Awake Double Lumen Intubation–Renewed Interest

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ABSTRACT

Background & Purpose of the study: Initially awake double lumen intubations were designated for preoperative assessment of pulmonary function in cases planned for pneumonectomy. But later on, the utility of double lumen tubes expanded widely to play a crucial role in adult thoracic surgeries requiring lung isolation. Patients undergoing thoracic surgeries for pulmonary resections are conventionally intubated with double lumen endobronchial tubes to achieve isolation and enable one lung ventilation with the aid of balanced anesthesia. Our objective is to adapt the technique of awake double lumen intubation in selected cases. Although most of the patients for pulmonary resections are intubated under general anesthesia, few selected cases have a need to achieve lung isolation in an awake condition. In such cases an anaesthesiologist gain control on the airway by inserting a double lumen tube with the aid of regional airway blocks.. **Methods** A total number of 20 patients were intubated in awake condition with appropriate size double lumen tubes under topical airway anesthesia provided by bilateral superior laryngeal nerve, glossopharyngeal and recurrent laryngeal nerve blocks in selected conditions like large proximal broncho pleural fistula, anterior mediastinal tumors and in patients with difficult airway. Maintenance of spontaneous breathing in conditions like bilateral pulmonary bullae until thoracotomy was performed aided with thoracic epidural analgesia was also possible with this technique. **Results**: Our experience for a period of 4 years is elaborated and also compared with other institutions, which emphasized renewed interest in awake double lumen intubation under airway anesthesia. **Conclusion**: The simple and easy technique followed in our hospital might be preferred in selected cases requiring lung isolation as well as maintenance of a patent airway until thoracotomy. This method may also demand a place in difficult airway algorithm in patients requiring lung isolation.

Key-words: Awake double lumen intubation, lung isolation, mediastinal tumors, difficult airway, broncho pleural fistula, bilateral pulmonary bulla.

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INTRODUCTION

Historically, awake double lumen intubations were done for preoperative assessment of pulmonary function in cases planned for pneumonectomy by bronchospirometry. This test was done to mimic the postoperative condition of the patient's status, which would influence the decision regarding fitness for pneumonectomy. Later, there was a substantial increase in the number of indications for one lung ventilation under balanced general anaesthesia and the utility of double lumen tubes expanded widely to play a crucial role in adult thoracic surgeries. But of late, there was a resurgence of interest in awake double lumen intubation. By and large the indications for lung isolation in patients who are awake are ever increasing owing to the safety of the technique. It was identified that there is also a need for maintenance of a patent airway until the thorax is opened in selective cases. Anaesthesiologists of different regions use various airway gadgets for isolating lungs in an awake patient, although basically topical airway anesthesia is a common requirement.

MATERIAL & METHODS:

A total number of 20 patients who have come for thoracic surgeries with different conditions like large proximal broncho pleural fistula, anterior mediastinal tumors and in patients with difficult airway and bullous lung disease were taken into the present study. All the patients were taken up for awake double lumen intubation. After detailed preoperative evaluation, patients were given topical airway anaesthsia. Intubation was preceded by intravenous glycopyrrolate 0.2 mg to reduce secretions that may otherwise obscure the anaesthesiologist's view. We avoided any type of sedation to maintain airway reflexes intact and ventilation is not compromised. The patient was asked to gargle lidocaine 2% viscous solution for 6-8 min to anesthetize the oro-pharyngeal structures or until the patient reported numbness at the base of his tongue and pharynx. The superior laryngeal nerve block was given by injecting 2 to 3 ml of 1% lidocaine between the greater cornu of the hyoid bone and the thyroid cartilage with a 23-gauge needle. Superior laryngeal nerve block anesthetizes the nerves that supply the base of the tongue, posterior surface of epiglottis, aryepiglottic folds, arytenoids and the laryngeal structures down to the false cords. A glosso-pharyngeal nerve block is achieved by injecting 1 ml of 1% lidocaine at the junction between the base of the tongue and the palatoglossal fold on either side. A glossopharyngeal nerve block anesthetizes the posterior 1/3rd tongue, the vallecula and anterior surface of the epiglottis, the anterior surface of epiglottis (lingual branch), the walls of the pharynx (pharyngeal branch) and the tonsils (tonsillar branch) and enables awake direct laryngoscopy without much discomfort. The transtracheal block was given by injecting 3-4 ml of 4% lidocaine through the cricothyroid membrane with a 23-gauge

needle in a caudal direction after confirmation of needle placement in the trachea with aspiration of air. A transtracheal block anesthetizes the trachea below the area of the vocal cords. Unlike the routine block, we used slightly larger volume for transtracheal block and adapted a technique of injecting the drug in a caudal direction in the pretext that the drug spreads to both main bronchi.

After confirming the adequacy of airway anaesthesia, the size of the double lumen tube was selected based on the airway morphology is lubricated well and under direct laryngoscopy, endobronchial intubation was performed without any difficulty. All the patients in our study were comfortable during and after intubation with double lumen tube. This is depicted in the picture. Correct placement of the double lumen tube was confirmed with the aid of 3.5mm OD pediatric FOB before positioning the patient in lateral decubitus position for thoracotomy.[8] Later after positioning the patient, FOB was again used to check for any displacement of the tube. Injection Fentanyl 2 ug/kg was administered. The patient is allowed to breath spontaneously 100% O2, 2-2.5% sevoflurane with supplementation of propofol as and when required until thoracotomy was done. A thoracic epidural catheter was secured in T3-T4 inter vertebral space prior to airway anaesthesia. Through the epidural catheter 4-6ml of 0.25% bupivacaine administered. After epidural analgesia is given surgeon is allowed to proceed for thoracotomy. Anaesthesia proceeded with the administration of non depolarizing muscle relaxant except in cases of bullous disease of the lungs where the patient is further allowed to breathe spontaneously until thorax is opened. Continuous heamo-dynamic monitoring was done by pulse oximetry, ECG and invasive blood pressure recording.

DISCUSSION

Thoracic anaesthesia encompasses a wide variety of diagnostic and therapeutic procedures involving the lungs, airways and other intra thoracic structures. Fundamental to the management in thoracic procedures is lung isolation to facilitate surgical access and prevent contamination of the healthy lung. This is achieved through various airway gadgets of which double lumen tubes play an important role.

Various isolation techniques were followed such as

1. Conventional single lumen endo bronchial tubes
2. Bronchial blockers with SLT
3. Univent tubes
4. Double lumen tubes

In emergency situations like airway trauma, massive hemoptysis, tension pneumothorax and also in cases of postoperative pneumonectomy, single lumen tubes are used which are deliberately introduced into either of the main bronchus. In 1949, *Eric Carlens* reported on a *new double-lumen endo-bronchial tube* for separation of the lung.[1] It

is a left-sided endo-bronchial tube with a carinal hook for securing its correct position. This flexible tube was primarily intended for bronchospirometry that could be introduced without the need for fluoroscopy or bronchoscopy. Carlens inserted the double-lumen bronchial tube under topical anesthesia. He placed a curved metal stylet into the bronchial lumen of the tube and tied the carinal hook to the tube with a moistened silk thread slip knot. After passing the tube through the laryngeal aperture under indirect laryngoscopy, he released the slip knot, withdrew the metal stylet, and advanced the tube into the left main bronchus until he felt the hook engaging on the carina. The following year Carlens and Bjork used a double lumen tube to avoid aspiration of infected material into the dependent lung during resection for suppurative pulmonary disease.[2] *Frank L Robertshaw* reported on new low-resistance double-lumen bronchial tubes (each lumen with D-shaped cross-section) made of red rubber without a carinal hook. These red rubber double lumen tubes became available in both left and right-sided versions with bronchial cuff and cuff-inflating tubes coloured yellow for identification.[3]

The now commonly used double-lumen bronchial tubes (PVC) were manufactured following the principle design of the Robertshaw double-lumen endobronchial tubes. They are transparent with bronchial cuffed and inflating balloon colored blue so that it is easy to identify through bronchoscope. *Awake double lumen intubation* is no more a herculean task for a thoracic anaesthesiologist to achieve lung isolation with a double lumen tube by conventional technique. But it is challenging, even for an experienced thoracic anaesthesiologist to achieve lung isolation under less ideal conditions like in spontaneously ventilating patients. The indications for awake double lumen intubation are ever increasing owing to the safety of the various techniques available. Evidence show that, considerable number of cases needs maintenance of the patent airway until the thorax is opened.[4,5] In awake intubation, isolation is confirmed by fibre optic bronchoscope (FOB) and the thorax is opened while maintaining spontaneous ventilation. The following are few scenarios where the patients are preferably intubated awake:

Mediastinal masses with preoperative signs of compression
Proximal large broncho-pleural fistula
Giant bulla
Complicated lung cysts (ex: Ruptured hydatid cysts)
Bilateral bullous disease
Tracheal or bronchial trauma
Anticipated difficult airway
Massive hemoptysis

Mediastinal Mass: Anterior mediastinal masses may compress the superior vena cava, the trachea and the heart. The extent to which these structures are involved must be established preoperatively. Supine dyspnoea is a particularly worrying symptom. Computerized Tomographic (CT)

scan will delineate the anatomical extent of the mass, functional assessment can be obtained with spirometry performed in the upright and supine positions. A marked reduction in the supine FEV1 and PEFR indicates significant airway obstruction.[6] If the biopsy by mediastinoscopy cannot be performed under local anaesthesia, a spontaneously ventilating anaesthetic is recommended to help maintain the airway patency. This may be commenced following an awake fiberoptic intubation or awake double lumen intubation with the patient's upper body elevated if the supine position is not tolerated.

Pulmonary Hemorrhage: Immediate attempts should be made to protect the uninvolved lung. Awake double-lumen intubation is ideal; an alternative is to advance a single-lumen tube into the unaffected bronchus. Advancing the tube blindly will usually result in intubation of the right main bronchus. Left main bronchial intubation may be facilitated by using a fiber optic bronchoscope as a guide; however, this may be difficult due to blood obscuring the view.

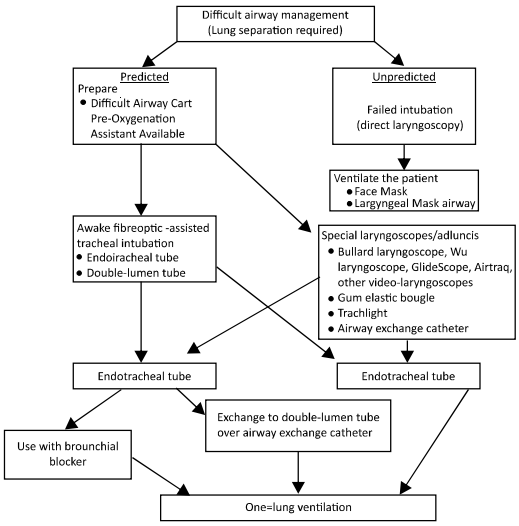
***Bronchopleural fistula*:** Bronchopleural fistulas occur following lung resection (usually pneumonectomy), rupture of a pulmonary abscess into a pleural cavity, pulmonary barotrauma, or spontaneous rupture of bullae. The majority of patients are treated conservatively; patients come to the surgery when chest tube drainage and antibiotics have failed. Anesthetic management may be complicated by the inability to effectively ventilate the patient with positive pressure because of a large air leak, the potential for a tension pneumothorax, and the risk of contaminating the other lung if an empyema is present. The empyema is usually drained as much as possible preoperatively, prior to closure of the fistula. Some clinicians recommend an awake intubation with a double-lumen tube in the presence of a large air leak and maintain spontaneous ventilation until isolation of diseased lung is achieved. If there is a chest tube on the affected side, it should be left unclamped prior to intubation and later the diseased side is isolated.

***Lung cysts and bullae*:** Apical blebs tend to occur in young patients, while emphysematous blebs are found in older patients with advanced chronic airway disease. Large bullae may rupture due to positive pressure ventilation. Awake intubation with double lumen tube is indicated in such cases through which the threat of bulla rupture and consequent pneumothorax can be avoided. If intubation is done under general anesthesia, minimizing ventilating pressure; withholding the use of nitrous oxide can also prevent the rupture of bulla.

***Anticipated difficult airway*:**Selective collapse of a lung and one-lung ventilation (OLV) is now performed for most thoracic surgical procedures with double lumen

tubes. However, OLV in the patient with a 'difficult airway' can present a major challenge to the anaesthesiologist and requires considerable skill.[7] Anticipated difficult airway either congenital or acquired may require awake intubation to secure the airway.

With the modern diagnostic methodology and their treatment with radiotherapy and surgery in and around the head and neck regions, the possibility of fibrotic changes around the airway may result in difficult intubation. There are reports of such anticipated difficult intubation cases being intubated in the awake state, by different techniques. Nevertheless, predicting difficult airway may not be possible always. So, it is mandatory for a thoracic anesthesiologist to be prepared to deal with unanticipated difficult airway when there is a need for lung separation quite frequently it his modern era. To overcome this problem an algorithm is suggested as follows. Awake intubation with double lumen tube can be included in anticipated difficult airway under topical airway anesthesia. Algorithm for difficult airway management when lung separation is required.[7]



There are different techniques to achieve single lung ventilation in awake patients. Under topical airway anaesthesia, with the aid of latest intubation guides like Airtrac video laryngoscope, Video Macintosh laryngoscope, glide scope, Bullard laryngoscope, Wu scope and other video laryngoscopes can aid the introduction of double lumen tube to achieve isolation of diseased lung. We performed awake intubations with double lumen tubes in selective cases at Government chest hospital, a tertiary care institute for lung surgery by airway anesthesia achieved with superior laryngeal, glossopharyngeal and recurrent laryngeal nerves and surface anesthesia of the oral cavity.

The technique followed by us is simple and needs less equipment. Although there are a couple of cases with difficult airway, in our study group they were not the only choice of us to proceed with awake double lumen intubation unlike other recent case reports. We selected cases with unique indications like bilateral bullous disease, giant bulla, large proximal broncho pleural fistula, anterior mediastinal mass for awake intubation with DLT. In bilateral bullous disease of lungs secondary, we adopted a technique of awake oral intubation with double lumen tube. With this awake technique, isolation of the diseased lung could be achieved and positive pressure ventilation avoided barotrauma and consequent pneumothorax before the thorax is opened. This technique also avoided any event of pneumothorax with subsequent

hemodynamic compromise in a closed chest. The patient was allowed to breathe Oxygen with 2-4% sevoflurane spontaneously on the DLT without any significant increase in work of breathing until thoracotomy was done. Nitrous oxide is avoided as there is a possibility of increase in the size of bulla. The moment thorax is opened the patient was paralyzed to facilitate IPPV of the dependent lung lest paradoxical breathing ensues with open thorax. In presence of extensive bilateral bullous disease, in order to avoid complications secondary to rupture of bulla and consequent pneumothorax, our CT surgeon was requested for prophylactic insertion of an inter costal tube in the dependent lung. By adapting the technique of awake DLT intubation, we could prevent rupture of bulla, which is likely to occur either before intubation (with mask ventilation) or after intubation with IPPV until the thorax is opened.

The next group of cases selected for awake intubation were those of proximal large bronchopleural fistula posted for pneumonectomy. As these cases are associated with chronic empyema, which could not be managed conservatively, there are two problems to deal with. First one is that isolation of the lung is mandatory for the obvious reason that the healthy lung might get soiled when induction agent is administered and the second problem is of wasted ventilation on the diseased side. Both the issues were dealt by inflating the bronchial cuff immediately after endo bronchial intubation of healthy side and clamping the tracheal lumen avoiding ventilation of the side in which BPF is present. Hence, awake double lumen tube intubation was planned in these cases. After intubating the case with the similar technique as mentioned in the previous case, the bronchial cuff was immediately inflated to prevent spillage of purulent material. So it is customary to ventilate only the healthy side from the moment the isolation is achieved. FOB was used for confirmation of DLT position. In these cases controlled ventilation can be initiated after the tracheal lumen is clamped and only healthy lung is ventilated, unlike the case in bullous disease of the lung where controlled ventilation is not initiated until thoracotomy.

In anterior mediastinal masses the extent to which these structures are involved was established preoperatively. The anatomical extent of the mass was delineated with computerized tomographic scan (CT) and functional assessment was obtained with spirometry performed in the upright and supine positions. Although biopsy of mediastinal tumors by mediastinoscopy can be performed under local anaesthesia, one patient required a spontaneously ventilating anaesthetic to help maintain the airway patency with preoperative signs and symptoms of airway obstruction. In cases planned for surgery, the tumor can be lifted anteriorly so that the degree of obstruction tends to lessen. This may be achieved by following the introduction of rigid bronchoscope or awake double lumen intubation with

necessary precautions. There was a dual advantage with this technique. First advantage was the ability to secure the airway throughout the whole length of the trachea as well as the main bronchus. Second advantage was providing a calm and immobile patient for surgical convenience. This is followed by bronchoscopic confirmation of the position of double lumen tube. Patient was anesthetized for thoracotomy and biopsy of the mass. After the procedure was completed, the patient was extubated in fully awake state. This awake technique was also followed for further definitive surgical treatment in two other cases. Anticipated difficult intubation was another indication for awake intubation. The criteria for difficulty were decided primarily by mallampati grading along with assessment of thyromental distance, neck circumference, and history of sleep apnea and adequacy of mouth opening. This is followed by a Cormack lehane'slaryngoscopic assessment in mallampati grade III patients and above. Isolation of the lungs could be achieved with double lumen tube under topical airway anaesthesia. Patients were paralyzed after confirmation of isolation by clinical examination, EtCo2 tracing and FOB guidance. An airway exchange catheter was introduced before extubation to take care of any further untoward events.

Other reported cases by thoracic anaesthesiologists elsewhere were slightly different. Cases scheduled for lung resection surgery who had a history of head and neck surgery, with radiotherapy were intubated with DLT with the aid of Airtraq laryngoscope where there were preoperative clinical signs of difficult airway[9]. Fibreoptic brochoscopic guided DLT intubation preceded by awake nasal single lumen tube intubation in combined maxillofacial and pulmonary surgery stands another example. Such cases present a unique combination of factors, thereby making airway management both interesting and difficult. These cases were managed by awake nasotracheal intubationunder topical airway anaesthesia using a 6.0-mm nasal RAE tube mounted onto an Olympus LF-2 intubation fibrescope followed by insertion of an oral double lumen tube which was mounted onto the LF-2 intubation fibrescope and oral fibreoptic endoscopy was performed. The fibrescope was then passed alongside the nasal tube into the trachea. When the cuff of the tube was encountered, the cuff was manually deflated and the tip of the fibrescope was advanced to lie in the left main bronchus under general anaesthesia.[10]

CONCLUSIONS:

Our experience for a period of 4 years is elaborated and also compared with other institutions. We have made an attempt to review our experience and discuss various modalities available adapted by other centers The simple and easy technique followed in our hospital might be preferred in selected cases requiring lung isolation as well as maintenance of a patent airway until thoracotomy. This method may also

demand a place in difficult airway algorithm in patients requiring lung isolation. We emphasize that there is a renewed interest in adapting the technique of awake double lumen intubation in selected cases where positive pressure ventilation should be avoided.

In conclusion, awake double lumen intubation has various applications in the field of thoracic surgery. A simple and easy technique followed in our hospital might be preferred to the use of sophisticated latest intubation gadgets like Airtrac video laryngoscope, Video Macintosh laryngoscope, glide scope, bullard laryngoscope, Wu scope, video laryngoscopes which are very expensive and have limited availability. Maintaining spontaneous ventilation and not losing the control of the airway during induction plays a crucial role in the management of selective cases discussed above. This poses a demand on anesthesiologist to manage cases coming for thoracic surgery with a need for lung isolation. The relative "ease" of the awake intubation in the above cases does not suggest that the procedure will proceed as accurately as those described. But all the techniques mentioned above will come to rescue if properly planned and executed by an experienced anaesthesiologist.

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A photograph showing a patient intubated with DLT in awake condition