several potential advantages including avoidance of airway trauma associated with endotracheal intubation, general anaesthesia, and single lung ventilation. General anaesthesia may lead to complications including hypoxia due to double lumen endotracheal tube malposition, hyperinflation of the dependent lung, re-expansion pulmonary edema, and unilateral ventilator-induced lung injury [3–6]. By using awake anaesthesia, many of these complications could potentially be avoided.

Among the advantages of awake epidural anaesthesia is the avoidance of the use of muscle relaxants in patients with myasthenia gravis. Patients with myasthenia gravis have unpredictable response to the action of muscle relaxants [7]. In addition, the action of these drugs is potentiated by the use of inhalation agents such as sevoflurane [8]. Avoiding muscle relaxants in patients with myasthenia gravis can potentially lower the risk of postoperative muscle weakness and respiratory insufficiency thus leading to faster patient’s recovery [9–12]. Other possible advantages of thoracic epidural anaesthesia include better patients’ satisfaction, reduced hospital length of stay, and improved resource utilization.

Disadvantages of awake epidural anaesthesia are that it is technically more challenging for anaesthetist and the surgeon, the possibility of failed block and the risk of dural puncture.

The purpose of this study is to review the experience of a tertiary center in major thoracic surgical procedures performed under awake epidural anaesthesia.

2. Materials and methods

2.1. Settings

King Abdulaziz Medical City is a tertiary care academic center having around 800 beds. It is a referral center for several thoracic surgical procedures including thymectomies for myasthenia gravis.

2.2. Surgical selection criteria

Selection of cases for surgery was made by the thoracic team (surgeon and the anaesthetist). All patients referred for thoracic surgical procedures were considered with the following exceptions: uncooperative patients, uncontrolled cough, bleeding disorders or unfavourable anatomy for thoracic epidural anaesthesia. Consent was obtained after explaining the type of anaesthesia and the surgical procedure.

2.3. Anaesthetic technique

All patients were pre-medicated using midazolam 3–4 mg intramuscularly (I.M.) and fentanyl 50 mcg intravenously (i.v.). Then patients were placed in the lateral decubitus position. An epidural catheter was inserted between T3–T4 and T4–T5 for all thoracic procedures except sympathectomy and thymectomy. A test dose (3 ml) of 1.5% lidocaine with epinephrine was given, followed by 8–12 ml of bupivacain 0.5% with epinephrine and 50 mcg of fentanyl. The objective was to achieve sensory and motor block between C7 and T7 levels. At this level diaphragmatic respiration was maintained. The anaesthesia level was monitored by warm–cold discrimination. For sympathectomy and thymectomy, the epidural catheter was inserted between T7–T1 and T1–T2 to achieve sensory and motor block between C5 and C6. At this level of block, the cervical horn of the thymus was included.

If the patient developed excessive cough as a result of surgical manipulation, stellate ganglion blockade was done using 10 ml of 0.25% bupivacain. Basic monitoring included blood pressure, pulse oximetry, temperature, electrocardiography and end-tidal carbon dioxide monitoring (ETCO2). During the procedure, all patients received oxygen via facemask to maintain oxygen saturation (SpO2) above 92–95%. In patients who needed to be converted to general anaesthesia, this was induced using propofol (2 mg/kg), fentanyl (0.2 mg/kg) and rocuronium (0.5 mg/kg) and maintained using inhaled sevoflurane and rocuronium. Double lumen endotracheal tube was placed under direct vision using fibro-optic bronchoscopy.

2.4. Surgical considerations

The surgical procedure was commenced only when full sensory blockade was achieved. In video-assisted thoracoscopic surgery (VATS), if the lower incision area was not covered by the epidural blockade, intercostal nerve blockade was performed by the surgeon if the following methods failed to extend the area of blockade: increasing the dose of the local anaesthetics, elevation of the head of the bed, or manipulation of the epidural catheter. When the chest wall was opened, spontaneous collapse of the lung occurred. If significant desaturation occurred, suction tube into pleural cavity was applied until the lung was re-inflated and the cause could be investigated before deflation of the lung again. During surgery, if the patient developed cough due to hilar manipulation, the surgeon usually administered lidocaine trans-bronchially. During thymectomy or any mediastinal procedure, if iatrogenic hole into the contra-lateral pleura occurred then the situation was easily managed by introducing a nasogastric tube through the created hole then got connected to continuous suction to keep the contra-lateral lung passively expanded.

2.5. Study design and data collection

All consecutive cases of thoracic surgical procedures performed under awake anaesthesia between September 2002 and September 2006 were included. A written consent for the procedure was obtained from all patients. Exclusion criteria included: uncooperative patient, uncontrollable cough, bleeding disorders or unfavourable anatomy for thoracic epidural anaesthesia. The following data were documented: patients’ demographics, the type and approach of the procedure, operative time, intraoperative complications, conversion to general anaesthesia, mortality, the need for intensive care unit (ICU) admission and postoperative length of stay. This retrospective study was approved by the hospital Institutional Review Board.
3. Results

A total of 79 procedures were performed over the study period. The mean age was 37 ± 18 years. Fifty-nine percent (59%) of patients were males. Table 1 shows the surgical approach. The most common approach was video-assisted thoracoscopic surgery (VATS) in 61 patients (77%), followed by thoracotomy, which was done in 11 patients (14%). In another patient, VATS was converted to median sternotomy as a result of unexpectedly large tumour size that was adherent to mediastinal structures. Median sternotomy was performed in three patients (4%), and chest wall surgery in three patients (4%).

Table 2 describes the surgical procedures. Twenty-five patients (32%) underwent thymectomy, all for myasthenia gravis through left video-assisted thoracoscopic surgical approach. Apical resection and pleurodesis was the second most common procedure performed in 15 patients (19%), followed by pulmonary resection in 11 patients (13%), including 2 patients who underwent pneumonectomy. Sympathectomy was performed in eight patients (10%), seven were bilateral and one was right-sided sympathectomy. Other procedures included lung biopsy in four patients (5%), mediastinal lymph node biopsy in four patients (5%), decortication in four patients (5%). Chest wall surgery in three patients (4%), closure of bronchopleural fistula in one patient (1%), pericardial window in one patient (1%), unilateral lung volume reduction surgery (LVRS) in one patient (1%), talc pleurodesis in one patient (1%) and trans-diaphragmatic resection of hepatic hydatid cyst in one patient (1%).

Table 3 shows the main outcomes. The median operative time was 72 min (Q1—Q3 was 55—100 min). Only 25 patients (32%) required chest tube insertion at the end of procedure. The median postoperative stay was 1.5 days, with 33% of cases being discharged on the same day of operation (day surgery). Only five patients (6%) required ICU admission (three of these patients in 2002 did not need ICU, but epidural policy at that time required ICU admission — only 2/79 (2.5% required ICU). One patient died as a result of his underlying metastatic hepatocellular carcinoma 9 days postoperatively. Another patient was converted early to general anaesthesia prior to pneumonectomy after discovery of left upper lobe involvement and he died 3 months postoperatively. There was no anaesthesia related mortality.

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The intraoperative surgical (non-anaesthesia related) complications are reported in Table 4. One patient (1%) with lung cancer and history of myocardial infarction developed intraoperative cardiac arrest, but he recovered fully and was discharged in a stable condition. Another patient (1%) had lung parenchymal laceration as a result of non-functioning stapler. One patient (1%) had right ventricular perforation during release of extensive mediastinal adhesions. One patient (1%) had azygous vein injury. Contralateral pneumothorax developed in two patients (2%) and diaphragmatic laceration in one patient (1%).
Nine patients (11%) required conversion to general anaesthesia, indications for conversion are illustrated in Table 5.

Two patients who underwent thoracotomy for decortication and thoracoscopic thymectomy under awake anaesthesia are shown in Videos 1—2, respectively. As demonstrated, the patients were awake intraoperatively.

4. Discussion

Our study is the largest series of major thoracic procedures performed under awake epidural anaesthesia. It demonstrated that major thoracic surgeries could be performed under awake anaesthesia with very low morbidity and no procedure-related mortality. In addition, awake anaesthesia is associated with short hospital length of stay (LOS) and the ability to discharge patients on the same day of surgery.

Only few studies in the English literature have described thoracic surgical procedures performed under awake anaesthesia (Table 6). Pompeo et al. randomized 60 patients to have thoracoscopic resection of solitary pulmonary nodule either under general anaesthesia or awake epidural anaesthesia [13]. They found that awake thoracoscopic resection of solitary pulmonary nodule resulted in shorter length of stay and better patient satisfaction [13]. Tsunezuka et al. described the results of thymectomy performed in three patients with myasthenia gravis under awake epidural anaesthesia [14]. They concluded that awake epidural anaesthesia was safe and had the advantage of avoiding intubation and the use of muscle relaxants [14]. Mukaida et al. described the results of video-assisted thoracoscopic surgery (VATS) pleurodesis for secondary pneumothorax performed under epidural anaesthesia [15]. There was no postoperative complications or procedure-related mortality [15]. A recent study published in 2006, assessed the feasibility and safety of awake anaesthesia for lung volume reduction surgery (LVRs) [15]. The investigators reported faster recovery and satisfactory 6-month outcome with this technique [16].

An important finding in our study is that 33% of patients were discharged on the same day of operation. The median postoperative stay was 1.5 days. This resulted in improved patient satisfaction and hospital resource utilization. Other studies have shown that 1-day admission after major lung resection can be a safe practice with minimal morbidity [17—19]. Only five patients in our study required ICU admission. One patient was admitted to the ICU after he had intraoperative cardiac arrest, he recovered and was discharged home. A second patient underwent unplanned left pneumonectomy and was admitted to the ICU mainly for optimal nursing care. The other three patients were admitted to ICU for monitoring of postoperative epidural analgesia, which was not permitted in the normal wards at that period of time.

Another important finding in our study is that only 30% of patients required chest tube after major thoracic surgical procedures. Watanabe et al. examined the safety of postoperative management of lung resection patients without chest tube [19]. Their criteria for avoiding chest tube placement were: absence of air leaks intraoperatively, absence of bullous or emphysematous changes, absence of severe pleural adhesions and absence of prolonged pleural effusion. They concluded that such practice could be safe without increase in postoperative morbidity if patients were selected carefully [18]. Our results were consistent with this author’s findings and were not influenced by operating using awake anaesthesia.

The strengths of our study include the large number of patients and the wide variety of major thoracic surgeries performed. Among the limitations of this study are its retrospective nature, being performed in a single center and the lack of control group. This study demonstrates the feasibility of awake anaesthesia in a variety of thoracic cases and its findings should be validated in a clinical trial.

We conclude that major thoracic procedures can be safely performed under awake anaesthesia. The technique avoids general anaesthesia and endotracheal intubation, reduces postoperative hospital stay and minimizes intensive care unit admission. This study strongly suggests awake anaesthesia can improve outcomes and reduce cost. A proper multicenter clinical trial to further evaluate this technique is needed.

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References


Appendix A. Conference discussion

Dr M. Beshay (Bielefeld, Germany): I would like to ask you—how did these patients go home? Do you leave the epidural catheter inside? or, as you mentioned, if it is a day case, you would take it away and how do you control the postoperative pain as they go home without the epidural catheter?

Dr Abdullatief: If it is a day surgery, we don’t leave it. We just give a postop bolus dose and it will be working for about 48 h, and then the patient will start the oral analgesia at home. If he is an inpatient, then we’ll leave it for postop care.

Dr D. Waller (Leicester, United Kingdom): Could you give us more details about the drugs that were given to the patients during the procedure?

Dr Abdullatief: No intravenous at all. Dr Waller: It says in the abstract, though, you gave fentanyl, 50 mcg, and midazolam, 3 mg.

Dr Abdullatief: This is just if the patient needs sedation; otherwise it will be

Dr Waller: All patients were premedicated with intravenous fentanyl, 50 mcg, and midazolam, 3 mg. I will put it to you that this is not awake anaesthesia, this is aslee anaesthesia, and the patients are spontaneously ventilating.

Dr Abdullatief: No, it’s awake. They are awake, as you have seen it, and if they start to have agitation or are anxious.

Dr Waller: If I had 3 mg of midazolam and 50 mcg of fentanyl, I would be asleep.

Dr G. Varela (Salamanca, Spain): How can you conclude in your study that this is a cost-effective procedure when you have not presented any economic data?

Dr Abdullatief: Well, we have found in our center that we avoided admission in some patients, we reduced the hospitalization, and we didn’t use many ICU beds. There is one patient who had pneumonectomy and she went to the floor without passing through the ICU. This is the beginning. It needs further study in all directions to prove. This is actually step one, the beginning. In the future we can come with full answers about this. Sorry for not bringing my anaesthetist to verify and answer all the anaesthetist’s questions, but in the future we will come with more answers.

Appendix B. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.ejcts.2007.04.008.