Surgical Technique on Thoracic Surgery

Robot-assisted bronchoplasty using continuous barbed sutures

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Abstract: We describe in this article our bronchoplastic robot-assisted techniques. This consists of using continuous barbed sutures. Our aim is to show the feasibility and the interest of using robotics and this kind of suture material for complex bronchial procedures. We report four cases in France and the UK, two wedge bronchoplasties and two sleeve bronchoplasties for central pulmonary tumors.

Keywords: Robot-assisted bronchoplasty; barbed suture; V-Loc™

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Introduction

Bronchoplastic techniques were developed for curative treatment of lung cancer invading main or lobar bronchi where pneumonectomy was contraindicated.

The classical technique in textbooks is to use interrupted sutures for such reconstructions, later reports showed that continuous sutures are feasible with similar results. But, this can prove to be time-consuming and technically challenging, notably in video-assisted thoracic surgery (VATS).

We believe that the combined usage of robotics and barbed sutures may have a great interest for this kind of complex procedures.

Surgical technique

Patients' installation was in lateral decubitus with double lumen endotracheal intubation. The first case underwent a right upper lobectomy with wedge bronchoplasty, the second one a left upper lobe with wedge bronchoplasty, the third one a right lower sleeve lobectomy, whereas the last was a left lower sleeve lobectomy. A 3-arm approach with a utility port was used for the first two cases and a 4-arm approach with a utility port for the other two. The utility incision was eventually enlarged at the end for piece extraction.

The surgical procedure was performed as described in the literature with systematic lymph nodes dissection up to the bronchial resection.

For the first case, the right upper bronchus was incised to obtain clear margins. When the results of the frozen section samples came negative, a direct suturing of the trachea was performed. We used two V-Loc™ 4/0 running sutures starting from opposite ends in order to minimize the tension and achieve a complete closure. The first stitch was done through the cartilaginous part and the needle was then passed through the anchor loop in order to lock the suture without need for a knot. A similar stich was done the membranous part. The two sutures met in the middle and a knot was made to secure the running suture. Underwater test showed no leak and a pleural flap was done at the end to avoid complications (*Figure 1*).

The second case was similar to the first one, but instead of two V-Loc™ sutures, we used one, starting from the cartilaginous sides going to the membranous part, and then did a demi continuous suture of the membranous part to reinforce the suture at this level. No knot was made. No flap was done. Water test showed no leak (*Figure 1*).

When it comes to the third case, dissection was carried out up to the level of the bifurcation at the level of the lower part of the right main bronchus. After resection of the lower lobe bronchus. Wedge bronchoplasty was performed. However, the fresh frozen section results came positive and

Figure 1 Right upper lobe wedge bronchoplasty, and left upper lobe wedge bronchoplasty (1).
Available online: http://asvidett.amegroups.com/article/view/14160

Figure 2 Right lower bronchial sleeve (2).
Available online: http://asvidett.amegroups.com/article/view/14161

Figure 3 Left lower bronchial sleeve (3).
Available online:http://asvidett.amegroups.com/article/view/14162

suture was removed to do a sleeve.

The right middle bronchus anastomosis was then achieved using two V-Loc™ continuous running sutures.

The first stich was placed from the outside to the inside at the cartilaginous-mucous junction of the lower main right bronchus then inside out in the bronchus intermedius and locked in the same manner. For better exposure, a suture was passed the cartilaginous part of the bronchus intermedius and the fourth arm was used to tract the bronchus posteriorly. The process was carried out on the posterior aspect of the anastomosis. The stiches were tightened one by one until both bronchial ends met and overlapped. The second suture was placed at the level of the first one and suturing continued to finish the anterior aspect and meet with the first V-Loc™ where a knot was made for securing the anastomosis.

Underwater test showed air leakage at the membranous part, an interrupted suture was placed there. The second test showed no leak (*Figure 2*).

The last case was a left lower sleeve lobectomy, we started by cutting through the cartilages between the upper and left bronchi all through the secondary carina. After the left lower bronchus was completely separated, we "fashioned" the upper bronchus and started our continuous suture. First through the cartilaginous part then a second one through the membranous part. Almost at the end of the second suture, we broke the needle while holding it by the needle holder and the pro-grasp at the same time, this necessitated a third suture to achieve the bronchoplasty. Underwater test showed no air leak (*Figure 3*).

Discussion

Bronchoplasty was historically developed as a parenchymal sparing technique in the treatment of central lung cancers.

Nowadays, sleeve bronchoplasty is increasingly considered the treatment of choice rather than pneumonectomy as it contributes to saving lung tissue and doesn't compromise the oncological results on the long term (4). In 2012, Park *et al.* published their retrospective series of 191 patients suggesting that wedge bronchoplastic lobectomy for lung cancer does not compromise oncologic principles and can be considered an alternative to sleeve bronchoplasty and pneumonectomy (5).

After years of considering bronchoplasty as a "technical" contra-indication for VATS. In 2002, the first VATS sleeve lobectomy was reported, however the bronchial anastomosis was achieved by hand through the utility port (6). Larger

series were published later with the anastomosis achieved using interrupted sutures (7). Robot-assisted thoracoscopic surgery (RATS) sleeve bronchoplasty quickly caught up with Ishikawa reporting the feasibility of this procedure on a male cadaver, and the advantages related to the robot usage when it comes to the high quality 3D field, tremor filters, and the 7-degree of the movement by the Endwrist instruments allowing a high precision in performing these fine procedures (8).

V-Loc™ suture is used in gynaecology, urology and digestive surgery. The interest of using this type in video-assisted surgery is related to two important qualities; it is self-retaining, thus liberating the surgeon from the need to an assistant to hold the suture, and it provides knotless wound closure, and reduce the time required to make knots (9).

Classically, bronchoplasty was performed in interrupted manner. This technique can be hard and time-consuming for the video-assisted surgeons. The use of continuous suture allows to decrease the operative time and provides similar results in open and video-assisted surgery (10). V-Loc™ studies in laboratory on human cadaver tracheas showed comparable results to conventional closure by interrupted Vicryl™ (11).

In the limits of our modest experience, no major complications resulted from this technique. Follow-up bronchoscopy showed no stricture at the 6th postoperative month.

Conclusions

The use of barbed suture for robot-assisted bronchial procedures is feasible and safe. Both can allow a more precise and a time-saving alternative to current techniques. However, larger series are needed in order to assess this more thoroughly.

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Footnote

Conflicts of Interest: J Baste is a proctor for intuitive surgery. The other authors have no conflicts of interest to declare.

Informed Consent: Written informed consent was obtained from the patient for publication of this manuscript and any accompanying images.

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