Editorial on Robotic Surgery

Subxiphoid port applied to robotic pulmonary lobectomies

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Received: 21 February 2017; Accepted: 01 March 2017; Published: 24 March 2017.
doi: 10.21037/jovs.2017.03.01
View this article at: http://dx.doi.org/10.21037/jovs.2017.03.01

Introduction

Despite the lack of randomized clinical trials, minimally invasive thoracic surgery has without doubt significant potential benefits for patients who require a lung resection when compared with traditional surgery. Robotic lung surgery has established its role in the last ten years thanks to the work of pioneering surgeons who applied this technology for the treatment of thoracic conditions (1-5). Cerfolio *et al.* (1) compared complete portal 4-arm robotic technique with rib-nerve-sparing thoracotomy for pulmonary lobectomy. They concluded that the robotic approach offers the same pathological outcome with fewer post-operative complications, lower mortality, shorter length of stay and improved quality of life. Park *et al.* (6) had a wide experience in the treatment of early stage lung cancer since 2001 and stated that the oncological outcome is similar to VATS or open pulmonary lobectomy.

Robotic surgery can offer a magnified 3D view which is superior to 2D endoscopic cameras on the market, which may improve the patient's outcome due to more accurate dissection and lymphadenectomy. The other advantages are the instruments' degree of articulation, the operator's comfort, being able to perform long procedures, resting their arms on the console, and the filtration of operator tremor. The main relative disadvantages are the cost, the learning curve and consequently the operative time. Some authors raised concern regarding the distance between the surgeon and the patient3. The robot is available in few centers and when present is usually shared within different surgical specialties with more difficulties to have enough training. In our department, we had chance to start a programme for robotic thoracic surgery in 2014 with a Da Vinci Si.

Parallel to the development of robotic surgery VATS surgery has also developed considerably. Born 25 years ago, in the early nineties, VATS lobectomy developed from the application of thoracoscopy, which was until then used for diagnostic procedures, to perform major lung resection (7). This evolved during the years into other approaches, for example the standardized Copenhagen approach (8) or the Duke bi-portal approach (9,10). The concept of minimally invasiveness was further with uniportal surgery (11). Within the chapter of single incision surgery there are two series of patients reported in 2016 which describe successful uniportal subxiphoid technique for anatomical lung resection in a total of 148 cases (12,13).

The use of subxiphoid port as a single incision demonstrated that from the subxiphoid region we obtain an acceptable angle in order to tackle all the hilar structures. The posterior mediastinum is still an area that is difficult to access including for the subcarinal lymphadenectomy. Another interesting and important feature of a subxiphoid port for lung surgery is the lack of innervation on the fibrous linea alba when compared to the intercostal spaces. The intercostal muscle and the neurovascular bundles are delimited by relatively fixed bony structures, the ribs, and the intercostal spaces are only 8 to 10 mm wide. The soft tissue of the subxiphoid region can spread easier than the intercostal space. This allow the delivery of large specimens avoiding the spread of the intercostal spaces which is a common cause of significant postoperative post-thoracoscopy pain.

The subxiphoid incision itself is not novel as it was firstly described in hand -assisted metastasectomy, by Mineo *et al.* (14), to gain access to both hemithoraces and

Figure 1 Subxiphoid port applied to robotic pulmonary lobectomies. Section I: this clip demonstrates the patient position, marking of the patient and the placement of the ports for a left sided procedure. Section II: the video shows a robotic right lower lobectomy, for early stage primary pulmonary malignancy, with the adoption of a subxiphoid port as the assistant port (15).
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palpate the lungs but avoiding injury to the intercostal nerves.

Therefore, we adopted a subxiphoid port as a utility port during VATS procedures and this allowed us to reduce the intercostal incisions to 5 mm and developed this into a procedure called Microlobectomy (www.microlobectomy.com). We then applied this technique during robotic procedures and used a subxiphoid assistant port for robotic pulmonary lobectomies. The aim is to reduce the post-operative pain.

Surgical technique

We routinely mark the subcostal margins, the xiphisternum and the midline from the xiphisternum to the umbilicus (*Figure 1*, Section I) (15). This allows accurate marking before the patient is draped. The patient is positioned as usual in the lateral decubitus position but the midline is not covered. We use Cerfolio set up (2). The first port, a 5 mm port, is positioned over the ninth rib and 2 cm from the posterior midline. Further robotic arm ports are placed 12 cm and 22 cm from the spinous processes. A further anterior port is placed under vision as anteromedially as possible either in the same intercostal space or in the space above, and finally the subxiphoid port is performed, again under vision and with CO_2 insufflation. This replaces the assistant port. The robot is docked from the head and a Maryland bipolar forceps is used in arm 1, a Cadiere in port 2 and a 5 mm lung grasper for retraction is in arm 3. The bedside assistant hands swabs to the surgeon, uses suction and positions the staplers through the subxiphoid port. Also the lymph nodes are removed subxiphoid. As the port is inferior and anterior to the camera, this site is under vision and we do not need the bag for removal of lymph nodes. Once the lobe is completely resected this is placed into a bag and reduced in size (air and blood are drained by incising the vein and the stump of the bronchus). We now extend the incision of the subxiphoid port along the vertical, pre-marked, line and up to 4 or 5 centimeters. Then the specimen is finally delivered from the subxiphoid port as shown in the video (*Figure 1*, Section II).

Comments

Although we do not have enough data to state that there is less post-operative pain and therefore reduced postoperative morbidities, the patients who underwent this procedure had excellent outcome and enhanced recovery, and have all been discharged home within two to four days. We experienced that intraoperatively there was significantly fewer conflicts between the robotic instruments and the assistant instrumentation. The camera was able to keep the port under direct view and the operator could hand easily specimens and swabs to the assistant, who experienced less collision and impingement with the robotic arms and the diaphragm. From this site, he entered, positioned and fired the tristaplers on the hilar structures and lung parenchyma.

We suggest that removal of the specimen through the enlarged subxiphoid port can reduce the post-operative pain as this avoids the spread of the intercostal space. Even if there is some pain from the subxiphoid area we have found that this does not impair the ability to cough or breathe.

Finally, we have not yet experienced any diaphragmatic or incisional herniae with this incision when used for robotic surgery.

Acknowledgements

None.

Footnote

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

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doi: 10.21037/jovs.2017.03.01
Cite this article as: Nardini M, Migliore M, Jayakumar S, ElSaegh M, Mydin IM, Dunning J. Subxiphoid port applied to robotic pulmonary lobectomies. J Vis Surg 2017;3:35.