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Robot-assisted thoracoscopic bronchoplasty

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Background: Robotic systems have been used to enhance the surgeon's dexterity and visualization in endoscopic surgery and thus facilitate refined dissection, suturing, and knot tying. We describe use of the da Vinci surgical system for robotic-assisted thoracoscopic bronchoplasty in patient with centrally located lung cancer.

Methods: We used three robotic ports (a 12-mm trocar for the 30°-down camera and two 8-mm trocars for the robotic instrument arms) and one utility incision for assistance and specimen retrieval. Lung isolation were achieved using double-lumen endotracheal tube without carbon dioxide inflation. The bronchoplasty was performed by using 4/0 polydioxanone suture (PDS).

Results: Three cases of robotic-assisted thoracoscopic bronchoplasty (n=3) were performed. Case 1: right upper lobe lobectomy with right main bronchus primary closure; case 2: right upper lobe lobectomy with the anterior wall of the right main bronchus re-anastomosis; case 3: left upper lobe sleeve lobectomy. The surgery and post-operative course were smooth without complication.

Conclusions: We suggest that robotic-assisted thoracoscopic surgery offers specific advantages over conventional thoracoscopic surgery with accuracy and safety when doing bronchoplasty.

Keywords: Robotic; bronchoplasty; sleeve; thoracoscopy

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The robotic system has been used in a wide range of surgical procedures because of its unique superiority to other approaches in terms of the following: (I) up to 10 times magnification of the three-dimensional visual field; (II) use of instruments with a 7° articulated joint; and (III) prevention of shaking of the instrument and camera by using a motion scaling function. These facilitate the application of complex surgical techniques in narrow fields such as those in refined dissection, suturing, and knot tying (1,2).

Robot-assisted thoracoscopic surgery had been widely used in pulmonary resection, including lobectomy and segmentectomy. Many large series had been reported with variations in robotic settings, with or without carbon dioxide inflation, with a utility incision/port use, and with 3- or 4-arm systems, each demonstrating comparable perioperative outcomes (3-6).

Bronchoplasty, including sleeve resection, is among the most complex cases in thoracic surgery. Even in open surgery, these cases are usually challenging (7,8). Waseda *et al.* (2) examined the technical feasibility of robot-assisted airway reconstruction in a rabbit model, and it significantly improved the time compared with the traditional thoracoscopic group. Schmid *et al.* (9) and Nakamura *et al.* (10) demonstrated successful use of robotic bronchoplasty for central airway involved lung tumor. Dylewski *et al.* (3) presented 164 robotic pulmonary lobectomies, which included three sleeve lobectomies.

Although there are many concrete theoretical advantages of using robotic arms in performing bronchoplasty, which consist of complex and step-by-step suturing, few series or little detailed information of this procedure can be searched in the literature.

This video (*Figure 1*) shows three cases of bronchoplasty for lung cancer performed by using the robotic thoracoscopic approach.

Case 1: right upper lobe lobectomy with right main bronchus primary closure.

Figure 1 Robot-assisted thoracoscopic bronchoplasty (11). This video shows three cases of bronchoplasty using the robotic system after lobectomy for lung tumor.
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Case 2: right upper lobe lobectomy with the anterior wall of the right main bronchus re-anastomosis.

Case 3: left upper lobe sleeve lobectomy.

The patients were placed in the right/left lateral decubitus position, according to the lesion site, and the condition of the lung isolation was achieved by using a double-lumen endotracheal tube without carbon dioxide inflation. Three robotic ports (a 12-mm trocar for the 30°-down camera placed below the hilar and two 8-mm trocars for the robotic instrument arms placed symmetrically to the right and left) and one utility incision for assistance and specimen retrieval were made. The bronchoplasty was performed by using 4/0 polydioxanone suture (PDS) , with a single-directional continuous suture over the bronchial defect in case 1 and a multidirectional interrupted suture for the end-to-end anastomosis in cases 2 and 3, which were much technically challenging.

The authentic three-dimensional view and articulated joint instruments that the robotic system offered made bronchial suturing easier under the endoscopic setting. We suggest that robot-assisted thoracoscopic surgery offers specific advantages over the conventional thoracoscopic surgery, with accuracy and safety when performing bronchoplasty.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

Informed Consent: Written informed consent was obtained from the patient. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

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