

Uniportal video-assisted thoracoscopic surgery in esophageal diseases: an introduction

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Abstract: Esophagectomy followed by reconstruction is one of the most complex interventions in surgery of the alimentary tract. Over several decennia dedicated surgeons have realized a constant decrease in 30-day mortality being now well below 5% in expert hands. However quality of life after such intervention is often jeopardized by the high incidence of complications in particular pulmonary infections. The introduction and presently widespread use of total minimally invasive esophagectomy (MIE) has resulted in a substantial decrease of these pulmonary complications along with a decrease of the need for ICU admission and a decrease of length of hospital stay. But still a non-negligible share of patients may suffer from, sometimes severe, postthoracotomy pain. A problem that is thought to be the result of the manipulation of instruments at the port sites causing damage to the intercostal nerves. The growing popularity of uniportal video-assisted thoracoscopic surgery (VATS) in particular in lung surgery claims to diminish this problem. Currently there is little experience in the use of uniportal VATS for esophagectomy which seems to be in part related to its higher degree of technical complexity. As a result there are no published data on the results but there are a few dedicated centers that are building up their experience. Their preliminary results seem to hold promising perspectives in relation to overcome the pain problem using a single small port site. Future will tell what the place will be of uniportal VATS versus other techniques e.g., robotic esophagectomy, endoscopic interventions on the esophagus and new emerging avenues in molecular biology.

Keywords: Esophagus; surgery; minimally invasive esophagectomy (MIE); uniportal VATS; complications; quality of life

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The end of the 19th century was characterised by a true race to perform the first esophagectomy.

Franz Torek (1) won the race by performing the first successful transthoracic (and transpleural) resection of the esophagus in 1913. The operation was a formidable undertaking. The patient, a woman, presented with a mid-third squamous cell carcinoma. During surgery the tumor appeared to be attached to the left bronchus requiring a “longitudinal cut in the bronchus” followed by a repair if this incision with silk sutures. Reconstruction was not attempted and the patient was fed using a rubber tube connecting the proximal esophagostomy with a gastrostomy; she lived for 13 years.

Further attempts made in the following years were mostly unsuccessful due to lack of technology to adequately ventilate the lungs. Only after the introduction of safe orotracheal intubation in the late twenties by Rowbotham (2) and Magill (3) surgeons could undertake more safely such complex operation as a transthoracic esophagectomy. Torek’s operation was performed via left thoracoabdominal incision. In the subsequent years surgeons figured out that according to the location of the tumor different access routes could improve exposure and access to the tumor. Tumors of the lower half were preferentially approached from the left side (4,5) whereas supracarinal tumors were better approached from the right side (6,7).

Refinement of technique resulted in a gradual decrease of the mortality coming down from over 20% in the seventies to less than 10% in the eighties.

But esophagectomy and reconstruction mostly with a gastric pull up with an intrathoracic or cervical anastomosis remained major interventions the results often jeopardized by postoperative complications e.g., anastomotic leaks, pulmonary infection causing prolonged hospitalization and slow recovery.

In an effort to minimize complications, in particular pulmonary complications Orringer in 1978 introduced the concept of transhiatal esophagectomy i.e., removal of the esophagus without opening the chest (8).

This approach quickly gained popularity not in the least amongst general surgeons being less familiar with thoracic interventions. Transhiatal esophagectomy however was criticized because it was thought to be a less safe oncologic intervention not allowing for a proper intra thoracic lymphadenectomy.

The introduction of videoscopic minimally invasive, so called key hole, surgery in the late eighties created new perspectives. Cuschieri is to be credited for having performed the first thoracoscopic esophagectomy in 1992 (9).

But it is Luketich who really brought the totally minimally invasive esophagectomy (MIE) into the surgical practice (10).

With the rapid growing experience it became clear that MIE indeed results in a significant decrease in postoperative complications in particular pulmonary complications (11,12) in its turn resulting in a significant decrease of ICU stay, decrease in length of hospital stay and a clear improvement in postoperative rehabilitation and related quality of life (13,14).

But nevertheless a minority of patients may suffer from prolonged “post-thoracotomy” pain at the site of the small port incisions. This problem is thought to be the result of the manipulation of the scope and instruments through these small intercostal spaces causing potential damage to the intercostal nerves (13).

So surgeons have been exploring methods to minimize this sometimes debilitating complication by e.g., introducing pleural catheters delivering prolonged anesthetic fluid in the vicinity of the intercostal nerve. But the results are not unequivocally satisfactory.

The credit goes to Marcello Migliore from Catania to introduce to the thoracic surgical community the concept of uniportal video-assisted thoracoscopic surgery (VATS) (15). Through one somewhat larger incision different instruments

can be introduced through this single port which has a larger intercostal space because of its more anterior location on the chest wall.

The concept was rapidly picked up and gained popularity not in the least part through media coverage. Uniportal VATS is mainly used in pulmonary surgery. A recent systematic review comparing uniportal VATS lobectomy versus multiportal VATS lobectomy seems to indicate an outcome in favour of the uniportal VATS lobectomy in terms of the overall rate of complications, length of hospital stay and duration of postoperative drainage (16). However there are indications that uniportal VATS lobectomy does not present better outcomes in relation to pain sensation on visual pain scale and use of morphine in the first postoperative days (17). Clearly future has to tell whether the uniportal VATS lobectomy is superior to the multiportal one and importantly oncologically as safe.

Because the complexity of esophagectomy and reconstruction there is till now almost no data in literature on the use of uniportal VATS esophagectomy.

Dmitrii *et al.* (18) describe the technique of uniportal esophagectomy in a very recent publication but without further reporting on their experience and results. Presumably the largest experience has been built up by Hasan Batirel from Marmara University, Istanbul now exceeding several tens of esophagectomies. His technique of uniportal VATS esophagectomy will be described in detail this issue.

I have seen Prof. Batirel at work several times over the last few years and witnessed his progress from the very beginning of his experience. A first observation is that there is a steep learning curve even in a center with a large experience with esophagectomy for cancer.

Furthermore it appears that the uniportal approach is more difficult than the multi portal approach because in the latter it is easier to manipulate the esophagus. And finally crowding of the instruments through the unique small incision seems to be more problematic as compared to uniportal VATS lobectomy presumably because the location of the esophagus in the posterior mediastinum requiring more constant need for retraction of both lung tissue and esophagus. This inevitably also results in crowding of the hands of the two surgeons.

But all the surgeries that I observed were quality wise matching what is observed during multiportal esophagectomies.

To remediate the crowding of instruments and hands geometrical thinking patterns have been proposed to

overcome the problem but the reality looks less prosaic to me (19).

The main question is where to position the role of uniportal esophagectomy and what will be its future.

There seems to be an increasing trend to look into the possibilities to either omit chest tubes or to replace the classic chest tubes by tubes that are flatter and smoother. Indeed chest tubes are seen as another potential culprit of post-thoracotomy pain. If newer designs of tubes or even no tubes at all could indeed reduce the incidence and/or intensity of pain it may well be favoring the proponents of the 2 or multiport approach especially in the era of ERAS (20).

Certainly in the area of esophagectomy for cancer there is surge on publications dealing with enhanced recovery protocols. It remains to be seen how uniportal versus 2 or multiportal approaches will fit in these protocols.

Another challenge for the uniportal VATS is the robotic VATS, now called RATS (21), also again in part because of the media coverage of this technology.

It is claimed that using robotic instruments will result in less manipulation and/or traumatization of the intercostal nerves. And by definition uniportal approaches are not apt to the use of robotic approach.

Obviously much more studies and in particular long term follow results are needed to really judge the value of all these new evolving technologies and tools.

Surgeons throughout all times have been very inventive and creative but to quote Ronald Belsey one of the great giants in thoracic surgery: 'The battlefields of surgery are strewn with the remains of promising new operations which perished in the follow-up clinic'. It is therefore a duty of thoracic surgeons, in particular in the academic centers, to embrace all reasonable new technologies or tools in order to use them, evaluate them and objectively report on the advantages and disadvantages.

Besides all these emerging surgical technologies a similar evolution can be seen on the side of the interventional non-surgical area. The recent introduction of POEM (peroral endoscopic myotomy) in the treatment of Achalasia has clearly challenged the classic Heller-Dor myotomy (22). The endoluminal suturing device Overstitch from Apollo Endosurgery now allows for the first time to realize the placement of a continuous suture line via the endoscope, very much similar to a classical surgically placed one (23).

In cancer of the esophagus the introduction of biologicals has opened very promising perspectives possible leading to non-surgical therapy of esophageal cancer.

Combining surgical and medical nanotechnology is no

longer science fiction.

From all this it must become clear that there is a definite need for super-specialization in the field of esophageal pathology both benign and malignant.

The surgeon of tomorrow dealing with esophageal cancer will work in close collaboration with his/her peers in oncology, interventional radiology, interventional endoscopy.

And within this context the position of the surgeon of the future will require not only persistent creativity in designing new techniques in creating new technologies but also will require more than ever the ability of the surgeon to master the knowledge of esophageal diseases and to master the specifics of diagnosis and therapy (including complications and failure) in order to offer the best possible solution tailored on the profile of each individual patient.

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Footnote

Conflicts of Interest: The author has no conflicts of interest to declare.

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