

Uniportal VATS in Asia

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ABSTRACT

The history of uniportal Video-assisted thoracic surgery (VATS) stretches back almost a decade with the treatment of simple thoracic conditions. As the technique matures with increasing ability to tackle the full spectrum of thoracic surgical diseases, most notably major lung resections for lung tumours, the spread of uniportal VATS across the globe has been phenomenal. VATS centres in Asia are now performing uniportal VATS, and developing their individual styles and techniques with great successes. The enthusiasm from surgeons, demand from patients, as well as the dynamism and diversity of uniportal VATS in the region have helped fuel this excitement and change. The 1st Asian Single Port VATS Symposium in 2013 heralded the beginning of academic exchange between uniportal VATS centres in Asia and experts from around the world. Wetlabs in the region will provide further training for thoracic surgeons interested in super-specializing in uniportal VATS. The future of this approach will hinge on good regional collaboration, research and training.

KEY WORDS

Asia; lung resection; single port; training; uniportal; Video-assisted thoracic surgery (VATS)

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Introduction

"The future belongs to those who believe in the beauty of their dreams."

Eleanor Roosevelt, U.S. First Lady 1933-45

Video-assisted thoracic surgery (VATS) has evolved rapidly in the last two decades. Uniportal VATS has become an increasingly popular approach to manage thoracic surgical diseases, because of the reduced access trauma and better cosmesis. These advantages together with patient demand have seen uniportal VATS spreading across the globe. Furthermore, improvements in camera systems, instrumentation, and stapler technology have all facilitated this change.

Uniportal VATS started from humble beginnings, with an initial report of uniportal VATS thoracic sympathectomy in 2002 (1). Nevertheless, this paved the way for the development of more complex uniportal procedures for an ever increasing range of thoracic condition. In the following decade, uniportal VATS was performed for pleural and mediastinal biopsies, deloculation of

pleural effusion, pleurodesis and lung wedge resection (2-4). Most of the progress in these areas has been pioneered by Gaetano Rocco's group from National Cancer Institute, Italy. A major milestone for this approach came in June 2010 in the form of the world's first uniportal VATS lobectomy, which was subsequently reported in 2011 by Gonzalez Rivas's group in Coruna, Spain (5). Since then, complex uniportal VATS lung resection involving pneumonectomy, segmentectomy, bronchoplastic procedures and chest wall resection have been successfully accomplished. The initial clinical outcomes and short term results are encouraging, and more long term data is eagerly awaited (6).

More recently, uniportal VATS development has grown in popularity in Asia, with several centres in Hong Kong, Taiwan, Mainland China and Korea beginning to perform uniportal VATS major lung resections. The demand for increasingly more minimally invasive surgical approaches is perhaps even more important within the Asian culture. Interestingly, different uniportal approaches and techniques are emerging from different VATS centres across the Asian continent, making the future of uniportal VATS in this region even more exciting. This concise review is composed from literature search of all articles from Medline with keywords uniportal and single port VATS, as well as from discussions based on personal experience and those from acquaintances, with a strong focus on the Asia region.

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Crouching Tiger Hidden Dragon

The history of uniportal VATS in Asia is considered by many to be relatively short and limited. However, a literature search shows

that quite possibly the first reported uniportal VATS procedure was by Asians. A group from Israel in fact performed uniportal videothoroscopic sympathectomy for palmar hyperhidrosis back in the 1990s (1). Subsequently, groups in China and Turkey were able to perform and report their experience of uniportal VATS sympathectomy in 2009 and 2012 respectively (7,8). The most popular approach was a single 15 mm incision near the axilla using thoracoscope and endoscopic instruments to complete the sympathectomy. More innovative techniques for sympathectomy have also been attempted, including Vasoview sympathectomy which utilizes a 12 mm diameter integrated device encompassing both a thoracoscope, and a working channel for diathermy scissors or other energy source for the sympathectomy (9).

Uniportal VATS for the management of pleural pathologies including pneumothorax, pleural effusion and empyema have also been successfully performed by several groups in Asia.

Although numerous centres around Asia have performed uniportal VATS for the treatment of primary spontaneous pneumothorax in sporadic and selected cases, it was not until 2011 that a group in Taiwan (10) published their experience of a small series of 10 patients who received this procedure. By utilizing a single 2.5 cm incision, specialized 5 mm roticulating endoscopic instruments and a 10 mm thoracoscope, blebs and bullae were resected using endostaplers followed by mechanical abrasive pleurodesis. When compared with patients who had standard 3-port VATS pleurodesis in their centre, those who underwent uniportal procedure had less pain and higher patient satisfaction on postoperative day 1 and 2. However, no long term outcomes, such as recurrences, were investigated. Interestingly, the management of empyema by uniportal VATS within Asia was reported much earlier in 2007. Tander *et al.* reported their technique of balloon-assisted uniportal thoracoscopic debridement in children with late-stage parapneumonic empyema thoracic (11). Like in many parts of the world, it was the simpler thoracic procedures such as, sympathectomy, treatment of pneumothorax and empyema which formed the basis from which uniportal VATS took off in the Asia region.

It was initially interesting and surprising to find that amongst publications from Asia, a group in Beijing, China had already published in an article in 2010, their early experience of performing 21 “single port” VATS lobectomies (12). However, upon closer inspection of the article, the lobectomies were in fact performed with a “single utility port” in the anterior aspect of the upper chest with an additional smaller inferior port for the thoracoscope thus making it a two port VATS technique. Two years later, Chen’s group in Taiwan reported their initial experience of 3 cases of uniportal VATS lobectomies for tumour within left lower lobes and a right middle lobe (13). The approach was through a small 3.5 cm incision at the 5th intercostal space near the anterior axillary line, and utilized a mix of VATS and endoscopic instruments. Report such as

this not only heralded the beginning of uniportal VATS major lung resection in Asia, but also perhaps provided the impetus to overcome psychological barrier that is often associated with introducing a new technique to a region. With increasing familiarity with the uniportal approach in Asia, more innovative techniques such as incorporating hook-wire guidance into uniportal VATS lung resection has emerged, further increasing the effectiveness of uniportal VATS (14).

As confidence grew, other centres in Taiwan as well as numerous countries around Asia, for example Korea and Hong Kong, began performing uniportal VATS major lung resections (15). It is interesting to note that rather than developing the technique together or adopting a particular uniportal approach within the region, each VATS centre has invented their own signature uniportal VATS approach based on their 3 port VATS experience. Some centres would utilize the 30 degree 5 mm thoracoscope while others prefer a more versatile 120 degree larger thoracoscope for vision (16). For tissue dissection, different surgeons would incorporate the use of either or a mixture of, conventional instruments, standard VATS instruments, specially designed uniportal VATS instruments (curved) or 5 mm endoscopic instruments (straight or angulated) (13,16,17). Furthermore, heterogeneity in the approaches is perhaps most evident in the positioning of the single incision and operating surgeon. For example, many Korean surgeons prefer to stand at the posterior side of the patient and operate through a lateral port incision, while surgeons trained in Taiwan or Hong Kong usually perform uniportal VATS positioned in front of the patient through a port incision placed at a more anterior aspect of the chest to take advantage of wider intercostal spaces (18) (Figure 1). Like with 3 port VATS, there is never going to be “a best approach” for uniportal VATS for whole of Asia, but it is this diversity that will make the evolution of uniportal VATS major lung resection in the region of utmost interest.

Asian perspective

As uniportal VATS begin to spread across Asia, questions are being asked as to whether the Eastern culture, people and above all the Asian spectrum of diseases are suited for uniportal VATS. In the same way, when 3-port VATS was developing in Asia in the 1990s, many questioned whether the results, techniques and approach from the West are applicable to the Asian region (19). The high prevalence of pulmonary tuberculosis in Asia was an initial concern when 3-port VATS was introduced. Extensive pleural adhesions, difficult to dissect calcified lymph nodes that may be associated with history of tuberculosis did not stop the development of 3-port VATS in Asia (20). In fact, the earlier teaching that severe pleural adhesions is a contraindication to VATS may even have been dispelled at least in part by the



Figure 1. An anteriorly positioned uniportal incision for lobectomy. A 120 degree thoracoscope, flexible endostapler and sponge forceps are placed through the port.



Figure 2. Uniportal VATS wound following lobectomy for early stage lung cancer.

experience of VATS from Asia. The uniportal VATS experience so far from personal view as well as from uniportal authorities in Europe and US, suggest that pleural adhesions and indeed history of pulmonary tuberculosis are not contraindications

to this new technique. The use of specially designed long instruments and energy sources including, ultrasonic Harmonic[®] and pressure energy Ligasure[™] devices, as well as curved dissecting instruments have made difficulties associated with VATS pleural adhesiolysis a thing of the past.

Cost is always a concern for this region. Often, the success and failure of a new technique or approach in Asia is dictated by the cost of the change which correlates reciprocally with its adoptability. To fully explore the potential of uniportal VATS in major lung resection and allow minimization of the uniportal incision, the availability of flexible endostaplers is important to allow the best angles for staple-resection of major pulmonary vessels and bronchus. In order to save costs, some Asian centres are using suturing techniques to tackle these structures while performing 3-port VATS, however, it may not be possible for uniportal VATS. In general, we have always advocated the use of conventional instruments to perform VATS because it is less costly and are much more familiar to the surgeon (18). Certainly, the use of conventional instruments for retraction and dissection during uniportal VATS major lung resection is possible but far from ideal. Specifically designed uniportal VATS instruments are available with slight curvature and narrower shaft to allow for a smaller incision and reduce instrument fencing (16,17). The smaller body habitus of the Asian population in general should also be taken into account when purchasing equipment for uniportal VATS. Whatever changes are needed to pursue uniportal VATS are probably far smaller than adopting other new forms of technology such as robotic thoracic surgery, which has very high cost, development and training burden.

Finally, there is “That Asian Thing”. Patients in Asia demand all things minimally invasive, and smaller or less wounds are very attractive features of uniportal VATS (Figure 2). Even before robust or long term data are available for important endpoints such as survival and recurrence, often patients will still ask for the “latest”, “most minimally invasive” or “least traumatic” approach to treat their diseases. This is perhaps best illustrated in the over liberal use of percutaneous interventions for treatment of coronary artery diseases compared with coronary artery bypass grafting surgery in Asia. The fear of postoperative pain and disturbance of inflammatory and immune function, also known as “flow of life energy” or “Chi” in Asian culture, by surgical access trauma are probably the main reasons behind this thinking (21,22). Over the last 2 years, the rapid adoption of uniportal VATS major lung resection in countries like Hong Kong, Korea, Taiwan and China may be in part a reflection of these patient demands and beliefs.

Training and the future

Training and education is an integral part of introducing a new technique to a region, and for uniportal VATS, this is no

different. The 1st Asian Single Port VATS symposium and Live Surgery meeting (www.surgery.cuhk.edu.hk/vats2013) held earlier this year in Hong Kong, not only heralded the formal recognition of the uniportal VATS technique in Asia, but at the same time allowed the gathering of like minded uniportal surgeons and interested parties to exchange ideas. The successful Live Surgery demonstrations of uniportal lobectomies by world leaders for the audience also dispelled any myths surrounding the validity and limitations of this approach.

Following the symposium, several well established VATS centres in China and Taiwan began to experiment with and started performing uniportal VATS lobectomies, confirming that there is indeed great enthusiasm in Asia for this technique. In addition, it is a testament to the ease of learning uniportal VATS. Interestingly, one of the centres that has embraced uniportal VATS lobectomy have only performed open lung resection surgery in the past, hence making a “direct leap” from open to uniportal VATS. In fact, some surgeons have found uniportal VATS easier to learn than 3-port VATS lobectomy probably because the surgeon is working with their eyes and hands in the same plain, much like open surgery, which in contrast to 3-port VATS require operating through a diamond-like configuration (2). Therefore, this also begs the question whether it is necessary to be trained in 3-port VATS before a surgeon is allowed to progress to uniportal VATS. Certainly, from our centre’s experience and that of Dr Gonzalez Rivas’s department in Coruna Hospital, uniportal VATS lobectomy can be taught to residents in training, even if they have little or no experience of 3-port VATS. Although the learning curve may be steeper for those already familiar with 3-port VATS, we believe it is certainly not a prerequisite for learning the uniportal technique. However, in my experience, mastering the 3-port VATS technique can be an effective bail out approach when difficulty is encountered during uniportal VATS surgery, without the need to convert to a full thoracotomy.

Apart from symposiums and meetings, animal wetlabs will likely form an integral part of uniportal VATS training. Currently, centres in Asia capable of providing such facilities are few and far between, located in the larger cities of Hong Kong, Shanghai and Singapore. Wetlabs for “standard” VATS have been carried out to full capacity at these institutes for a number of years with great successes, however we are yet to see the inaugural uniportal VATS wetlab in Asia. Uniportal VATS wetlabs in Europe are fully booked for the next two years, and based on this enthusiasm it appears that a uniportal VATS wetlab in Asia is long overdue.

Besides training, the future of uniportal VATS in Asia will also depend on other key issues. Immediate and long term outcomes are important considerations for any surgical procedure, especially one that deals with oncological diseases. In the past, numerous studies, many of them conducted on Asian population have investigated the postoperative effects of 3-port VATS major lung resection on

the physiology (inflammatory and cytokine responses, immune dysfunction, and angiogenic responses) (23-26) and functionality (shoulder function, quality of life) of the patient (27,28). These have shown that standard 3-port VATS had equivalent or superior results when compared with open procedure. Perhaps more importantly, studies investigating the 3-port VATS and open approaches have found comparable, if not better, quality of mediastinal lymph node sampling, as well as mid and long term recurrence and survival rates in the minimally invasive group (29-31). As a Chinese Philosopher, Confucius (551-479 BC) once said, “Study the past if you would define the future”. The uniportal VATS approach will likely require a re-run of these studies to provide robust data for dispelling doubts from sceptics of this novel technique. The future of uniportal VATS in Asia will depend on regional collaborations, and high quality research and training.

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