A new surgical procedure for palmar hyperhidrosis: is it possible to perform endoscopic sympathectomy under deep sedation without intubation?†

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INTRODUCTION

Palmar hyperhidrosis (PH) is a common dysfunctional disorder due to excessive secretion of the eccrine sweat glands in amounts greater than required for physiological needs [1, 2]. It may be primary or secondary to another disease such as hyperthyroidism. It is reported that 0.6–1% of the general population are affected by hyperhidrosis [3], especially young people. Males and females are equally affected. Patients complain of embarrassment holding onto objects or shaking hands, which may lead to serious, occupational, educational and psychological problems. The cause of PH is unknown. The consensus viewpoint is that it is a central phenomenon of excessive stimulation of the sweat glands by an overactive sympathetic system [4–6]. Over the past several years, many treatments, both non-invasive and invasive, have been tried which had different effects [7–11]. Among them, endoscopic thoracic sympathectomy (ETS) was the most popular method applied clinically and yielded generally excellent results [12–16]. Various techniques of ETS have been described. Under general anaesthesia, conventional endotracheal intubation is performed before surgery, and 1–3 port ETS is performed with different patient positioning [17–19]. Since its introduction, little improvements have been made to this mature technique. Elia et al. [20] first described the application of sedation in ETS surgery; however, it has not yet been widely used.

In recent years, with the continued development of endoscopy, flexible thoracoscopy has been used to diagnose and treat pleural disease [21]. These patients are treated under local anaesthesia, and a purposefully created pneumothorax is used to permit examination and/or treatment. Such procedures can last up to half an hour with adequate patient tolerance. This, along with the realization that other similar procedures such as gastroscopy are performed under local anaesthesia or IV sedation only, led us to question whether such an approach could be applied to the slightly lengthier operative times of ETS. Such an approach could decrease the complications associated with endotracheal intubation and general anaesthesia.

This study reports a case series of patients that underwent ETS with flexible thoracoscopy under i.v. sedation without intubation.

PATIENTS AND METHODS

Thirteen patients including 9 males and 4 females with heavy PH (according to the Lai classification) were admitted to our department from May 2011 to October 2012. The ages ranged from 18
to 25. All patients were thin and thus consequential hyperhidrosis was excluded. Cardiopulmonary function was assessed preoperatively. Informed consent was obtained from all patients who understood the experimental nature of the procedure.

**Operation procedure**

All patients were given fentanyl (50 μg, i.v. injection) and propofol (1.5 mg/kg, i.v. injection) (Fig. 1). Throughout the surgical procedure, oxygen was delivered via nasal cannula and face mask. The patients were placed in the semiupright position with abduction of both upper extremities to expose the axillae. Two percent of lidocaine was infiltrated for local anaesthesia. A 0.5-cm incision in the third intercostal space was made bilaterally below each axilla, just posterior to the pectoralis major muscle. A single-valve trocar was used to create a pneumothorax and 150–200 ml air was injected into the thoracic cavity. Then, flexible thoracoscopy (Olympus, LTF-240; Tokyo, Japan) was applied to find the sympathetic chain. Before cutting the chain, 2% lidocaine was injected into both sides of the chain through the endoscopic syringe. Then, the nerve chain (T3 or T4) including the 2-cm tissue adjacent to it was cut with the endoscopic electrotome (Olympus PSD-20; Tokyo, Japan). The depth of the cut would be to the periosteum of the rib, while the width of the cut would be equal to the width of the third or the fourth rib. This measure would make sure that the nerve chain was cut off completely. The thoracoscopy device was then removed and vacuum suction applied in order to re-expand the lung.

**RESULTS**

During surgery, no patients needed intubation and the vital signs of all patients remained stable. No hypoxia or arrhythmia occurred. All surgeries were performed successfully. The operative times ranged between 30 and 40 min. The patients reported no pain during surgery and regained consciousness rapidly after surgery. The symptom of PH disappeared as soon as the nerve chain was cut off. One patient regained consciousness during surgery, reported no pain and was able to follow commands. After surgery, all patients remained in follow-up. The longest follow-up time was 6 months. Two patients experienced PH 1 week after surgery but the symptoms resolved after 2 days and have not recurred. No side effects such as compensatory sweat, Horner's syndrome or bleeding occurred. Postoperative chest X-rays showed no residual pneumothorax. All patients were discharged from the hospital in good condition on the second postoperative day.

Besides the clinical advantages of the awake technique, the cost of the procedure could be lower in non-intubated patients, and we are planning to compare the costs of two series of patients in further analysis.

**DISCUSSION**

Primary PH is a disorder of excessive sweating. When severe, it can be debilitating to one’s social and professional life. For severe PH, conservative therapy is often frustrating [22, 23]. Currently, ETS has been reported as the most popular and effective treatment for PH. The surgical procedure has been changed several times such as the three-port to one-port method. Traditionally, patients have undergone general anaesthesia with endotracheal intubation and ETS is then performed. Although generally well accepted, the procedure is not without shortcomings. First, the procedure is always performed under general anaesthesia with endotracheal intubation, leading to possible pulmonary complications and postoperative patient complaints of sore throat and dysphagia. Additionally, the cost of such anaesthesia with intubation can run as high as 6000 RMB. As for the surgery, although the ‘single-hole’ surgery was performed, the name of the procedure can be somewhat misleading. The single hole is larger than the traditional port hole and thus can accommodate two operating apparatus. So while the single-hole technique involves a single incision, the incision is larger and may lead to poor cosmesis, scarring, chest pain and increased difficulty controlling the volume of the pneumothorax.

Thus, in the present study, we used i.v. sedation instead of general anaesthesia with endotracheal intubation, drawing on the method of sedation used for gastroscopy. An analgesic and an amnestic, fentanyl and propofol, are used so that the patients do not experience or remember pain but are capable of breathing on their own. In addition to the i.v. medications delivered, in order to avoid pleural reaction and side effects to the heart while dividing the sympathetic chain, we injected 2% lidocaine under the pleura adjacent to the nerve via endoscopic syringe. When the surgery concluded, the patients in this study quickly regained consciousness and were able to talk normally. No patients reported pain, both operative or throat pain, dizziness or weakness, or had any recollection of the surgical procedure. All patients in the study were ambulatory earlier than patients undergoing the traditional procedure in our experience. In order to provide close monitoring, all patients remained in the hospital until the next day which is shorter than the hospital stay associated with the traditional procedure and helps reduce the overall costs to ≏50% of the cost of the traditional procedure.

As for the surgical procedure, we performed a single-hole surgery using a 5-mm hole. In order to control the volume of pneumothorax, modifications were made to the soft trocar. A single finger of the glove was added to the trocar and a single pinn-sized hole was made. Thus, a one-valve trocar was created (Fig. 2). Air can, therefore, only leave the thoracic cavity through this hole similar to closed thoracic drainage. Because the patients are not intubated, the lung cannot be deflated via the double lumen endotracheal tube, and thus, we created a pneumothorax by injecting air into the thoracic cavity through the modified one-valve trocar. In our experience, 150–200 ml air volume is enough for our surgery. We can adjust the volume of pneumothorax according to the conditions needed during the surgery. However, in 1 case, we did not use the one-valve trocar, just made the open pneumothorax and the surgery could also be performed successfully. So we think that maybe the one-valve trocar is not necessary.

As to the operating apparatus, flexible thoracoscopy was applied in our surgery. The head part of the thoracoscope can be bent, which enables it to reach every site of the thoracic cavity, something that cannot be achieved using the old rigid thoracoscope. Additionally, the endoscopic injector, electro-coagulator and vacuum suction can be used in the same thoracoscopy without the need for extra port holes. Thus, this method decreases the need for additional ports which may lead to improved scarring and a more pleasing aesthetic result (Fig. 2).

During the operation, some details should be clarified. Initially, when we injected lidocaine under the pleura adjacent to the nerve by endoscopic syringe, we found it difficult to inject. We...
found that the reason for this was that the pinhole was made under the sub-periosteum. This problem was avoided by changing the injection site to the intercostal space with care taken to avoid intercostal vessels. Second, the diameter of the electro-coagulator is smaller than the vessels near the sympathetic chain. Care must be taken to avoid damaging these vessels which may cause bleeding. Third, the procedure is completed, and the endoscope must be withdrawn under vacuum to allow the lung to re-expand.
While an improvement over the traditional method, the described procedure is not without flaws. First, as this was the primary evaluation of such a technique, we restricted the patient population undergoing the procedure to thin and young patients. These patients suffer no pleural adhesion, and there is little fat beside the nerve chain, which makes it easy to distinguish. It remains to be tested whether the procedure is possible in patients with a larger body habitus. Second, the visual field is decreased making it difficult to locate the sympathetic chain. Third, 2 patients experienced a brief relapse of their PH, and follow-up has been limited. Longer term follow-up is thus necessary before final determination is made as to the efficacy of this procedure.

CONCLUSION

Endoscopic sympathectomy with flexible thoracoscopy for PH under i.v. anaesthesia without intubation is safe and effective in this early clinical work. It is a promising method to treat PH especially in developing countries.

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Conflict of interest: none declared.

REFERENCES


Figure 2: The surgical apparatus. (A) Flexible thoracoscopy was applied in our surgery. The head part of the thoracoscope can be bent, which enables it to reach every site of the thoracic cavity. The red arrow shows the head of the flexible thoracoscopy. (B) The endoscopic injector that was used to inject the lidocaine. (C) and (D) show the soft trocar. The blue arrow shows the one-valve trocar (a single finger of the glove was added to it and a single pin-sized hole was made).


APPENDIX. CONFERENCE DISCUSSION

Dr G. Rocco (Naples, Italy): Awake thoracoscopic procedures are being increasingly performed, and you should be commended for bringing our attention to a sympathectomy done thoracoscopically through one port and on an awake patient. I had a chance to review your paper and I’d like to make a few comments. First of all, you don’t mention any injection of air into the chest cavity. And yet you say that you use the one-valve trocar to obtain the collapse of the lung. Can you expand and clarify that for us.

Dr Tang: Yes. At first we did use the self-made one-valve trocar to make the artificial pneumothorax. We would inject 100 ml of air into the thoracic cavity. But latterly we found that it was not needed to make the artificial pneumothorax, when we put the trocar into the thoracic cavity, the air could naturally go into the thoracic cavity and it was enough for us to perform the surgery.

Dr Rocco: How do you test the efficacy of your sympathectomy: do you use any probe, temperature probe? Do you use any device for measuring blood flow in the extremities?

Dr Tang: No, because in my hospital we don’t have a device to detect the effect of surgery.

Dr Rocco: I have another question for you. In the paper, and shown at some point in the slides, you said that the length of hospitalization was two days. Now, one of the major targets you want to achieve with this operation is to shorten the hospitalization. How do you see this? Because obviously in other awake procedures you have a length of stay of 4 hours, 5 hours after surgery, and then patients are dismissed.

Dr Tang: Now, if we perform traditional surgery, the patient will be discharged on the second day. For example, if surgery were being performed on the patient today, he would be discharged on the second day, which means the day after tomorrow. But if we performed this new surgery today, the patient can get up this afternoon or evening and tomorrow he can be discharged from the hospital. So the hospital stay will be shortened by one day.

Dr Rocco: And I have one last question for you: How do you avoid cough?

Dr Tang: We have no method of avoiding cough, but it does not occur very often during the surgery as the operative time is short.

Dr Rocco: You should describe how you do that by specifying the anaesthetic management.

Dr A. Sihoe (Hong Kong, China): One of the more impressive results you’ve shown in your slides was that you managed to cut the cost by 50%. Have you looked in detail at where the cost savings come from in your hospital? Is it from the reduction in anaesthetic costs or reduction in surgical instruments? Where do you save the money?

Dr Tang: The money is to be saved just in the anaesthetic method, because the anaesthesia is very expensive in our country; it costs more money. So if we do a local anaesthesia, there is a considerable cost saving.

Dr G. Kocher (Bern, Switzerland): Another comment on the hospital stay. Why do you keep the patients at all for one night, is it a legal issue?

Dr Tang: It is legal. The informed consent was obtained prior to the operation and the patients are aware of the experimental surgery.

Dr Sihoe: So you see the length of stay coming down after you pass this initial experimental stage?

Dr Tang: Yes.

Dr G. Friedel (Gerlingen, Germany): I want to return to the question from Gaetano. As we know, in endoscopic procedures such as bronchoscopy, despite the fact the patients are sedated, they are sometimes very agitated. How do you manage this? Or didn’t you see it?

Dr Tang: We have no method to solve this problem. We did not observe agitation in any of the patients.

Dr Sihoe: So the medication that you’ve given intravenously is usually enough to suppress anxiety and coughing?

Dr Tang: Yes, it is just enough.

Dr Sihoe: Have you ever had any problems with coughing in any of your 13 patients?

Dr Tang: We have performed this surgery for three years, from 2010 to the present, and before I published this paper the number of patients was 13. But since then, the number of patients has increased to 50, and we have had no severe problems. So we think it is safe to perform this surgery. I think it is very important to our developing country because it can save a lot of money for the patients and it is safe.