MINIMAL ACCESS TO MEDIASTINUM: CREATION OF WORKING SPACE

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Introduction

The mediastinum is accessed for diagnostic and therapeutic procedures by median sternotomy and lateral thoracotomy. These open surgical procedures cause significant morbidity and some bleeding during exposure. It exposes the interior of the body to the external environment, which will promote infections. The post operative pain will delay mobilization of the patient and will affect breathing, which is already compromised by reduced chest expansion. Reduced chest movements will also promote chest infections. Delayed mobilization will predispose to deep vein thrombosis, which has a lethal potential. There may be dehiscence of the surgical wound in the median sternotomy with serious life threatening consequences. The prolonged hospital stay due to pain and delayed mobilization may promote nosocomial infections increasing the morbidity. In addition it will increase cost to the hospital. The return for work will also be delayed (Kirk, 2000).

The same procedures can be done through small (key hole) incisions referred to as minimal access procedures. As the chest cavity is not opened it is essential to create a space within the chest to obtain a clear vision. In open surgical procedures into the posterior mediastinum the space is obtained by single lung ventilation and in the anterior mediastinum obtained by the long sternal split aided by strong retraction (Cuschieri, 2000). In minimal access procedures the space could be obtained by single lung ventilation causing a lung collapse. This can be further facilitated by introducing a pneumothorax using a small insufflations pressure. The space may be further augmented by positioning of the patient which will make the lung fall away from the field of dissection. A prone position will be useful for the procedures of the posterior mediastinum. The procedures in the anterior mediastinum will be facilitated by a supine position (Landreneau, 1992).

The objective of this study is to assess the efficacy of space creation during minimal access procedures that is essential for clear visualization and safe dissections to be performed.

Materials and Methods

Minimal access procedures done by the same surgical team at Teaching Hospitals Karapitya and Peradeniya from 2004 to 2009 were analyzed retrospectively. The method of anesthesia, position of the patient, pressure used to create a pneumothorax and the degree of space created by resultant lung collapse were analyzed. The adequacy of space for comfortable placement of the camera and working ports were also reviewed.

The time of the surgery was also assessed which is an expression of the smooth progression of the procedure. The need to convert in to an open surgical procedure was also analyzed.

Results

A total of 36 procedures were analyzed. There were 6 diagnostic procedures and 30 therapeutic procedures. Four patients had procedures of the anterior mediastinum and other 32 had procedures of the posterior mediastinum. The age ranged from 34 to 76 years. The diagnostic procedures comprised of 2 lymph node biopsies and biopsies from 2 mediastinal masses. The other two were patients with carcinoma of the esophagus who had a thoracoscopic evaluation of the tumor as the initial step of the planned resection. They were found to have tumour with gross infiltration to the surrounding tissues and decided for palliative therapy. The therapeutic procedures were 5 thoracic sympathectomies for Burgers disease, excision of 1 thymoma and 24 oesophagectomies. Of the oesophagectomy patients 22 underwent a three staged procedure. The thoracic esophagus was mobilized using thoracoscopy in them. Four out of 22 had their abdominal phase also done by minimal access (laparoscopy) and open access only in the neck. In the remaining 18, the abdominal and neck stages were done by open access. In two patients the oesophagectomy was performed by laparoscopic transhiatal method. They had their stomach mobilized by laparoscopy and the thoracic esophagus mobilized through the hiatus. The cervical esophagus was mobilized through a standard neck incision.

The surgery was performed under general anesthesia with endotracheal intubation using a double lumen tube. The patient was placed supine for the anterior mediastinal procedures and placed prone for the procedures in the posterior mediastinum. The lung on the side of the procedure was collapsed at the beginning of the procedure. A Verress needle was passed in to the pleural space and a pneumothorax of 4 mmHg was created using CO_2 insufflations. The 10 mm camera port was then introduced. For the anterior mediastinal procedures it was placed through the axilla in the 4^{th} or 5^{th} intercostal space in the mid-axillary line. For the posterior mediastinal procedures the camera port was placed in the 6^{th} or 7^{th} intercostal space just beneath the inferior angle of the scapula. In all the patients the space created was adequate. A clear vision (picture) of the organ with the pathology and the surrounding anatomy were clearly displayed within the operating space created. The working ports were then inserted 2 in all surgeries except for the thymectomy which needed 3 working ports.

The transhiatal oesophagectomy was an exception. In this patient a lung collapse was not necessary as the space in to the posterior mediastinum was obtained via the esophageal hiatus.

In the diagnostic group and the sympathectomies the average time taken was 45 min which is shorter than performing these operations by open access. The thymectomy took 3 hours,

thoracoscopic mobilization of the esophagus 2.5 hours which are comparable to the same procedures done by open access. The transhiatal mobilization of the esophagus took 1 hour, which may be done in about 30 min in open surgery. There were no conversions to open surgery.

Discussion and Conclusions

The working space for minimal access mediastinal procedures can be obtained by a combination of patient positioning, single lung ventilation and a pneumothorax with a low insufflations pressure. The lung collapse creates the necessary space. The creation of a pneumothorax augments the lung collapse. The supine position for the anterior mediastinal procedures and prone position for the posterior mediastinal procedures are helpful. The positioning helps as the collapsed lung falls away from the field of dissection.

Minimal access procedures reduces somatic and psychological trauma of surgery. In the chest the only effective way to get space is obtaining a lung collapse. This is possible by using a double lumen tube and single lung ventilation. However the lung wouldn't collapse effectively as the volume loss cannot be compensated because the chest is not communicating with the exterior in minimal access surgery. Therefore some air has to be introduced in to the pleura to obtain an effective lung collapse. This can be easily done by insufflations of CO_2 through a port. It is important to create the minimum pressure which is necessary so that there will be no compromise on circulatory or ventilator functions. A pressure of 4 mmHg was found to be adequate for this. In conclusion, in minimal access surgery positioning of the patient is used as an effective method of retraction. The adequate space created facilitated easy placement of working ports and comfortable dissection and completion of the procedures safely and during an acceptable time.

References

Cuschieri, A., Steele, R.J.C. and Moosa, A.R. (2000). Essential surgical practice, Oxford University Press, Oxford, U.K.

Kirk, R.M. (2000). General surgical options, Harcourt Publishers, Edinburgh, U.K.

Landreneau, R.J., Mack, M.J., Hazelrigg, S.R., Dowling, R.D. and Acuff, T.E. (1992). Video-assisted thoracic surgery: basic technical concepts and intercostal approach stratergies. Ann Thoracic surgery, 54: 800-807.