The Prognosis in Idiopathic Diaphragmatic Paralysis*

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In the practice of thoracology the physician occasionally encounters a patient having complete paralysis of one of the hemidiaphragms. In some of these cases a detailed history and careful examination of the neck, thorax, and abdomen fail to disclose the cause of the disorder; such cases may be classified conveniently as "idiopathic."

A number of possible etiologic factors have been advanced in efforts to explain the cause of idiopathic unilateral diaphragmatic paralysis. Bingham expressed the view that birth injury to the phrenic nerve is possible even without demonstrable injury to the brachial plexus. Couch reported five cases in which he believed the paralysis had resulted from antecedent pneumonia. Lieberman suggested a selective neuritis as the cause in some cases. Joannides described a primary inflammation of the diaphragm. Kahn cited the possibility of damage to central nuclei and to the paralyzing potentiality of neurotoxic infections or poisons.

Material and Methods

A survey of Mayo Clinic records of patients examined since 1935 yielded hundreds of instances of elevated hemidiaphragm not attributable to phrenic operations, but for the purpose of this study selection was limited to cases in which total paralysis had been demonstrated fluoroscopically. Fifty-nine cases satisfied these requirements; of these, 19 were set aside because of the existence of circumstances that reasonably could have been held responsible for the physiologic or anatomic disruption of one of the phrenic nerves. Such exclusions, with their numerical frequencies, are shown in the table. This group having been eliminated, our study was concerned with the remaining 40 cases, which could be considered examples of "pure" idiopathic diaphragmatic paralysis. Thirty-one of the patients were males, and 9 females. Their ages ranged from 11 months to 64 years, averaging 49 years. The paralysis was on the left side in 21 and on the right in 19.

Some kind of follow-up information was available from 35 (87 per cent) of the 40 patients. The intervals between the diagnosis and the latest observation ranged from 4 months to 19 years. These intervals exceeded 15 years in one instance (2.5 per cent), 10 years in 6 (15 per cent), 5 years in 16 (40 per cent), 2 years in 28 (70 per cent), and 1 year in 32 (80 per cent). Information as to the general state of health was available in 34 instances.

Opportunity to inspect a new roentgenogram of the chest and to compare it with older films was available in 27 instances, and in seven of the cases it was possible to re-examine the chest fluoroscopically. For purposes of analysis it was assumed that an unchanged roentgenographic appearance indicated no significant recovery of diaphragmatic function, and that a normal roentgenographic appearance indicated recovery of

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at least some degree of function on the affected side. It is possible that some of the patients whose films showed no change regained a degree of diaphragmatic function undetectable in so incomplete an examination as evaluation by roentgenographic means alone.

None of the traced patients died during the period covered by the study, though there were two deaths after the last observation, one allegedly due to a heart attack and the other of unknown cause.

Findings

Associated Symptoms and Conditions. — As it has been known that unilateral diaphragmatic paralysis may exist without significant impairment of respiratory function, it may not be surprising that among the 40 patients only four complained of exertional dyspnea at the time of the examination in which the paralysis was discovered. Other associated thoracic conditions were recurrent hiccough in one patient, allergic bronchial disease in two, auricular fibrillation in one, and paroxysmal tachycardia in one. One patient had idiopathic paralysis of the ipsilateral vocal cord and another had paralysis of the facial nerve on the same side and of the vocal cord on the opposite side. The other 29 patients had no symptoms and no associated findings of significance.

Health and Symptoms at Follow-up. — Among the 35 patients from whom information as to the state of health was available, 22 had no thoracic symptoms. Eleven reported significant exertional dyspnea, two reported recurrent thoracic pain, and one reported a sensation of pressure in the region of the affected hemidiaphragm. With the incomplete information available, it was not possible to determine whether any or all of these symptoms were results of the disorder of the diaphragm; but of the patients whose diaphragmatic function returned, only one complained of dyspnea.

New and Recent Roentgenologic Studies. — Among the 27 cases in which follow-up thoracic roentgenograms and sometimes fluoroscopic examination were available, no change in the height or function of the affected hemidiaphragm was discoverable in 18. The interval between diagnosis and last observation in this group ranged from 4 months to 14.7 years. In seven cases, with follow-up intervals ranging from 2 to 19 years, return of the diaphragm to normal position or function was evidenced by roentgenogram in four and by fluoroscopic appearances in two others. The seventh patient, last observed 4½ years after diagnosis, showed return of the affected hemidiaphragm to normal but marked elevation of the opposite hemidiaphragm, suggesting that he had re-
covered from his affliction only to have the same trouble develop later on the opposite side.

Beyond these 25 who clearly recovered or clearly did not, one patient, last observed at 2 1/4 years, exhibited the same elevation of the hemidiaphragm but with apparently normal respiratory excursion. One patient, last observed at 1 1/2 years, exhibited the same degree of elevation as before but with the diaphragmatic mobility estimated at 50% of normal. These last two cases of the 27 suggest that significant return of function is possible without return of the hemidiaphragm to its normal position, and they tend to invalidate the thoracic roentgenogram alone as a sufficient basis of follow-up study in cases of diaphragmatic paralysis.

Regarding the date and speed of onset of idiopathic phrenic paralysis the study yielded only meager information, though enough to indicate that at least some of the cases were acquired and not congenital. In one patient fluoroscopic examination 2 years before the date of diagnosis had showed partial paralysis of the diaphragm; in another, a thoracic roentgenogram made 1 year before the date of diagnosis had not demonstrated abnormality. These two cases, added to the seven that exhibited return of phrenic function, give a total of nine affording definite evidence that the paralysis was acquired.

In only 1 case did late examination reveal a thoracic disorder which had not been present at the time of diagnosis and which conceivably might have been related to the paralysis: a roentgenogram made 5 years after the diagnosis showed calcified paratracheal nodes on the same side as the paralysis in a male patient 44 years old.

**Treatment**

Since hemidiaphragmatic paralysis of undetermined origin usually is asymptomatic, efforts at treatment seem unnecessary. In one case of this series, regarded as idiopathic until explored, an operation was performed on a man of 50 to establish the cause of the paralysis and correct it if possible. Exploration of the phrenic nerve showed it to traverse a dense fibrotic mass. From this it was freed by dissection. Partial return of diaphragmatic function was noted during his convalescence, and the same incomplete but improved mobility was noted in a re-examination 2 1/2 years later. (This case is not included in the follow-up records).

**Comment**

Unexplained interruptions of nerve function — apparently similar to that assumed in idiopathic diaphragmatic paralysis — are noted also in cases of Bell's palsy and those of idiopathic paralysis of one of the vocal cords. Pickerill and Pickerill* have written that spontaneous recovery occurs in 75 to 90 per cent of cases of Bell’s palsy, but Huppler and associates1 found that the chance of spontaneous recovery of the voice after idiopathic paralysis of one of the recurrent laryngeal nerves is one in three. As mentioned, some degree of recovery eventuated spontaneously in nine of 27 traced cases of our series. The natural history of the three conditions seems sufficiently similar to suggest that their originating causes may be related.

**SUMMARY**

Forty cases of idiopathic diaphragmatic paralysis were studied in an effort to learn something of the permanence of the condition. Follow-up information was available in 87 per cent, including roentgenologic evidence in 68 per cent. None of the patients died or had serious illness during the period of observation, which ranged from 4 months to 19 years. Twenty-six per cent of the traced patients exhibited spontaneous return of the diaphragm to apparently normal function, as evidenced by re-examination after intervals ranging from 2 to 19 years. The findings indicate that idiopathic
diaphragmatic paralysis is a benign condition, and that without untoward associated findings unilateral idiopathic phrenic paralysis is seldom, if ever, a harbinger of serious disease. Further, the study suggests that in phrenic paralysis there is a likelihood of at least 25 per cent that complete or partial recovery of normal diaphragmatic function will occur spontaneously.

RESUMEN
Se estudiaron cuarenta casos de parálisis diafragmática idiopática tratando de averiguar algo sobre la permancia de esa parálisis. Se pudieron seguir en el 87 por ciento con evidencia roentgenológicamente en 68 por ciento. Ninguno de los enfermos falleció o tuvo enfermedad grave durante el período de observación que fué de 4 meses a 19 años. Veintiséis por ciento de los enfermos seguidos mostraron regresión espontánea de la función diafragmática aparentemente a lo normal, según se demostró al volverlos a examinar después de 2 a 19 años. Estos hallazgos indican que la parálisis diafragmática idiopática constituye una afección benigna y que, no habiendo otros hallazgos desfavorables asociados, la parálisis frénica rara vez si acaso es precursora de una enfermedad grave. Más aún, el estudio sugiere que en la parálisis frénica hay una posibilidad por lo menos de 25 por ciento de que se logre la recuperación completa o parcial de la función diafragmática, de manera espontánea.

RESUMÉ
40 cas de paralysis diaphragmatique idiopathique furent étudiés dans le but de tirer quelque enseignement de la longue surveillance de cet état. Des indications provenant de contrôles réguliers purent être utilisées dans 87% des cas, dont 88% contrôles radiologiquement. Aucun des malades ne mourut ou n'eut de maladie grave pendant la période d'observation qui s'étendit de 4 mois à 19 ans. Chez 26% des malades suivis on assista à un retour spontané de la fonction apparentement normale du diaphragme. Ceci fut mis en evidence par de nouveaux examens à des intervalles qui s'étageaient de 2 à 19 ans. Ces constatations font la preuve que la paralysis diaphragmatique idiopathique est un état bénin et que sans autres éléments associés, elle est rarement, et même pour ainsi dire jamais, le signe précurseur d'une affection grave. D'ailleurs, cette étude permet de penser qu'il est vraisemblable qu'au moins 25% des paralysies phréniques retrouveront spontanément de façon complète ou partielle une fonction diafragmatique normale.

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REFERENCES