Video-assisted endoscopic thoracic ganglionectomy

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Sympathetic nerve disorders of the upper extremities can be treated by neurosurgeons using upper thoracic sympathectomy via a posterior approach. Descriptions have been published of alternative endoscopic procedures involving thermocoagulation, laser coagulation, or nonvideo-assisted ganglionectomy using equipment not widely available, with low morbidity and excellent results. The authors describe the use of an endoscopic approach to the thoracic sympathetic ganglia with systems designed for laparoscopic cholecystectomy. Thoracic ganglionectomy is reported in 22 patients with primary palmar hyperhidrosis and eight patients with reflex sympathetic dystrophy. The patients underwent double-lumen endotracheal intubation, after which 11- and 5.5-mm trocars were introduced into the chest cavity. Pneumothorax was produced with CO₂ insufflation. Fiberoptic closed-circuit television was used to visualize the structures to be dissected. The parietal pleura over the heads of the first and second ribs was excised using 5-mm blunt and sharp insulated coagulating microscissors. The stellate and upper thoracic ganglia were clearly identified and dissected. The T-2 and T-3 ganglia were grasped with forceps and excised. A No. 16 French chest tube was introduced through a trocar, placed under water seal after the lungs were re-inflated, and removed in the recovery room. The average hospital stay was 15.4 hours. There were no intraoperative complications. The average operating time was 30 minutes per side. Five patients had mild pleuritic pain which resolved within 2 weeks after surgery. Six (75%) of the eight patients with reflex sympathetic dystrophy had complete or partial relief of their symptoms (average follow-up period 5 months), and all patients had complete relief of hyperhidrosis (average follow-up period 8 months). Endoscopic ganglionectomy requires readily available and easily used instrumentation and provides a well-tolerated, cost-effective alternative to posterior thoracic sympathectomy for primary palmar hyperhidrosis and reflex sympathetic dystrophy.

KEY WORDS • video endoscopy • ganglionectomy • reflex sympathetic dystrophy • hyperhidrosis

Primary palmar hyperhidrosis and reflex sympathetic dystrophy refractory to conservative therapy are commonly treated surgically by interruption of the sympathetic supply to the hand via a posterior approach. This procedure is associated with a low (2.5%) incidence of complications but requires up to 1 week of hospitalization and is a technically difficult and time-consuming procedure. Percutaneous radiofrequency sympatholysis has been described but is limited by its imprecise localization of often variable upper-thoracic sympathetic anatomy. Various endoscopic procedures have been described involving thermocoagulation, laser coagulation, and nonvideo-assisted methods. We describe the use of newer, widely available systems designed for laparoscopic cholecystectomy* to perform precise, video-assisted endoscopic thoracic sympathetic ganglionectomy for medically refractory primary palmar hyperhidrosis and reflex sympathetic dystrophy.

* Video-assisted endoscopic systems manufactured by Storz, Culver City, California, and Cabot Medical, Langhorn, Pennsylvania.

Summary of Cases

Operative Technique

The procedure was performed on 30 patients (22 patients with primary palmar hyperhidrosis and eight with reflex sympathetic dystrophy). The procedure was bilateral only in the 22 hyperhidrosis patients. The patients were admitted for same-day surgery and underwent preoperative chest radiographic examination and routine laboratory analyses. With the patients under general double-lumen endotracheal anesthesia in a semi-Fowler’s position with the arms abducted, one 11-mm and two 5.5-mm trocars were introduced through incisions at the second, fourth, and fifth intercostal spaces in the anterior axillary line. Pneumothorax was produced via CO₂ insufflation and fiberoptic closed-circuit television visualization was provided of the field (Fig. 1 left). The lung was gently retracted and the parietal pleura over the heads of the appropriate ribs excised using 5-mm blunt and sharp insulated coagulating microscissors. The stellate and other thoracic ganglia, as well as accompanying rami communicantes, Kuntz' nerve, and other branches arising from upper
thoracic nerves to the brachial plexus and surrounding tissues were carefully dissected, coagulated, divided, and removed (Fig. 1 right). Histological confirmation of ganglia was obtained intraoperatively. A No. 16 French thoracostomy tube was introduced through a trocar under video guidance, placed under water seal after the lung was reinfated, and removed in the recovery room. Each incision is closed with a single, subcutaneous absorbable suture.

**Operative Results**

There were no complications. The average operating time was 30 minutes per side. The average hospital stay was 15.4 hours. Follow-up data were obtained from all patients. All of the patients with primary palmar hyperhidrosis were completely satisfied with their outcome from the procedure. Compensatory hyperhidrosis occurred in three patients. Of the eight patients with reflex sympathetic dystrophy, five (62%) were completely satisfied and two (25%) were partially satisfied with the result. A transient Horner’s syndrome occurred in four of these patients. Five patients had transient pleuritic pain after surgery.

**Discussion**

**Anatomy of the Upper-Thoracic Sympathetic Nervous System**

For complete sympathectomy of an upper extremity, connections from the T-2 nerve and ganglion to the brachial plexus must be severed to provide an anatomically complete sympatholysis. Interruption of preganglionic fibers of the T-2 and T-3 ganglia and the sympathetic trunk below the T-3 ganglion does not consistently provide total lasting elimination of sympathetic activity to the arm and hand. Smithwick divided preganglionic outflow to the T-2 and T-3 ganglia and to the sympathetic trunk below T-3, then performed an intrarachnoid resection of the anterior roots of the T-2 and T-3 spinal nerves with resection of the portion of the nerves from which sympathetic rami arose; however, there were cases of recurrence of sympathetic activity and regeneration of fibers. Ganglionectomy was not performed in that series. Haxton has also documented regeneration after sympathectomy.

In 18 preparations of upper-thoracic sympathectomy specimens, there was a high variability in the size and direction of branches arising from the second intercostal nerve to the brachial plexus, besides the nerve of Kuntz, and bundles of fibers connecting the T-2 and T-3 ganglia with branches to the second and third intercostal nerves. Ganglia have also been observed in these nerves, and perikarya and intermediate ganglia in the communicating rami and spinal nerves may be a potential source of reinnervation if a sympathectomy is performed without their removal.

**Endoscopic Ganglionectomy**

The dorsal midline approach to the upper-thoracic sympathetic trunk as described by Cloward is the technique most commonly used among neurosurgeons and provides a low complication rate when compared to other surgical methods. Endoscopic procedures have included direct visual thermocoagulation with an 87% to 100% success rate for treatment of primary palmar hyperhidrosis and a comparably low complication rate with shorter hospital stay and operative time. In a recent report, Kao described using a video-assisted endoscopic thoracic sympathectomy via a single trocar 2.4-mm operating thoracoscope and noted that the sympathetic trunk was not clearly visible in one-third of the cases. He also observed that significant pleural adhesions prevented the use of the technique and that there was no reliable method of controlling hemorrhage. A Doppler flowmeter was required to confirm the location of the sympathetic trunk, and it was not possible to dissect the various neural structures.
completely. The modification of endoscopic thoracic gangliectomy that we have described enables the surgeon to lyse pleural adhesions, precisely dissect and identify all structures, and control hemorrhage from vessels. Although our experience is limited by our small patient population, we conclude that endoscopic sympathetic gangliectomy, using instrumentation that is now readily available, provides a well-tolerated, cost-effective alternative to dorsal upper thoracic sympathectomy with low morbidity.

Disclosure

The authors have no financial interest in the methodology or instrumentation described in this report.

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