The usual manifestations of pneumocephalus are headache, dizziness, cranial nerve palsies, and seizures. Management includes bed rest, analgesia, avoidance of coughing, sneezing, nose blowing and straining due to physical activity, and laxative use to minimize the increase in intra-abdominal pressure during a bowel movement. Most effective in decreasing intracranial pressure is repeated lumbar taps with the removal of CSF which is best achieved with an indwelling lumbar subarachnoid catheter.* The course is generally benign since the majority will heal during the first week; however, those who do not are at higher risk for meningitis and may require surgical repair.

The majority of patients with obstructive sleep apnea tolerate CPAP therapy fairly well, but in most series, there were some patients (5 percent) who did not. The causes included mask discomfort, nasal dryness or congestion, diffuse chest discomfort, nasal pain, and conjunctivitis. The last two complications may be caused by barotrauma to the inner ear or the conjunctiva (through a leak in the mask or via the lacrimal duct). There have been no reports of pulmonary barotrauma, and to our knowledge, this is the first case of CSF leak and pneumocephalus associated with the application of nasal CPAP.

We believe that this complication associated with nasal CPAP is uncommon. However, it needs to be considered in those with persistent nasal discharge, especially when associated with new neurologic abnormalities like dizziness, headaches, seizures and cranial nerve palsies.

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A Muscle-Saving Posterolateral Thoracotomy Incision*

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A posterolateral thoracotomy incision which spares the latissimus dorsi and serratus anterior muscles and provides adequate exposure for major thoracic procedures and structures in the posterior hilum is described. Preservation of these accessory muscles of respiration results in improved respiratory dynamics, decreased postoperative pain, and early recovery. (Chest 1989; 96:1426-27)

A posterolateral thoracotomy is the incision of choice for the majority of thoracic procedures. The standard approach results in division of the latissimus dorsi and serratus anterior muscles and paralysis of the caudal portion of the transected muscle. Alveolar hypoventilation and "frozen shoulder" are not uncommon sequelae.1

TECHNIQUE

Twenty-five consecutive patients underwent a muscle-preserving thoracotomy for a variety of intrathoracic procedures. These patients were subjectedively evaluated with respect to pain, respiratory mechanics, incisional disfigurement, and recovery.

The incision in the skin is made from the anterior axillary line coarsing two finger-breadths below the tip of the scapula heading posterosuperiorly between the scapula and spine (Fig 1A). Flaps of skin are raised along the posterior edge of the latissimus dorsi muscle using electric cautery. The musculotaneous triangle is identified, and the posterior margin of the latissimus dorsi is identified and dissected superiorly and inferiorly (Fig 1B). Having mobilized the latissimus dorsi, the surgeon is ready to mobilize the serratus
anterior. This is done by having the assistant retract the latissimus dorsi anteriorly and away from the chest wall. The serratus is then separated from the latissimus dorsi and the chest wall.

The appropriate interspace is chosen in the usual manner, and an incision is carried out along the superior aspect of the inferior rib of the chosen interspace. A two-retractor technique is used to enhance intrathoracic exposure (Fig 1C). The ribs are reaproximated with simple paracostal sutures. The muscles usually fall into place or may be reaproximated with a few interrupted sutures. The subcutaneous space is drained by two large closed suction drains to prevent seroma formation. In this respect, we undermine the flaps of skin minimally restricting the deeper dissection along the muscle edges only. For additional exposure the postero medial origin of the latissimus can be divided for approximately 2 to 3 cm so that the muscle can be retracted anteriorly easily. The trapezius may be divided partially to the posterior limit of the incision. The importance of gradually opening the chest retractor and good muscle relaxation cannot be overemphasized. This applied to both the rib and muscle retractor.

**DISCUSSION**

Surgical time and loss of blood have not been increased. The latissimus and serratus are important accessory muscles of respiration which are recruited during forced inspiration, expiration, and coughing. We have subjectively noted less postoperative pain and better respiratory dynamics. Edema of the muscles and chest wall that is seen cephalad to the standard thoracotomy incision is also eliminated. Early mobility of the shoulder girdle is improved. In addition, the intact latissimus dorsi and scalenus anterior muscles may be valuable as pedicle grafts should septic complications within the chest occur. Our approach to preserving these muscles is different from that of Bethencourt and Holmes in that the muscles are retracted anteriorly, and better exposure of the posterior aspect of the hilum is obtained. The importance of gradually opening the chest retractor and good muscle relaxation cannot be overemphasized. This applies to both the rib and muscle retractor. Preservation of the latissimus and serratus muscles is compatible with adequate operative exposure while preserving shoulder function, lessening postoperative pain, and maximizing respiratory performance.

Exposure obtained by this technique is about the same as a standard posterolateral thoracotomy. In very muscular patients, it may be slightly less; however, this has not been a consideration in selecting the type of procedure performed by this method. We have used this technique for wedge resections, lobectomies, and pneumonectomies and thoracotomies for neurosurgical and orthopedic procedures on the thoracic spine. In the past six months, we have used this technique almost exclusively for all thoracotomies, except those for emergency trauma situations where a quick entry into the thorax is required. The major disadvantage is the time required for the initial muscle dissection and delayed entry into the thorax.

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