Emphysema surgery – loop ligation approach

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Abstract

Objectives: To demonstrate the efficacy of using thoracoscopic endoloop ligation of bullae in patients with bullous emphysema. Methods: From 1992 to 1997, 93 advanced age (mean age, 66 years) and oxygen dependency patients underwent thoracoscopic procedure using endoloop ligation for treatment of bullous emphysema. Clinical data were collected from chart review. Thoracoscopic loop ligation of bulla was carried out under general anesthesia with double lumen endotracheal tube and single lung ventilation. Results: Eighty-two patients (88%) exhibited subjective improvement in their symptom status at 3-month follow-up (from grade 2 or 3 to grade 1 or 2) according to the modified Medical Research Council dyspnea scale. The mean duration of chest drainage was 7.5 days (range, 4–19 days). Average hospital stay was 9.5 (range, 5–26) days. There was no post-operative death. A comparison of pre-operative and post-operative functional evaluation was available in 27 patients who showed an average increase in FEV1 (from 0.89 to 1.12 l) and declined in residual volume after operation. Complications include persistent airleak over 10 days in nine patients (9.7%), wound infection in three patients and localized empyema in five patients. There was no recurrent after a mean follow-up of 37 months. Conclusion: Thoracoscopic loop ligation of bulla has proven to be a safe, reliable and cost effective means of technique for bullous emphysema. © 1999 Elsevier Science B.V. All rights reserved.

Keywords: Bullous emphysema; Endoloop

1. Introduction

Many thoracic diseases can now be performed with the help of video-assisted thoracoscopic techniques in order to ensure better post-operative recuperation. Bullous disease is a progressive disease which is being recognized with increasing frequency. Selected patients are being referred to thoracic surgeons for bulla ablation. Consequently, numerous operative approaches to the management of bulla have been used and favorable clinical results have been reported [1–9]. In view of the fact that video-assisted thoracoscopic surgery has been recently considered minimally invasive and has been shown in functionally impaired patients to have faster recuperation and clinical improvement, an increased number of these patients have been considering surgery than had been previously appreciated. Several minimally invasive surgical techniques using stapler or laser has been shown effective in achieving lung volume reduction in patients with bullous or diffuse emphysema. However, these are not inexpensive. In an effort to reduce the cost, we demonstrated here an alternative technique of using thoracoscopic loop ligation to achieve cost effective ‘volume reduction’ procedures in patients with bullous emphysema.

2. Materials and methods

Ninety-three patients with the clinical impression of bullous emphysema were managed for breathlessness and dyspnea on exertion, which severely interfered with their daily life quality despite aggressive respiratory care and medical therapy. The patients consisted of 81 men and 12 women with a mean age of 66 years (range, 37–101 years). The majority of the patients had a history of smoking, but most had quit several years ago. All patients had significant limitation of their daily life activities, grade 2 or 3 according to the Modified Medical Research Council dyspnea scale (MMRC). Sixty-seven (72%) of these patients were using oxygen either continuously or intermittently. All patients were scheduled for video-assisted thoracoscopic intervention.

General endotracheal anesthesia was administered via a
double-lumen tube and patient was placed in the lateral decubitus position. Surgical procedures were carried out using a 10 mm, zero degree rigid thoracoscope, a video camera, dual monitor screen, and conventional thoracic surgical instruments. Adhesions were commonly encountered and freed by a sharp dissection technique using electrocautery. The bullae were also freed in this manner from the adjacent tissue. In general, bullae were found at the sites of adhesions. Sometimes the interlobar fissure was divided to expose the hidden bullae. After the superficial bulla was freed from the adhesions, it was stabbed to collapse (Fig. 1) using the tip of the electrocautery. The shrunken bulla was twisted to its base until normal lung parenchyma was reached (Fig. 2), at which point the endoloop was applied (Fig. 3) and the preformed loop was tightened using knot advancer (Fig. 4). Frequently, two to three endoloops of No 1 PDS (Ethicon, UK) were applied to each bulla cyst to ensure the tightness of the bulla. After ligation of all bullae, the lung was manually inflated, and if no bullae bulged out and the consistency of the underlying lung parenchyma appeared normal, the ligation was considered adequate. If a significant number of bullae bulged out, these were ligated again. After ligation, talcum powder (3 ~ 5 gm) was routinely insufflated to enhance post-operative pleurodesis. After completion of the procedures, a chest tube (32 fr.) was inserted with all the wounds closed and the patient was sent to the intensive care unit for further management.

3. Results

In most patients, the bullae occupied most of the upper lobes and varying amounts of the middle and lower lobes. There was no intraoperative morbidity or mortality attributable to the procedure. The operating room time ranged from 40 to 110 min (mean, 70 min). The average duration of ventilator support was 19 h (range, 2 h–9 days). Of the 93 patients, there were six patients who were on a ventilator support for more than 72 h. Among them, two patients required a tracheostomy. The ventilator was weaned off on day 7 and 9. There were five patients (5.4%) who suffered from progressive and extensive subcutaneous emphysema which required placement of a second chest tube after the operation. Non-fatal complications occurred in 17 patients (18.2%). These included three minor wound infections, and nine patients (9.7%) with prolonged air leaks (> 10 days). Five patients had suspected empyema with purulent discharge from the chest tube; all of these patients were treated conservatively. The mean duration of chest drainage was 7.5 days (range, 4–19 days). The length of hospital stay varied from 5 to 26 days (mean, 9.5 days).
Among 27 patients who had pre-operative bronchopulmonary-metries, the mean pre-operative FEV1 was 0.89 l, representing 28% of the predicted value. At 3-month follow-up, 26 had pulmonary function re-evaluations after the operation who showed an average increase in FEV1 to 1.12 l (P < 0.0001) or 39% of predicted. Similar improvements in FVC were noted after the endoloop ligation procedure. Residual volume also showed significant (P < 0.0001) declines after operation. The DLCO was also significantly improved after operation, from 33% before the operation to 41% after the operation. Eighty-two patients (88%) exhibited subjective improvement in their symptom status at a 3-month follow-up. Among them, 19 (20.4%) patients were in MMRC grade 1 (initial in MMRC grade 2), and 63 (67.6%) patients exhibited dyspnea status from grade 3 to grade 2. Post-operative chest X-rays in this group of patients at 1 month showed significant ‘volume reduction’ compared to the pre-operative chest films. There was no recurrent after a mean follow-up of 37 months.

4. Discussion

Recently, video-assisted thoracoscopic surgery has proved minimally invasive and has been shown to benefit functional impairment patients with faster recuperation and clinical improvement [1,9-15]. Thus in the group of bullous lung disease, the number of patients considering surgical intervention has increased.

In our group of patients with bullous emphysema, the indication for operation was incapacitating dyspnea with unequivocal compression of relatively normal parenchymal lung tissue. From our experience, good results have been in patients with multiple, well-demarcated bullae and with roentgenographic evidence of compression. Under these circumstances, we have accepted very poor risk patients for minimally invasive ‘volume reduction’ surgery using endoloop ligation. Clinical results have been gratifying even though improvement in terms of respiratory function was often insignificant. Only 29% of our patients had preoperative pulmonary spirometry data. Most of the patients with bullous emphysematous change of the lung did not receive pre-operative assessment of pulmonary function when the chest tube had been inserted. In view of all the patients, 88% of the total patients have shown clinical improvement and rehabilitation from grade 2 or 3 to grade 1 or 2 according to the Modified Medical Research Council dyspnea scale. Admittedly, they constitute a group with higher surgical risk. However, with a minimally invasive surgical technique combined with the ligation of unventilated pulmonary tissue, the results are promising, and the risks seem to be low.

There are several procedures developed for the relief of dyspnea in patients with bullous emphysema. These procedures include endostapler, cutter (EndoGIA) and laser ablation of the bulla cyst. The newly developed instruments have enabled us to replace some of the prior operations requiring classic thoracotomy with surgical therapeutic thoracoscropy. Undoubtedly, the advent of video-assisted thoracoscopic surgery has renewed interest in the therapy of bullous emphysema. No group of patients has presented more difficult problems than those with bullous emphysema who were referred for surgical intervention. Previously, we have reported that thoracoscopic endoloop ligation has been an effective approach in patients with parenchymal blebs or bullae [10-12]. Our attempts to ligate the bulla in patients with spontaneous pneumothorax appears promising. We chose to use endoloop ligation because it is convenient and commonly available in all hospitals. In addition, it is truly cost effective. As comparing the total costs incurred in patients undergoing video-assisted thoracoscopic bulla ablation with those in similar patients using stapler technique, we found that patient who undergo thoracoscropy were more likely to spend money in the endoscopic disposable instruments. On review of the data published in the English literatures, most of the study favored using endostapling devices or laser technique to resect the bullae [4,6,9]. The use of these devices is expensive.

Since the importance of reducing health-care costs is now of increasing concern, the endostapling device, as the most costly instrument, must be used cautiously. Our previous experience suggests that thoracoscopic endoloop ligation of blebs has been shown to be safe, simple and cost effective. The clinical results in this report support also the rationale for the use of endoloop ligation in managing patients with bullous emphysema to achieve lung volume reduction. While many expensive surgical approaches have been proposed and evaluated for bullae ablation, including lung volume reduction, thoracoscopic endoloop ligation of visible bullae seems to be the only technique which was shown to be quite cost-effective and minimally invasive. The surgeon should try to reduce to a minimum the cost for patients who are most likely to benefit from minimal invasive surgery. In our hands, loop ligation is now our routine procedure of choice in bulla ablation with bullous lung disease.

References

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