ARTIFICIAL PNEUMOPERITONEUM IN THE DIAGNOSIS AND TREATMENT OF HIATUS HERNIA

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THE ANATOMY and physiology of the distal oesophagus is well established and the radiological boundaries of hiatus hernia are well defined so that uncertainty in diagnosis is now unnecessary. Nevertheless, correlation between the radiological evidence of hiatus hernia and the symptomatology is incomplete. Large hernias may exist with minimal or no symptoms; conversely, severe symptoms often accompany minor radiological changes.

The true incidence of hiatus hernia is unknown, and varies with the techniques employed and in the selection of patients. The radiological incidence varies from 1% to 2% (Kirkland and Hodgson, 1947), to 73.3% (Schatzki, 1932). Edmonds (1957) reports an incidence of 3.3%, Hafter (1958), 12.5% and Stein and Finkelstein (1960), 50% in 100 consecutive examinations in adults. It has been suggested that approximately half the patients with hiatus hernia are asymptomatic and in a further 25% there is often doubt as to whether the hiatus hernia is directly responsible for symptoms (Moersch, 1963).

Akerlund (1926) originally classified the radiological appearances into Type 1 — the congenitally short oesophagus and or with thoracic stomach; Type 2 — the para-oesophageal type; and Type 3 — the remainder, in which the distal variants may be accompanied by identical symptoms. Allison (1951) considered that sliding and para-oesophageal hernias gave rise to different symptoms and had a different prognosis. Barrett (1954) simplified the classification into (A) — sliding hiatus hernia; (B) — para-oesophageal hernia; (C) — mixed; and this appears a practical classification, though true para-oesophageal is probably rare, the majority of these being of the mixed type.

It is probable that the symptoms associated with hiatus hernia are produced by interference with the sphincteric mechanism at the distal oesophagus. Tumen, Stein and Schlansky (1960) graded their series of hiatus hernias according to the size and

extent of herniation, but after studying 300 cases of hiatus hernia by cinefluorography, Campeti, Geffen, Charles and Watson (1962), believed that the symptoms were related to the tone of the lower oesophageal sphincter. If the sphincter was hypotonic and overcome, oesophageal reflux would occur and this produced symptoms. If the sphincter was hypertonic then dysphagia could result. Such a classification, however, though functionally useful, presupposed that the symptoms were all due to oesophageal reflux and this is clearly an over-simplification. Symptoms may also result from congestive, ulcerative and inflammatory changes in the oesophagus or gastric loculus, early stricture formation, motor dysfunction of the oesophagus and a lower oesophageal ring.

The symptoms of hiatus hernia may be confused with those of peptic ulcer, biliary tract disease, or even cardiac disease, and in many cases though an anatomical defect may be demonstrated, the difficulty in establishing a diagnosis is so great that doubt is left as regards treatment. Palmer (1955) in correlating symptomatology with hiatus hernia found 17 distinct symptom-complex patterns and Clerf, Shallow, Putney and Fry (1950) in a group of cases diagnosed as hiatus hernia found, on completion of investigation, an error in diagnosis of 35% in 110 cases, in which the disease was confused with carcinoma, achalasia, peptic ulcer, myocardial disease and cholecystitis. This difficulty in diagnosis is, of course, compounded by the coincidental disease of these other organs, and may add to any symptoms already the result of hiatus hernia. Palmer emphasised the association of diseases sometimes described as 'Saints triad' (hiatus hernia, cholecystitis, diverticulosis coli), and found this association in 17% of 381 patients. When doubt existed as to which feature was responsible for symptoms, than a retrospective analysis of the results of treatment suggested that in these patients the least relief was obtained from cholecystectomy and the greatest satisfaction accrued from repair of the hiatus hernia. Edmonds found coincidental disease in 12% of 204 cases of hiatus hernia.

In this clinical dilemma some method of assessing the likely results of surgery would be valuable and

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a technique for predicting the outcome of surgery would clearly resolve many of the difficult problems. Under these circumstances, a method of imitating the end result of surgery might be expected to predict the value of operation and we have used artificial pneumoperitoneum in this respect.

Artificial pneumoperitoneum is a well-established method of treating pulmonary tuberculosis and has also been used as a pre-operative measure to stretch the abdominal wall prior to surgery for giant ventral hernia (Mason, 1956; Kootz and Graves, 1954). Maisel and others described the technique which we have used and its usefulness in the pre-operative preparation of patients undergoing total gastrectomy has been assessed (Weedon and Maisel, 1958; Maisel, Cooper and Glenn, 1956). They have also used it as an aid in the differential diagnosis where myocardial insufficiency and hiatus hernia have been confused (Maisel and Horger, 1956), and in the treatment of debilitated geriatric patients with hiatus hernia (1958). Berry, Holbrook, Langdon and Matthewson (1955) reported similar experiences in 10 cases of hiatus hernia with good results in nine, and the present report summarises the experience over a period of 12 years by one of us (BM) in the use of this technique for diagnosis and therapy in hiatus hernia.

Methods and Results

74 patients with hiatus hernia, irrespective of type, and associated diagnostic or therapeutic problems were studied at the New York Hospital

between 1950 - 1962, and of these 12 were examined using cinefluorography. The patients were divided into two groups:—

Diagnostic (Group A)

In 36 patients whose average age was 58 years, (the youngest 14 months and the oldest 85 years) artificial pneumoperitoneum was induced and the result noted. (Table 1). All had symptoms such as heartburn, belching, dysphagia, regurgitation, haematemesis, etc., which could be directly attributable to hiatus hernia. In many, radiological and other examinations provided evidence of associated lesions (cholelithiasis, diverticulitis, peptic ulcer, cardiac disease) and often there was considerable doubt as to the significance of the hiatus hernia in causing symptoms. In some cases artificial pneumoperitoneum was instituted after failure of the medical treatment. After artificial pneumoperitoneum, 21 patients were relieved of their symptoms and this was regarded as a positive test. All the patients were treated by operation, with satisfactory results in 20; one patient had a recurrence of the hernia eight months after operation. In 15 patients the artificial pneumoperitoneum had no effect on symptoms, a negative test, and in eight of these another diagnosis was subsequently made. (Table 1.) In seven cases, however, though reduction of the hernia had no effect on symptoms, no other cause was found.

Therapeutic (Group B.)

In 38 patients whose average age was 76 years, it was decided to assess the therapeutic value of artificial pneumoperitoneum for associated debilitating disease, principally cardio-pulmonary disease which made the elderly patients unsuitable for surgical treatment or in cases where surgery was refused. Treatment consisted of 850 - 1500 ml. of air given at intervals of two weeks, though sometimes treatment was interrupted for several months to assess the efficiency of the procedure. All

TABLE 1

74 PATIENTS TREATED WITH PNEUMOPERITONEUM

GROUP A.	GROUP B.
<p>36 Patients treated as a diagnostic test (Average Age - 58 years).</p> <ol style="list-style-type: none"> 21 Positive tests and hernioplasty performed: 20 are well 1 recurrent hernia with symptoms 15 Negative tests: <ol style="list-style-type: none"> 2 sustained coronary occlusions (one of these fatal) 1 retroperitoneal Hodgkin's disease 2 cancer of pancreas at autopsy 2 chronic cholecystitis and cholelithiasis relieved by cholecystectomy <ol style="list-style-type: none"> 10 year follow up 6 months follow up 1 cancer of stomach at autopsy 7 had no symptoms associated with hiatal hernia No cause found, even in retrospect 	<p>38 Patients treated without plan for hiatal hernioplasty (Vis-a-tergo poor in each). (Average age - 76 years)</p> <ol style="list-style-type: none"> 37 Patients were well during therapy 1 Patient requires continuous pneumoperitoneum (850 cc. of air) at 2 weekly intervals

forms of medical treatment were withheld during the therapy. In all cases the hernia was reduced with alleviation of the most distressing symptoms. All patients remained well and the only complications of treatment were temporary, including occasional epigastric distress, shoulder pain or vomiting which was alleviated by a mild sedative and subsided within two or three days. In one case, however, the artificial pneumoperitoneum was responsible for the precipitation of an inguinal hernia. One patient was maintained in this manner for six years. The initial pneumoperitoneum was induced in hospital and thereafter refills were carried out on an out-patient basis at the pneumoperitoneum clinic.

Discussion

These results show that the induction of an artificial pneumoperitoneum provides a useful diagnostic test in patients who suffer from hiatus hernia associated with other lesions, and where there is no doubt regarding the role of the hernia in contributing to the symptomatology. In all cases where the symptoms improved after artificial pneumoperitoneum, subsequent treatment of the hernia surgically showed excellent results except for one patient who had an early recurrence of the hernia. In contrast, half of the patients who failed to respond to artificial pneumoperitoneum were subsequently found to be suffering from associated disorders, not all of which were apparent at the time of the diagnostic test. There were seven patients, however, where the test was negative, but no other explanation of the symptoms could be found.

The efficacy of this diagnostic test is perhaps confirmed by the results of treatment in patients not considered suitable for surgery. The maintenance of artificial pneumoperitoneum in 38 patients has shown satisfactory results in all but one.

The technique is simple and safe and can be relied on to alleviate the most distressing symptoms. Moreover, artificial pneumoperitoneum has not produced clinically recognisable interference with cardiopulmonary function, nor has it complicated the operative and post-operative management of these patients. On the contrary, the great amount of space beneath the stretched and elevated left diaphragm may facilitate the repair of the diaphragm and manipulation of the stomach and oesophagus.

The anatomical and physiological effects of artificial pneumoperitoneum have been studied experimentally (Maisel, 1955). In dogs its main effects are an increase in the size of the peritoneal cavity and in the erect position an elevation of the diaphragm and a visceroptosis of the upper abdominal organs including the stomach. These effects result in a lengthening of the abdominal segment of the oesophagus, and so reinforces the continence of the sphincteric mechanism (Nagle and Spiro, 1961; Wolf, 1960). The increased intra-

FIG. 1. — The large para-oesophageal hernia has been reduced, the abdominal segment of the oesophagus lengthened, and the hernial sac stays filled with air.

abdominal pressure resulting from the artificial pneumoperitoneum may even cause an abnormally long delay in emptying of the oesophagus. This occurred in one of our cases and was relieved by the withdrawal of 300 ml. of air. After reduction of the hernia, the preformed peritoneal sac stays filled with air (Figs. 1 and 2).

A mechanism of the production of visceroptosis has been suggested by Banyai (1939). He measured a negative pressure in the immediate subdiaphragmatic portions of the diaphragm presumably as a result of the transmitted negative intrathoracic pressure. This negativity exerts an upward force on the upper abdominal organs. The artificial increase in intra-abdominal pressure will accumulate in the upper part of the abdomen in the erect or semi-erect position and neutralise the effects of this negativity and its upward force. The degree of visceroptosis and elevation of the diaphragm will depend on the phase of respiration, tonicity and integrity of the abdominal wall and diaphragm, size of the abdominal cavity, variable status of the lungs and pleura and the presence or absence of pleuro-pulmonary or peritoneal adhesion. There will of course be no hernial reduction if the hernia

FIG. 2.—Another case alleviated by pneumoperitoneum. Stomach in the normal position. Liver and spleen displaced downward. Abundant air under both diaphragms and in the hernial sac (outlined by arrows).

is incarcerated or peri-oesophageal adhesions are present.

Para-oesophageal and mixed type hernias are intraperitoneal. They will be more uniformly reduced than sliding hiatus hernias which have a small sac of peritoneum on the left side only. The right side includes the bare area of stomach and is devoid of peritoneum. In large sliding hiatus hernias, both sides will be covered by peritoneum and artificial pneumoperitoneum can be expected to relieve them (Fig. 3)

In the supine or prone positions, the air will move to the anterior and posterior abdominal walls respectively resulting in a return of the original negativity under the diaphragm. The increased positive abdominal pressure will then be a potent force in the return of the hernia to its original thoracic position. In addition, in the supine position the increased positive pressure will be transmitted to the hernia and if this force is sufficient to overcome the sphincteric mechanism, oesophageal reflux will result. The importance of the erect or semi-erect position in diagnosis or therapy by artificial pneumoperitoneum is thus emphasised.

FIG. 3.—Small sliding hernia partially reduced, but improvement of symptoms.

Summary

Artificial pneumoperitoneum affords an effective and safe method for the management of hiatus hernia in the aged and poor surgical risk patient and as a diagnostic and therapeutic test in the younger patient to distinguish between symptoms from cardiac, gall bladder and other gastro-intestinal disease from those due to hiatus hernia.

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