Saline-cooled radiofrequency coagulation during thoracoscopic surgery for giant bulla

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Abstract
Two patients were admitted to our hospital due to giant bullae. During thoracoscopic surgery, saline-cooled radiofrequency coagulation devices were used to shrink the wall of the bulla. In each case, the volume of the bulla was gradually reduced and the boundary between the lung and bulla was clearly delineated. This method is considered to be useful for performing thoracoscopic surgery of giant bulla.

Keywords: Giant bulla • Thoracoscopy • Endoscopic procedures

INTRODUCTION
Video-assisted thoracoscopic surgery (VATS) has become very popular during the past few decades; however, the operative procedures of VATS are still under development and must be improved. During surgery of giant bulla performed under VATS, the bullae do not collapse, even with unilateral lung ventilation, and the thoracoscopic view is sometimes obstructed. In addition, it is often difficult to appropriately determine the border between the lung and the bulla in the thoracoscopic view. We herein present the method of saline-cooled radiofrequency coagulation [1–5], with which the appropriate resection line can be easily determined by shrinking the wall of the bulla.

SURGICAL TECHNIQUE
Case 1
A 65-year old male was admitted to our hospital due to a giant bulla (Fig. 1A–C). Three thoracoports were placed at the anterior axillary line of the fourth intercostal space, the midaxillary line and the posterior axillary line of the seventh intercostal space.

The giant bulla did not collapse, and the thoracoscopic view was very poor (Fig. 2A). We created a saline-cooled radiofrequency coagulation device by attaching a thin tube to an electric scalpel with a ball tip (Ball Electrode, 5 mm, E1564, Covidien, MA, USA) (Fig. 2B). The saline was dropped very slowly through the tube. The wall of the bulla was then cauterized using 15–35 W coagulation, and the thin semitransparent wall of the bulla (Fig. 2C) shrank and became a thick, white wall (Fig. 2D). After the wall in the front had shrunk, the adjacent wall in the side moved towards the front and became a new object for cauterization (Supplementary Video 1). The bulla continued to shrink gradually, and the thoracoscopic view improved. When the bulla had sufficiently shrunk, determining the resection line between the lung and bulla was easy (Fig. 2E and F). The patient’s postoperative course was uneventful, and the bulla was completely resected (Fig. 1D–F).

Case 2
A 61-year old male with a giant bulla underwent thoracoscopic bullectomy using a saline-cooled radiofrequency coagulation device (Monopolor Products ENDO FB3.0™, Medtronic Advanced Energy, NH, USA), similar to the device we created in Case 1. Bullectomy was performed easily using the exact same technique as reported in Case 1 (Fig. 2G and H).

DISCUSSION
Performing thoracoscopic surgery of giant bullae is not easy because giant bullae do not sufficiently collapse, even with unilateral lung ventilation, and the operative view is inappropriately poor. We herein presented the method of saline-cooled radiofrequency coagulation [1–5] for performing thoracoscopic surgery of a giant bulla. After cauterizing the bulla at 100°C or less, the wall of the bulla shrunk without rupture, which caused a new surface of the bulla to move into the thoracoscopic view [6, 7]. When the bulla had sufficiently shrunk in size, the thoracoscopic view improved, the suffered lobe of the lung appeared to anatomically normalize, the boundary of the bulla and lung became clear and the resection line was easily determined. On the other hand, when a standard electrocautery without saline-cooling or other energy devices was used instead of our method, the wall of the bulla was easily torn and the bulla rapidly collapsed, with the...
result that we found, in the operative field, a very large wreck of the bulla and the remaining lung. Such situations can be managed with some additional time; however, we herein presented an easier method of handling.

In Case 1, we created a device that consists of an electric scalpel with a ball tip attached to a thin tube for dripping saline to prevent cauterizing the bulla at a high temperature. In Case 2, we used a saline-cooled radiofrequency coagulation device manufactured by another company [1–5], and it was possible to perform the procedure using the exact same technique as described in Case 1.

Saline-cooled radiofrequency coagulation is often performed in liver resection [1, 2], partial resection of the kidneys [3] and distal pancreatectomy [4]; however, there are only few reports of its use in pulmonary surgery [5–7]. Pulmonary wedge resection with this method was originally reported [5], but there have been no successive reports. On the other hand, there are reports of the use of this method in surgery for cystic lung disease [6, 7]. Some investigators have reported that performing cauterization using this method is adequate to repair small bullae and blebs [7]. However, there have been no reports of results after longer follow-up periods. Regarding surgery of giant bullae, the cauterized portion of the bulla can be resected, which presents no problems with respect to safety. This method is very useful for performing thoracoscopic surgery of giant bullae because the operation is simple and secure.

SUPPLEMENTARY MATERIAL

Supplementary material (Video 1) is available at EJCTS online.

Supplementary Video 1: The thin semitransparent wall of the bulla shrank and became a thick white wall by the cauterization. After the wall in the front had shrunk, the adjacent wall moved towards the front and became a new object. When the bulla had sufficiently shrunk, the resection of the bulla was easy.

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REFERENCES


