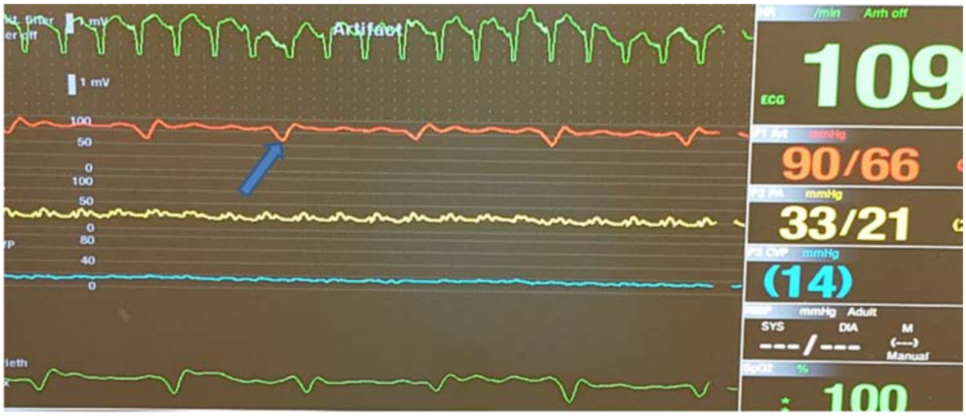

Fig 3. Arterial waveform showing the effects of the HeartMate 3 artificial pulse feature. *Blue arrow* shows that the artificial pulse activation is not synchronized with heart rate.

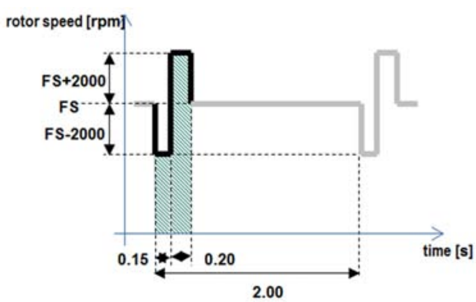

Fig 4. Image demonstrating the mechanics of the HeartMate 3 artificial pulse feature. Image courtesy of Abbott, Abbott Park, IL.

Echocardiographers should be aware of the spectral Doppler inflow pattern of the HM 3 when assessing the inflow cannula for potential obstruction.

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Erector Spinae Plane Block for Postoperative Rescue Analgesia in Thoracoscopic Surgery

To the Editor:

The erector spinae plane (ESP) block is a recently described interfascial regional anesthetic block that has shown promise as an effective and potentially safer alternative to the paravertebral or epidural block.[1] The utility of the ESP block has been described at the cervical, thoracic, and lumbar levels for managing both acute and chronic pain.[1-5] Here we describe the successful application of the ESP block at the T5 level for acute post-surgical pain relief after a video-assisted thoracic surgical (VATS) excision of a paraspinal mass in a patient with compromised respiratory function and contraindications to both epidural and paravertebral blocks.

Written, informed consent was obtained for this report. A 46-year-old, 80 kg man presented for VATS excision of a probable paraspinal thymoma metastasis at the level of T10 in the right extrapleural plane. Other medical history included a thymectomy 11 years prior without significant surgical or anesthetic complications, current myasthenia gravis with only intermittent diplopia not requiring cholinesterase inhibitor therapy, and severe aplastic anemia with a platelet count of 34×10^9/L for which he received plasmapheresis the week before and 1 U of platelets immediately preoperatively. The patient's regular medications included cyclosporine, 275 mg twice a day. He was not taking opioids.

General anesthesia was induced with fentanyl, 1.25 µg/kg, propofol, 2.5 mg/kg, and succinylcholine, 2 mg/kg, followed by maintenance with sevoflurane and remifentanil infusion at 0.1 µg/kg/min. Video laryngoscopy and intubation with a size 39 left-sided double lumen endobronchial tube were performed. Dexamethasone, 4 mg, and ondansetron, 4 mg, were

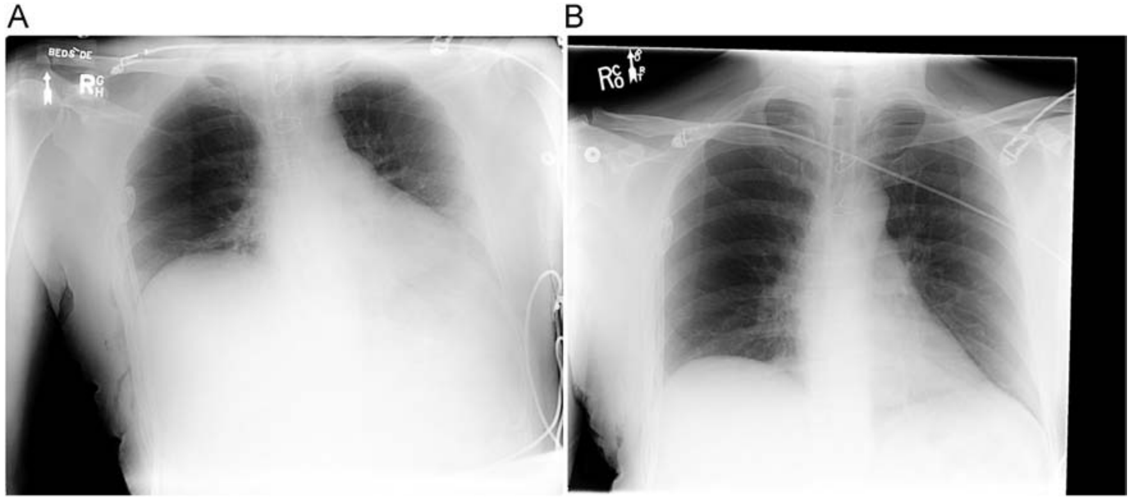

Fig 1. An anterior-posterior chest radiograph series of the patient with pain and dyspnea after a video-assisted thoracic surgical excision of a right-sided mass taken (A) before and (B) after an erector spinae plane block.

given intraoperatively to prevent emesis. Surgery proceeded through 3 port incisions. At the end of surgery, a right-sided 14 Fr pigtail catheter was left in situ through the 10 mm port, and the surgeon used 20 mL of 0.5% bupivacaine with epinephrine for local infiltration of the port and incision sites. Before extubation, 0.4 mg hydromorphone was administered.

The surgery was uneventful, lasting a total of 110 minutes. The patient's airway was extubated in the operating room and he was transferred to the postanesthetic care unit in a drowsy state, but was responsive to voice and commands and was complaining of pain at the T 7/10 level in his right chest. He was unable to breathe deeply or cough, and an arterial blood gas (ABG) analysis shortly after arrival showed respiratory acidosis (pH 7.32, partial pressure of carbon dioxide 51 mmHg, partial pressure of oxygen 128 mmHg, bicarbonate 25 mmol/L). No baseline ABG was performed; however, the patient's preoperative bicarbonate level was 26 mmol/L. An anterior-posterior (AP) chest radiograph showed bilateral subsegmental atelectasis and a small amount of subcutaneous emphysema over the right lower chest wall and flank (Fig 1A).

Because of excessive sedation, only minimal doses of fentanyl were given—50 µg at 25 minutes after arrival and 25 µg at 75 minutes after arrival. However, despite this, the patient demonstrated excessive sedation and pain mismatch and had recurrent desaturations while complaining of dyspnea. In an attempt to improve the patient's pain control and ventilation while avoiding respiratory depression, the decision was made to perform an ultrasound-guided ESP block at the T5 level on the surgical side.

The block was performed with sterile technique and deep to the erector spinae muscles (ESM) via the technique first described by Forero et al.[1] With the patient supported in a left lateral decubitus position, skin at the block site was prepared with a 2% chlorhexidine and 70% isopropyl alcohol solution. Ultrasound views of the T5 transverse process were obtained in the sagittal plane using a linear, high-frequency transducer (Edge HLF50 × 5-16 Mhz; Sonosite Inc, Bothell, WA). Initially, identification of the T5 rib and underlying pleura was sought, then moving medially until the characteristic flat appearance of the transverse process could be seen in the absence of underlying pleura, with the ESM lying directly superficial. A 10 cm, short-beveled block needle (Sonoplex; Pajunk Medical Inc, Geisingen, Germany) was advanced in-plane, with the aim of needle-tip placement directly on the T5 transverse process until bony resistance was felt. Care was taken to ensure needle-tip placement within the ESP by watching for a lenticular spread of local anesthetic on injection. A total of 30 mL of 0.5% ropivacaine was injected into the ESP.

Over the course of the next half hour, the patient's pain and breathing subjectively improved, with his pain score dropping to 3/10. A repeat ABG and AP chest radiograph were performed 70 minutes after the ESP block and showed an improvement in the patient's hypercapnia (pH 7.30, partial pressure of carbon dioxide 38 mmHg, partial pressure of oxygen 123 mmHg, bicarbonate 18 mmol/L). An AP chest radiograph revealed a decrease in bibasilar atelectasis with improved bilateral air entry and a new, small, right-sided apical pneumothorax consistent with the surgical procedure (Fig 1B). Shortly thereafter, the patient was discharged to the ward and made a good recovery; he was discharged from the hospital 2 days postoperatively.

This letter describes a successful application of the ESP block in a patient with significant acute postoperative pain and contraindications to neuraxial and paravertebral anesthesia. The block provided the patient with better analgesia compared with parenteral opioids alone, with decreased respiratory depression as evidenced by improved ABG and chest x-ray results. This block should be considered as a part of the pain control armamentarium for patients undergoing unilateral thoracic procedures. Based on our experience, we now use ESP blocks on a more routine basis in patients undergoing VATS procedures if epidural or paravertebral analgesia are not considered or are contraindicated.

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Diaphragmatic Ultrasound: Early Diagnosis When Phrenic Injury in Thoracic Surgery Is Suspected

To the Editor:

The diaphragm is the main muscle of ventilation. It is innervated by the phrenic nerves. Injury of this nerve is a complication that can occur during any surgery near its location. Different mechanisms of injury have been described, such as hypothermia or ischemia during cardiac surgery,[1,2] in addition to direct mechanical injury in cardiac and thoracic surgery. Salati et al estimated that the incidence of phrenic nerve injury (PNI) during thymic resection surgery is 7%.[3] The main consequence of PNI is ipsilateral diaphragmatic dysfunction. This loss of function can mean a serious complication in the postoperative period in patients with respiratory function altered by diseases such as chronic obstructive pulmonary disease, obesity, or neuromuscular diseases. A quick and sensitive test to diagnose the lesion early can help prevent the onset of complications in these patients. We present a case in which ultrasound was used to evaluate the function of the diaphragm in the presence of high suspicion of PNI during a thymectomy in a patient at risk of developing postoperative pulmonary complications (PPCs).

The patient was a 47-year-old man who underwent thoracic surgery after an incidental finding of a mediastinal mass on a computed tomography scan. His medical history included smoking, obesity (body mass index 29), obstructive sleep apnea, and thyroidectomy. The mass was located at the anterosuperior level, affecting the prevascular area. The intervention was performed by an anterior minithoracotomy in the fourth intercostal space from the inferior side of the tumor to the respective phrenic nerve. The tumor was removed, and a structure highly suggestive of being a nerve in the tumor was visualized. After the completion of the surgery, extubation of the patient was performed without incident. Given the high suspicion of phrenic nerve resection, an ultrasound was performed on the operating table to assess diaphragmatic function. The thickening fraction (TF) of both hemidiaphragms was measured by a linear probe in the anterior axillary line in the eighth intercostal space. Measurements of diaphragmatic thickness were obtained at the end of inspiration (DTins) and at the end of expiration (DTesp) (Fig 1a), and the following formula was applied: $TF = (DTins - DTesp) / DTesp$. Likewise, the diaphragmatic excursion (DE) of both sides was measured by a convex probe in the anterior midline in the subcostal area. The difference between maximum inspiration (white arrow) and expiration (green arrow) was measured in millimeters in M-mode (Fig 1b). The results were TF 42.8%, DE 36.1 mm on the right side and TF 53.3%, DE 32.2 mm on the left side. Because of the performance of the ultrasound, it was possible to verify the normal function of both

Fig 1. (a) Ultrasound measurements of thickening fraction and (b) diaphragmatic excursion of both hemidiaphragms. The *yellow arrows* indicate the diaphragm. The *white arrows* indicate the point of maximum inspiration, and the *green arrows* indicate the point of maximum expiration.