



## Techniques and Procedures

# Single Port Thoroscopic Surgery Using the SILS® Tool as a Novel Method in the Surgical Treatment of Pneumothorax

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### ABSTRACT

Single Incision Laparoscopic Surgery (SILS) has recently been used by general surgeons to perform cholecystectomies and pre-peritoneal hernia repairs with mesh using minimally invasive surgery, thus decreasing post-operative pain and a more cosmetic result of the surgery being obtained. We describe the first cases of video-assisted thoracic surgery (VATS) in spontaneous pneumothorax using the SILS system. There are no previous reports on the use of the SILS system in VATS for spontaneous pneumothorax. This system also allows us to obtain a more cosmetic surgical result, as well as decreasing the mean post-operative hospital stay and the need for analgesics to improve the post-operative pain.

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## Cirugía toracoscópica monoportal utilizando el instrumento SILS® como un método novedoso en el tratamiento quirúrgico del neumotórax

### RESUMEN

#### Palabras clave:

Neumotórax espontáneo  
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Toracoscopia monoportal  
Single incision laparoscopic surgery

La *single incision laparoscopic surgery* (SILS, 'cirugía laparoscópica a través de incisión única') ha sido recientemente utilizada por cirujanos generales para realizar colecistectomías y reparación de hernias preperitoneales con malla mediante cirugía de mínima invasión disminuyendo así el dolor postoperatorio y obteniéndose un resultado más cosmético de la cirugía. Describimos los primeros casos de cirugía torácica videoasistida en neumotórax espontáneos utilizando el sistema SILS. No hay reportes previos del uso del SILS en cirugía torácica videoasistida para el neumotórax espontáneo. Este sistema, además de permitirnos obtener un resultado quirúrgico más cosmético, también disminuye la estancia media postoperatoria y la necesidad de analgésicos a fin de reducir el dolor postoperatorio.

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### Introduction

The video-assisted thoracic surgery (VATS) significantly decreases postoperative pain when compared with traditional chest incisions. However, over 50% of patients undergoing VATS for spontaneous

pneumothorax experience complications of postoperative paraesthesia of the chest wall, which are often related to the sites of access ports.<sup>1</sup> In an attempt to reduce these complications, the conventional VATS surgery has evolved to surgical ports of a smaller size and of a lesser amount. Murphy et al.<sup>2</sup> compared the technique for thoracoscopic thoracic sympathectomy between one and two ports. The group with one port showed advantages in terms of hospital stay, frequency of postoperative pneumothorax and the need for chest tube placement. Furthermore, Rocco et al.<sup>3</sup> reported

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less postoperative pain and a lower incidence of paraesthesia when comparing the single-port procedure with the standard three-port VATS in the surgical treatment of spontaneous pneumothorax.

### Procedure and Surgical Technique

An incision of 2 to 2.5 cm is performed in the sixth intercostal space in the mid- and anterior axillary line. Following the "baseball diamond" triangulation, in order to perform said technique and the resection of the diseased tissue of the lung apex, we will need to use articulated instruments that enable traction on the lung from different angles, which do not converge with the angle of the chamber. In this way, the instrument inserted through the single port does not collide with itself.

For this incision (fig. 1), we use a multi-station flexible instrument that allows access to the thoracic cavity (Covidien SILS® PT12 - Tyco Healthcare). This instrument will allow us to organise the ports for traction forceps (endograsp roticulator), a 5 mm lens and a 3.5 mm roticulator stapler. These instruments are introduced through three of the four working channels of the SILS® instrument (fig. 2).

We initially explore the cavity and locate the lung lesions through an ipsilateral lung clamping to the operated side. We free the lung of

all its adhesions to the wall and we mobilise the pulmonary apex using the endograsp roticulator, while the endostapler should be linked in such a way as to locate the flow to the lesions that are to be resected. We carry out a mechanical abrasion with sandpaper using an electric scalpel that is inserted through the 12 mm trocar.

We finally place a 24 ch chest tube through the surgical incision, which we secure by using the standard method of connecting it to a Pleur-evac system.

### Patients and Results

From June 2008 to October 2009, 24 patients were treated (5 women, 19 men) with pneumothorax; 20 of these were treated for idiopathic spontaneous pneumothorax (83%), 5 women (25%) and 15 men (75%). The average age of patients with spontaneous pneumothorax surgery was 26.4 years. The average age for men was 23.73 years and the average age for women was 34.4 years.

100% of the patients with idiopathic spontaneous pneumothorax were treated with thoracoscopy. Concerning the number of ports used in the thoracoscopy, 25% were treated using 3 ports, 30% using 2 ports and 45% using 1 port.

The SILS® system was used in 66% of those patients who underwent a single-port thoracoscopy.

We have reviewed the overall average postoperative hospital stay (APHS), which was 2.15 days. However, if we calculate the APHS based on the number of ports used during surgery, we report the following results: for three-port surgical procedures, the APHS was 2.75 days; for two-port surgical procedures, the APHS was 2.66 days; and for single-port surgical procedures, the APHS was 2.12 days.

In our series, we did not have to convert the thoracoscopic technique to thoracotomy in any of the cases. However, in one patient we converted the single-port technique to a three-port one because he presented with a great number of adhesions, representing a conversion of 11.1%.

The recurrence rate of pneumothorax following surgery in our series is 0%.

Concerning pain, we created a simple scale to assess pain, which was divided into three categories (mild, moderate and acute). Each of the categories of pain was given a numerical value: mild = 1, moderate = 2 and acute = 3. Patients were classified according to the pain medication they received: the need for morphine was classified as acute pain; NSAIDs were classified as moderate pain; and paracetamol or metamizole as mild pain. On that basis, all patients treated with thoracoscopy had mild to moderate pain with numerical values between 1.75 and 1.5. The patients treated with a three-port surgical procedure experienced more pain, with a value of 1.75, while those operated with two ports showed a very similar pain scale (1.55 versus 1.5) compared to those treated with a single-port procedure.

The average pain experienced in the group of patients operated using the single-port technique together with the SILS® system was 1.55, while the average pain was valued at 1.67 in the group of patients treated with the single-port technique without the SILS® system.

### Limitations and Contraindications

This technique may be limited by all those processes that affect the performance of thoracoscopy, such as lung clamping intolerance or the presence of previously severe adhesions. The execution of a skilled surgical procedure depends on the surgeon's learning curve. In addition, we believe it is important that the instruments used to perform this technique should be articulated, both forceps and endostapler, so that the angles of traction on the diseased area of the lung do not converge, facilitating resection. It is also essential that in order to perform the procedure the lens should be 5 mm in diameter,



Figure 1. SILS® instrument and cutaneous incision of the technique.



Figure 2. Instrumentation of the thoracic cavity through the SILS® port.

whether it is at 0° or 30°, which depends on the surgeon's skills. However, lenses larger than this diameter cannot be used technically as the SILS® system has only one 12 mm port that should be used by the endostapler.

No death was reported in the patients operated with this procedure. We converted one case to a three-port thoracoscopy due to pleural adhesions, which means that the reconversion of the technique in our cases is 11%, probably in relation to our learning curve.

### Discussion and Comments

Spontaneous pneumothorax surgery has undergone major changes over the last three decades. It was initially performed through traditional posterolateral thoracotomy incisions. Later on, in order to decrease postoperative pain and respiratory complications, smaller thoracotomy incisions were made through the axillary route. More recently, the surgical approach of this pathology has changed radically with the appearance of video-assisted thoracic surgery. This technique involves access to the pleural cavity by inserting three trocars, metallic or made of polyethylene, to resect the diseased lung apex with mechanical staplers.

However, up to 50% of patients with spontaneous pneumothorax who undergo video-assisted thoracic surgery experience the following postoperative complications: paraesthesia of the chest wall and pain from the compression of the intercostal nerves during surgery.

In general, to reduce these complications of video-assisted thoracic surgery, doctors have tried to perform the same procedures with fewer injuries to the chest wall and with fewer trocars inserted into the pleural cavity. This is the case of the thoracic sympathectomy technique for the treatment of palmar hyperhidrosis, which currently can be performed with the insertion of only one trocar.

In 2004, Rocco et al.<sup>4</sup> first reported five patients with primary spontaneous pneumothorax treated with single-port VATS through a single incision of 2.5 cm, made at the 6th intercostal space on the posterior axillary line. They introduced a 5 mm, 0° thoracoscope, an endostapler and grip forceps, with which they managed to resect blebs or bullae in the lung apex. They reported some disadvantages, such as quality of vision, which sometimes may not be sufficient; however, this is not a problem if a 30° lens and articulated instruments are used. The absence of any protected channels for introducing the material in the cavity can lead to intercostal nerve injury and can increase the need to clean the optical lenses, thus delaying the operative time.

Salati et al.<sup>5</sup> operated on 28 patients using the single-port spontaneous pneumothorax technique, which, according to Rocco et al., reduces hospital stay and the frequency of paraesthesia, thus decreasing costs.

Recent advances in laparoscopic surgery (SILS®) have made it possible to perform cholecystectomies through a single umbilical incision, thus reducing the trauma in the surgical approach.<sup>6</sup>

In 2009, Rahman y John<sup>7</sup> reported the first case of transabdominal pre-peritoneal hernia repair, which improved the cosmetic result without any additional risks.

We present the first patients treated with single-port VATS for spontaneous pneumothorax using the SILS® system (SILS Port®). We

wanted to make a descriptive analysis of several parameters that we have selected in relation to the single-port surgical technique. We wish to note that among these parameters postoperative pain decreased when we used the SILS® system. We therefore implemented a simple scale to measure pain: mild, moderate and acute, where the values are between 1 and 3 for mild to acute pain, respectively. The patients were included in the scale according to the use of morphine, NSAIDs or paracetamol/metamizole, based on the intensity of the pain. We observed that when we used the SILS® system the average pain was 1.55, which is lower regarding the pain experienced by patients who underwent the single-port technique without SILS® (1.67). This questions whether the elastic elastomeric material of this instrument in some way influences the improvement of the pain status by absorbing the compression exerted on the intercostal space by the trocars. Likewise, when assessing the APHS, we found that as the number of trocars decreases so does the APHS. The overall APHS for pneumothorax thoracoscopy was 2.15 days. Nevertheless, if this figure is broken down, we see that in the case of the three-port procedures the APHS is 2.75 days, for the two-port procedures it is 2.66 days, and for the single-port procedures it is 2.12 days. On the other hand, when we break down the APHS figure in the single-port procedures using the SILS® system, compared to that of the single-port procedures that did not use this system, we see that those patients on whom we used the SILS® system show a reduced hospital stay in front of the overall APHS and the APHS without SILS® (1.6 days and 3 days, respectively). Therefore, we believe that this instrument reduces pain and may decrease the APHS of patients, thereby diminishing hospital admission costs.

We believe that the procedure can be performed safely and comfortably with no mortality and minimal morbidity. In addition to the clear aesthetic results brought by one single scar in place of two or more, this procedure also reduces the APHS and postoperative pain of patients, thus contributing to the reduction of hospital admission costs. Future studies on and improvements in the actual instrument, which would enable it to be used in the chest and the intercostal space, are needed to define the promising advantages of this technique.

### References

1. Sihoe AD, Au SS, Cheung ML, Chow IK, Chu KM, Law CY, et al. Incidence of chest wall paraesthesia after video assisted surgery for primary spontaneous pneumothorax. *Eur J Cardiovasc Surg.* 2004;24:1054-8.
2. Murphy MO, Ghosh J, Khwaja N, Murray D, Halka AT, Carter A, et-al. Upper dorsal endoscopic thoracic sympathectomy: a comparison of one-and two ablation techniques. *Eur J Cardiothorac Surg.* 2006;30:223-7.
3. Jutley RS, Khalil MW, Rocco G. Uniportal vs. standard three-port VATS technique for spontaneous pneumothorax: comparison of post-operative pain and residual paraesthesia. *Eur J Cardiothorac Surg.* 2005;28:43-6.
4. Rocco G, Martin-Ucar A, Passera E. Uniportal VATS Wedge Pulmonary Resections. *Ann Thorac Surg.* 2004;77:726-8.
5. Salati M., Brunelli A, Xiumè F, Refai M, Sciarra V, Soccetti A, et-al. Uniportal video assisted thoracic surgery for primary spontaneous pneumothorax: clinical and economic analysis in comparison to the traditional approach. *Interact Cardiovasc Thorac Surg.* 2008;7:63-6.
6. Chow A, Purkayastha S, Aziz O, Paraskeva P. Single-incision laparoscopic surgery for holecystectomy: an evolving technique. *Surg Endosc.* 2009. Epub 2009 Aug 18.
7. Rahman SH, John BJ. Single incision laparoscopic trans-abdominal pre-peritoneal mesh hernia repair: a feasible approach. *Hernia.* 2009. Epub 2009 Aug 26.