PARALYSIS OF THE PHRENIC NERVE DURING BRACHIAL PLEXUS ANESTHESIA

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Received for publication September 11, 1948

In the earliest days of brachial plexus anesthesia, paralysis of the phrenic nerve was thought to be an unusual but serious complication of the procedure (1, 2, 3). The clinical descriptions of these cases, however, fit our present concepts of pneumothorax and in 1 case (3) no anesthetic solution had been injected because no paresthesias had been elicited. Härtel and Keppler (4), in 1913, showed that paralysis of the phrenic nerve was a frequent occurrence during brachial plexus block. Of 17 cases they studied by roentgenography and fluoroscopy at the termination of operation, 15 had diaphragmatic paralysis on the same side as the block. Since there has been no report on this subject in thirty-five years, it was thought that this problem should be reinvestigated.

At the level of the first rib, the phrenic nerve is separated from the brachial plexus by the scalenus anterior muscle. Higher in the neck, however, at the level of the fifth cervical vertebra, the phrenic nerve and the plexus occupy the same fascial compartment as they originate from the cervical nerves. Anesthetic solutions injected to anesthetize the brachial plexus can spread in the space between the scalenus anterior and medius muscles to anesthetize the phrenic nerve. This is probably the mechanism of such phrenic nerve involvement.

METHOD

Fifteen patients between the ages of 20 and 36 years were studied while undergoing operations during brachial plexus anesthesia. Anesthesia was instituted by various approaches using 30 cc. to 40 cc. of 2 per cent procaine hydrochloride in physiologic saline solution containing epinephrine in a concentration of 1:300,000. Roentgenograms of the diaphragmatic region were then taken during inspiration and expiration. It was necessary to instruct the patients how to breathe abdominally in order to produce maximum excursions of the diaphragm. If this was not done, little or no motion of either dome of the diaphragm was evoked.

RESULTS

The results are shown in table 1. It will be seen that 12 of 15 patients exhibited ipsilateral paralysis of the phrenic nerve as evidenced
TABLE 1

<table>
<thead>
<tr>
<th>Type of Block</th>
<th>Paralysis Present</th>
<th>Paralysis Absent</th>
</tr>
</thead>
<tbody>
<tr>
<td>SuprACLavicular, right</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Supraclavicular, left</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>InfrACLavicular, right</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>InfrACLavicular, left</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>12</strong></td>
<td><strong>3</strong></td>
</tr>
</tbody>
</table>

by failure of the diaphragm on that side to descend during inspiration. In every case this was asymptomatic and caused no difficulty whatsoever. Paradoxic motion of the diaphragm was discovered in 2 cases. The paralysis of the diaphragm appeared at about the same time as anesthesia of the brachial plexus, and lasted one and a half to three hours.

DISCUSSION

Paralysis of the diaphragm occurs frequently during brachial plexus anesthesia. It is harmless and asymptomatic. Indeed, it can only be certainly discovered by roentgenology. In the event that general anesthesia must be administered to a patient who has recently had a brachial plexus block, however, it must be remembered that half of the diaphragm is probably not functioning even through the original block was ineffective or has worn off. In such instances, intercostal paralysis should be avoided. Because of this diaphragmatic involvement, brachial plexus anesthesia is probably contraindicated in cases of emphysema, rheumatoid arthritis of the spine, dorsal kyphoscoliosis, and in other conditions in which the thoracic component of respiration is impaired.

SUMMARY

Paralysis of the phrenic nerve occurred in 12 of 15 patients during brachial plexus anesthesia. Phrenic nerve paralysis is a common but asymptomatic accompaniment of brachial plexus block. It is important only in certain special instances in which thoracic respiration is decreased.

REFERENCES