ogy Department was subsequently consulted for airway management. Laryngoscopy and anesthesiology residents using Macintosh-I and Miller-5 blades revealed only the tip of the epiglottis. At this point, an anesthesiology attending physician, recently apprised of the situation, arrived with a Bullard laryngoscope with a blade extender and multifunctional stylet. Bullard laryngoscope placement in the oropharynx was difficult because of lingual swelling. A partial view of the vocal cords beneath a swollen epiglottis was obtained. An 11 French Cook airway exchange catheter (Cook Critical Care, Bloomington, IN) was advanced through the vocal cords via the hollow multifunctional stylet, and a 7.0-mm endotracheal tube was advanced over the multifunctional stylet, airway exchange catheter and passed through vocal cords on the first attempt. Bilateral breath sounds were noted, and the endotracheal tube was secured. A brief episode of ventricular tachycardia after intubation was treated successfully with synchronized cardioversion, and the patient was transferred to the intensive care unit with an oxygen saturation of 100% (FIO₂ = 1.0) stable hemodynamics, and a normal sinus rhythm, and receiving an epinephrine infusion of 0.05 μg·kg⁻¹·min⁻¹. At subsequent examination, the patient was macrognathic with a submental distance of two fingers' breadth. Unfortunately, the patient died in the intensive care unit approximately 4 hours after the initial episode of cardiac arrest.

Although a fiberoptic bronchoscope has been recommended for elective tracheal intubation with a halo device, moving one from the operating room and using it in this episode of cardiac arrest would have been extremely difficult. We recently found that the Bullard laryngoscope allowed more rapid tracheal intubation than the fiberoptic bronchoscope did in an unselected population with unstable necks for elective surgeries. Notably, intubation was performed with any preexisting neck immobilization devices left in situ. Unfortunately, successful use of the Bullard laryngoscope necessitates almost as much experience as the fiberoptic bronchoscope, relatively few training programs educate residents about Bullard laryngoscopy, and only 35% of practice settings recently surveyed have one rapidly available, whereas approximately 93% have a fiberoptic bronchoscope rapidly available. Cricothyroidotomy would have been a reasonable option and would have been the procedure of choice had the Bullard procedure failed. However, even with this procedure, a significant failure rate may exist. In one study, a cricothyroidotomy procedure could not be successfully completed by an Advanced Trauma Life Support verified physician in 10.4% of patients.

References


(Accepted for publication April 22, 1998)

Pressure-guided Method for Identification of the Epidural Space in Children

To the Editor:—The loss-of-resistance technique is the most common method of locating a needle in the epidural space. However, the use of air in children may result in patchy analgesia. There is also a small risk of air embolism. We use a pressure-guided method for identification of the epidural space in children. After the trachea is intubated, epidural puncture is performed with a 19-gauge, 5 cm Tuohy needle at the lumbar intervertebral space using a median approach in the lateral flexed position. Before starting the puncture, the pressure transducer with saline-filled sterile tubing is connected to the Tuohy needle. The zero level was set at the midline of the back before measurement. As the needle advances through tissue, the recorded pressure rises, eventually to the pressure applied, to

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transducer flush the reservoir bag. As soon as the tip of the needle enters the epidural space, the pressure suddenly decreases, and the pressure tracing is synchronized with the heart beats (fig. 1).

To evaluate this technique, we performed a prospective trial. The study protocol was approved by our Institutional Research Committee, and informed consent was obtained from the parent of each patient. Fifty patients (American Society of Anesthesiologists physical status I) aged 1–8 yr, scheduled for elective inguinal hernia repair were studied. Each consecutive patient was randomly assigned to one of the two groups (n = 25 each) according to the techniques for identification of the epidural space as follows: pressure-guide group and standard group (using loss of resistance to saline injection). Routine monitoring (blood pressure [BP], electrocardiography, heart rate [HR], precordial stethoscope, and pulse oximetry) was established, and general anesthesia was performed with sevoflurane and nitric oxide in oxygen. After tracheal intubation, the patient was placed in the lateral decubitus position, and epidural puncture was carefully performed with a 19-gauge Tuohy needle at L2–3 intervertebral space with each method. A catheter was inserted and advanced approximately 3 cm into the epidural space. The patient was then placed supine, 0.5 ml/kg bupivacaine, 0.25%, was injected through a catheter into the epidural space. Fifteen minutes after bupivacaine injection, surgical procedures were started. A successful block was defined as one in which there was no hemodynamic response to surgical stimuli during a 10-min period after incision. A positive response was defined as a 15-mmHg increase in systolic blood pressure or a 20-beats/min increase in heart rate. The patients who showed positive responses were regarded as not having successful epidural anesthesia, they were immediately administered sevoflurane, 3–4%.

Patient demographic data (age, body weight) were compared between groups using the unpaired Student’s t test. Success rates and incidence of complications were compared between groups using the Fisher’s exact probability test. A probability value < 0.05 was considered the minimum level of statistical significance.

Demographic data, success rates, and complications were shown in Table 1. No significant differences between groups were observed.

When a stylet is used at skin puncture in the patient with a shorter distance than expected between skin and epidural space, an unexpected dural puncture cannot be avoided. We recommend that a Tuohy needle without a stylet should be connected to the pressure line in shallow subcutaneous tissue just after starting the procedure to avoid an unexpected dural puncture in patients with a shorter distance than expected. The power of the study in relation to the sample size may limit the interpretation of the current results. At least 150 patients would need to be studied to exclude a type II error in success rate and at least 637 patients would need to be studied to exclude dural puncture rate.

There are several airless techniques to identify the epidural space during intervertebral epidural anesthesia in children. In addition to these techniques, we will recommend our visible and reliable pressure-guided method of airless identification of the epidural space in children.

<table>
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<tr>
<th>Table 1. Demographic Data, Successful Block Rates, and Complications during Epidural Anesthesia</th>
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<tr>
<td>Pressure Guide</td>
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<tr>
<td>Number of patients</td>
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<td>Age (yr)</td>
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<td>Body weight (kg)</td>
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<td>Success rate</td>
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Demographic data are mean ± SD.

References


Metallic Mercury Leak from the Esophageal Bougy and Postoperative Chest Pain

To the Editor — Accidental mercury ingestion after rupture of the mercury-filled balloon in the Miller-Abbott tube has been reported. We would like to report another case of mercury ingestion that was caused by leakage from needle holes in the bougies used in the Nissen fundoplication.

A 47-yr-old man with a 5-yr history of gastric reflux underwent a laparoscopic Nissen fundoplication during general anesthesia. The patient was generally healthy and active. He had no remarkable medical history other than gastric reflux. He took only antacids as an occasional medication. Induction and maintenance of general anesthesia were performed uneventfully using propofol, fentanyl, isoflurane and air/oxygen. Laparoscopic surgery was performed during carbon dioxide insufflation. During the procedure, an anesthesiologist inserted mercury-filled Mahoney esophageal bougies (Pilling Weck, Fort Washington, PA) ranging from 42 French to 50 French to facilitate the procedure.

Emergence from anesthesia was uneventful. As soon as the patient was extubated and regained consciousness, he complained of severe mid-chest pain with shortness of breath and diaphoresis. He described the pain as sharp and burning, with a 10/10 on an analog pain scale. The chest pain did not radiate to the shoulders or arms and was not relieved by administration of nitroglycerin or opioids. Twelve-lead electrocardiography showed no signs of myocardial ischemia and no changes from the preoperative study. Chest radiography revealed vertically streaked 1 cm × 3 cm shadows in the mid-chest field (fig. 1). Because of the location of the shadow in the mediastinum, mercury deposition in the esophagus was suspected.

After careful inspection, needle punctures were found in one of the used bougies, and leak of mercury was easily identified by squeezing. Gastroenterologists performed endoscopy on the patient during intravenous sedation and found a collection of mercury in the mucosal pouch in the distal esophagus. A total of 3 cm³ mercury was aspirated through the scope. Rupture of the esophagus was ruled out. After the removal of mercury, the patient’s chest pain subsided during the next 24 h. Subsequently, the patient was discharged without problems.

Ingestion of elemental metallic mercury is considered to be harmless because of the poor absorption in the gastrointestinal tract. However, metallic mercury may undergo oxidation to yield reactive divalent mercuric acid when water and chloride are available. Systemic mercury intoxication after rupture of a Miller-Abbott tube is reported. A high concentration of the soluble mercuric salts can act corrosively on mucosal membranes, causing painful necrotic lesions in the mouth, the esophagus, and the stomach. We believe that the chest pain probably was caused by the mercurial irritation of the esophageal mucosa, which was subjected to the surgical injury, and active removal of the trapped mercury was most indicated.

James Taylor, M.D.
Hiroshi Kamaya, M.D.
Department of Anesthesiology
University of Utah Medical Center
VA Medical Center
Salt Lake City, Utah

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Fig. 1. Mercury shadows in the esophagus.