The Value of Fluoroscopy before Performing a Phrenic Nerve Block

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Phrenic nerve blocks with local anesthetics have been used to terminate hiccups after medical management has failed, but the need for fluoroscopy before this procedure has not been stressed. This case report illustrates the value of fluoroscopy.

REPORT OF A CASE

A 73-year-old male physician with unresectable Class IV adenocarcinoma of the right lung had been treated with external radiation to the mediastinum and to the tumor in the right lower lobe. He also had coronary heart disease an angina pectoris that was treated with 10 mg propanolol, orally four times a day. He was hospitalized for severe back pain with radiation to his right leg. Tomograms showed bony destruction to the anterior and lateral margins of the body of the fourth lumbar vertebra on the right side, compatible with metastatic disease. Radiation treatments were administered to the lumbar spine. Two metastatic lesions were identified on tomography of the head, one in the right posterior fossa and the other at the left posterior frontal region. Medications included dilaudid and dexamethasone, orally, and morphine, intramuscularly. He developed hiccups, eructation, and abdominal distention. Dexamethasone was gradually decreased and finally discontinued. Chlorpromazine, 100 mg, im, was followed by 25 mg orally every 4 hours but failed to relieve the hiccups. Simethicone, cimetidine, magnesium and aluminum hydroxide suspension and carbamazepine were also ineffective. The frequency of hiccups increased to as often as four per minute. On the eighth day, a phrenic nerve block was requested. Fluoroscopy of the patient’s diaphragm was performed before the block was attempted. The left hemidiaphragm was hyperactive but the right side did not move on its own. With normal inspiration, between hiccups, the left hemidiaphragm descended 1–2 interspaces. The right hemidiaphragm followed passively. The stomach was very dilated and the fundus was in contact with the undersurface of the left hemidiaphragm. A phrenic nerve block was not done. A nasogastric tube insertion was attempted to reduce the gastric distention but this was unsuccessful. The patient subsequently refused most of his narcotic medication. Abdominal cramps and constipation of which he had complained since hospital admission subsided and his hiccups became infrequent and finally terminated five days after narcotics were discontinued.

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Hiccup is a reflex characterized by a clonic spasm of the diaphragm resulting in a sudden inspiration abruptly terminated by an audible closure of the glottis.¹ The vagus, phrenic nerves, and sympathetic chain from the sixth to the twelfth thoracic nerves probably serve as the afferent limb of the reflex with the phrenic nerve as the principal efferent limb.² Hiccup is served by a supraspinal mechanism distinct from that generating rhythmic breathing. The principal site of interaction of hiccups discharge with other descending drives to the respiratory motoneuron is at the spinal level.³ A study of the characteristics of hiccups revealed the involvement of muscles other than the diaphragm, with only minimal effect on ventilation. An increased PaCO₂ reduced hiccup frequency but left amplitude unchanged, a decreased PaCO₂ caused an increase in amplitude but did not influence instantaneous frequency.⁴ Of 220 patients with intractable hiccup, 92 per cent of the females were of psychogenic origin while 93 per cent of the males had organic disease.⁵ Numerous remedies have been advocated, but none is uniformly successful.⁶ Phrenic nerve injection and crush had been advised if medication is unsuccessful. Selective phrenic nerve block is difficult to perform even with the use of a nerve stimulator. The sympathetics, vagus and recurrent laryngeal nerves may be blocked inadvertently.⁷ This patient’s hiccups could have been due to gastric distention secondary to narcotic intake with irritation of the diaphragm, tumor infiltration, or radiation damage of the diaphragm or the phrenic nerve, transmural diaphragmatic esophagitis from the dexamethasone, metastatic brain lesion, or coronary heart disease with associated arteriosclerosis of the vessels to the medulla. It may also have been psychogenic in nature. We believe the marked decrease in use of narcotics by the patient probably contributed to termination of the hiccups.

A left phrenic nerve block in this patient with a non-functional right hemidiaphragm would have resulted in bilateral diaphragmatic paralysis. Bilateral phrenic blockade in healthy volunteers does not cause impairment of ventilation in the sitting position, although there is 25 per cent reduction in inspiratory capacity.⁸ Bilateral diaphragmatic paralysis in the supine position may produce orthopnea. The elevation of the diaphragm in the supine position causes a decrease in lung volume and increased stiffness of the lungs. These factors, along with the mechanical inefficiency of the paralyzed diaphragm against the increased pressure of the abdominal contents produces orthopnea.⁹ Our patient was confined to bed for his back pain and orthopnea could have been disabling. Orthopnea, and tachycardia from possible concomitant block of the vagus nerve could also have aggravated his angina. We elected not to block the phrenic nerve for these reasons.

It was surprising in this patient to find the left hemidiaphragm to be hyperactive on fluoroscopy, when the pathology was thought to be on the right side. Physical examination did not reveal the nonfunctioning nature of the right hemidiaphragm. Diminished breath sounds at the right lung base were ascribed to the presence of tumor. Without fluoroscopy, it is often difficult to determine whether both hemidiaphragms are affected and which nerve should be blocked.¹⁰ Fluoroscopy has been advised prior to phrenic nerve block in patients with intractable hiccups if they are not too ill.¹¹ This case demonstrates that sick patients also benefit from prior fluoroscopy. We believe fluoroscopy is indicated when performing phrenic nerve blocks to locate the hyperactive diaphragm, to ascertain the presence of function on the opposite side, and to check the success of the block.

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REFERENCES