The Significance of Pleural Effusions as Indicating the Presence of Abdominal Disease*

A. H. AARON, M.D.** and LEON J. LEAHY, M.D.***
Buffalo, New York

About five years ago we were impressed by the frequency with which we were seeing individuals with abdominal distress in whom we found inflammatory, malignant, or nonmalignant lesions of the organs of the abdominal cavity, with or without ascites, and associated with the following physical signs at either base of the lungs:

1) Decreased tactile fremitus,
2) Impaired resonance to flatness, not altered by deep inspiration,
3) Increased resistance to the percussing finger in these areas,
4) Seldom was there any marked change in the breath sounds, except at times there was a slight diminution in their intensity,
5) There was no alteration in voice transmission, egophony was not present.

In the early cases that we saw we thought that these were produced by atelectasis due to the accumulation of intra-abdominal fluid elevating the diaphragm. But later on we found them in infectious or malignant lesions of the abdominal cavity in which only small amounts or no fluid was present in the abdomen.

For many years, on the medical service at the Buffalo General Hospital, Doctor Nelson G. Russell Sr. was doing many chest taps with vacuum tubes without any untoward results, and finding a high percentage of fluids in the pleural cavity in various conditions. It was his skill in interpreting these physical signs that led us to make these taps with so many positive results. This was being done well before the x-ray became so valuable in revealing the presence of fluid, and was based on the physical signs we have mentioned. It is generally recognized that fluid at the base and early atelectasis are difficult to distinguish from each other, and here the exploratory tap was of greatest value.

**Professor of Clinical Medicine, University of Buffalo.
***Associate Professor of Clinical Surgery, University of Buffalo.
Most textbooks state that it takes between 300 to 400 cc. of fluid to be present in the thoracic cavity to be recognized, and about 600 cc. in the abdominal cavity. We feel rather certain that we have been able to find smaller amounts of fluid present in both cavities, and proving their presence by abdominal or thoracic aspiration. With this background and the group of patients we have mentioned increasing in number, we performed more taps with positive results, and should like to present our methods of examination of the abdomen and chest, technique of collecting the fluid, the character of the fluids withdrawn, and their diagnostic significance.

**Physical Examination**

In all patients the well-known signs of fluid were sought for, and in many they were present. We found, though, that the following methods were valuable, and we believe have elicited one which may not have hitherto been emphasized. In our experience, it has been easier to demonstrate the presence of a medium amount of fluid in the abdominal cavity by having the patient stand for the performance of the fluid transmission wave. We believe that in the erect position the pelvic cavity is filled above the brim by a quantity of fluid which when the patient is supine fills the abdominal cavity without coming up far enough laterally to produce adequate fluid transmission or shifting dullness. Attention was called to this by Robert L. Pitfield, of Philadelphia, some years ago.

A physical sign that we have elicited in a number of these cases, where a large amount of fluid was present in the abdomen and a smaller or large amount was present in the left chest cavity, is demonstrated as follows: Placing the left hand on the anterior abdominal wall well down towards the pubic region and with direct percussion over the left thoracic cavity posteriory from the scapula down with the right fingers, when one reaches the level of the fluid in the chest cavity, the percussion impulse is transmitted through the fluid in the chest, through the diaphragm, through the abdominal fluid to the left palpating hand on the anterior abdominal wall. In other words, there is a continuous column of fluid which is an excellent transmitter of percussion waves. This has been of value in demonstrating fluid in both the abdominal and thoracic cavities. We have not elicited this sign as readily when the right chest cavity is involved, due, we believe, to the interposition of the liver.

**Method of Securing Fluids**

All of our fluids from the chest and abdomen have been secured by using the vacuum tube, or a 20 cc. syringe with a 16
to 18 gauge 1½ to 2 inch needle, straight or short bevel. We have withdrawn the peritoneal fluids with the patient in either the standing or sitting position. We have used ethyl chloride spray only for anesthesia purposes in securing fluids. In 104 pleural and 100 peritoneal aspirations we have had no accident due to injury to the lung, pleura or abdominal contents.

We have performed this abdominal tap just before surgery, and have investigated the peritoneal surfaces and the abdominal organs in the vicinity of the tap, and found no evidences of hemorrhage or trauma. Under these circumstances, we believe that it is not necessary to use a trochar to secure fluids for diagnostic purposes from the abdominal cavity. Even when fluid is not present in the abdominal cavity the insertion of a needle of this size and type has not been associated with trauma. In a personal communication from Dr. J. A. Bargen, he stated that following the injection of various vaccines to stimulate the peritoneal response in patients with ulcerative colitis they had not injured the intestinal canal.

In aspirating fluid from the left chest, and in the presence of ascites, one must be sure that the needle is inserted high enough
to be well above the level of fluid in the abdominal cavity so as to be certain we are not withdrawing fluid from the abdomen. In none of our cases did we find empyema present.

SELECTED CASE REPORTS

Inflammatory Lesions in the Abdomen Associated with Fluid in the Pleural Cavity and Combined Symptomatology

The presence of fluid in either pleural cavities is associated with fever, leucocytosis and an increased sedimentation rate when the etiological factor in the abdominal cavity is inflammatory in type. We should like to present the following case of this type to demonstrate these findings.

Case 1: A physician, 52 years old, had considerable distress and discomfort of five week's duration, in the left upper abdomen and pain in the left side at the costal margin, urinary frequency, pain in the left lower chest posteriorly not associated with respiration.

Physical examination revealed a temperature of 100°, pulse 83, respirations 22. There was tenderness over the left kidney, impaired resonance at the left base not altered by deep respiration, and a small amount of clear fluid was removed, which on culture and sedimentation studies was negative. White blood count, 12,100; 77 filaments; blood culture, negative; negative urine; negative urogram with skiodan.

X-ray examination of the chest: suggestion of an elevation of the left hemidiaphragm. A flat film of the abdomen revealed some bowing of the spine to the right and a disturbance in the psoas muscle shadow. The diagnosis was made of a perinephritic abscess close to the left diaphragm with fluid formation in the left pleural cavity due to inflammatory reaction beneath the diaphragm. Surgical drainage of the kidney area was done and a perinephritic abscess was found.

This was one of our first cases in which we correlated early the accumulation of fluid in the pleural cavity secondary to an inflammatory lesion beneath the diaphragm. Since this time, we have accumulated 6 cases of fluid in the right pleural cavity due to a subdiaphragmatic abscess secondary to a perforated peptic ulcer, post-cholecystectomy, ruptured appendix, and one due to amebiasis.

Right-Sided Pleural Effusion Secondary to a Right-Sided Subdiaphragmatic Abscess

Case 2: A young man of 34, had rheumatic heart disease with aortic insufficiency and duodenal ulcer. Two days previous to his admission to the hospital, he was seized with severe epigastric pain, nausea and emesis, with chills and fever and burning on urination. There was no diarrhea. He had not worked for one year previous, and had never been outside the city of Buffalo.

Physical examination by several examiners revealed tenderness in the mid-epigastrium, more marked over the liver, which was enlarged. He was slightly icteric. There was impaired resonance at the right base. An enlarged liver and spleen developed. The right hemidiaphragm showed
fixation, and there appeared to be a small amount of fluid in the right hemithorax.

The leucocyte count went to 38,000; 60 bands, 36 filaments; icteric index, 20; sedimentation rate, 50; Urinalysis was negative. A pleural tap showed the presence of a clear yellow fluid in the right hemithorax.

Hepatitis was considered as a possible diagnosis. With the appearance of fluid in the chest, which was removed, cultured and imbedded and found to be negative, a diagnosis of an inflammatory lesion beneath the right diaphragm with inflammatory response in the pleural cavity was made. Etiological source being undetermined, a ruptured peptic ulcer was suspected. Drainage of the abscess was instituted by the surgeon, a fistulous tract developed, and while under the observation of the surgeon, its persistence made him suspect that it might be due to amebiasis. He made the necessary studies and demonstrated the presence of motile amoeba in the drainage fluid, and a complete response was made to the administration of emetin.

Right-Sided Fluid Due to Perforated Peptic Ulcer

Case 3: A male, 56 years old, with a previous history of a peptic ulcer 25 years ago, and a resection of his caecum for a carcinoma 5 months previously entered the hospital complaining of severe epigastric distress which occurred very suddenly. The abdominal pain was described as being rather steady than sharp, it lasted for 1½ hours when he received a hypodermic injection of morphine. Vomiting of fluid and solid particles, and several loose stools were noted.

The immediate physical examination revealed a small amount of tenderness in the region of the scar of his resection. No diagnosis was made at this time, except consideration was given to acute gastroenteritis, perforated abdominal viscus was considered unlikely. Four days later diffuse epigastric abdominal tenderness was observed, and six days later it was noted that he had considerable hiccupping. There was limitation of motion of the right hemidiaphragm. Pleural friction sound was heard, and the diagnosis of diaphragmatic pleurisy was suggested. Flat films revealed no free air in the abdominal cavity. Physical examination at that time revealed impaired resonance at the right base with the possibility of fluid considered. Tap performed, and slightly cloudy yellow fluid was withdrawn. X-ray demonstrated partial obliteration of the costo-phrenic angle, some pleural thickening, some streaky atelectasis.

Fifteen days after admission a large subphrenic abscess was drained and subsequently, fluid was found at the right costo-phrenic sinus. The patient returned home in four weeks.

In 8 weeks he was re-admitted to the hospital, and he had definite evidence of dullness and a few rales at the right base. X-ray film showed an obliterative pleuritis as well as a definite fluid level between the liver and the diaphragm. Through the old incision, another small localized abscess was drained.

These three cases are examples of patients originally presenting symptoms of upper abdominal distress and discomfort associated with localized signs in the abdomen and chest, and representing an inflammatory reaction on the pleural surface of the diaphragm.
and the pleura covering the lung and an accumulation of fluid in the pleural space. Ochsner called attention in 1,380 cases of subdiaphragmatic abscess, pleurisy with effusion occurred in 388 on the affected side.

**Abdominal Fluid Associated with Benign Pelvic Tumors**

Woman, 71 years old, with increasing swelling of the abdomen in the past 5 years. Patient noticed a year previously, a sense of pressure and fullness in the lower anterior chest with marked exertional dyspnoea. Had gained 18 lbs. in the past three years; no cough. The abdomen showed definite distension with fluid; liver and spleen not palpable; fluid wave readily demonstrable with shifting dulness. Diagnostic abdominal paracentesis was done, and 50 cc. of clear yellow serum was secured. Examination of the fluid was negative for micro-organisms and malignant cells. Examination of the chest revealed impaired resonance of the left base, some distant coarse rales at both bases, a small amount of fluid was present in the left chest cavity. A firm irregular mass was present in the pelvis. An x-ray film of the chest was negative. The differential diagnosis lay between a malignant tumor of the pelvis with implants on the peritoneal surfaces and pulmonary metastases, or a benign tumor associated with ascites and hydrothorax. On opening the abdomen, 700 cc. of clear serous fluid escaped, and benign bilateral ovarian cystomas were removed.

In 1937 Meigs called attention to a group of cases in which ascites and hydrothorax was associated with fibroma of the ovary. In July 1943, in a subsequent article, he called attention to the fact that in 1937 Muriel B. McIlrath located a report by Lawson Tait, who in 1892 described a patient with left-sided hydrothorax and ascites associated with a large solid growth of the right ovary. The removal of this tumor resulted in a complete recovery. Tait states, "The striking result obtained in this case has gone a long way to confirm me in the advisibility of extending the principles of exploratory incisions in the abdominal disease to an almost universal application."

Since Meigs called attention to this syndrome, a number of these cases have been reported, and the emphasis has been placed upon the fact that the presence of a pelvic tumor and ascites and hydrothorax does not necessarily mean carcinoma in the abdomen with pulmonary metastases. Meigs stated that benign tumors of the ovary should be considered an etiological factor, and may cause a simultaneous collection of fluid in the abdominal and chest cavities.

Our patient represents a combined symptom complex of abdominal distress and thoracic distress with no evidence of vascular or pulmonary disease to account for it, with a small amount of effusion in the left chest and ascites, secondary to a benign tumor of the ovary.
In the complete discussion of the presence of fluid in the abdomen with dyspnoea, abdominal pain, and abdominal tumor, Meigs and others state that it is not known why fluid accumulates in the abdomen and pleural spaces. There is no inflammatory reaction in the abdomen or chest in these patients. Serum protein determinations in his cases and our own have been found normal to rule this out as an etiological factor, and there have been no cardiac or renal conditions present.

Pinner and Moerke, in a careful review of the etiology of pleural effusions, came to the conclusion that the pleura is highly permeable in either direction for the constituents of the blood, but were unable to offer from these findings why such an exchange occurred. Meigs demonstrated by the injection of carbon into the abdominal cavity containing ascitic fluid its rapid passage into the pleural cavity. He believes that the transmission is through lymphatic drainage.

In six cases of cirrhosis of the liver, and in five cases of ascites due to malignant implants on the peritoneal surfaces, fluid was present in the left hemithorax.

In many of the fluids in the abdomen due to a cardiac condition, fluid was present in the left hemithorax as well as in the right. Recently, McPeak and Levine have called attention to the ratio of this finding. Depending on the method considered, right hydrothorax predominated in from 56 to 89 per cent of cases and left hydrothorax in from 12 to 17 per cent. Fluid was equally distributed in 3 to 27 per cent.

Analysis of Cases with Fluid in the Pleural Cavity

By the performance of these taps we were impressed by the number of times we were able to demonstrate fluid in the left hemithorax with a minimal presence of physical signs. We found

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| TABLE 1 |
|-----------------|--------|
| **ETIOLOGY OF PLEURAL FLUIDS OTHER THAN TUMOR** |        |
| Arteriosclerotic Heart Disease | 15     |
| Tuberculosis | 6      |
| Rheumatic Heart Disease | 6      |
| Cirrhosis | 3      |
| Pneumonia | 2      |
| Post Operative Embolus | 2      |
| Nephritis | 2      |

One Each: Lupus Erythematosus, Ovarian Cyst, Post-Operative Effusion, Hemolytic Anemia, Over-Hydration, Chronic Lung Disease.
the X-ray findings of limited value. Sante called attention to the
difficulty in the interpretation of basal exudates of subphrenic
origin by X-ray film.

In this group of patients, we had 9 cases of cirrhosis of the liver,
3 of which were proven by postmortem, 6 proven clinically, with a
maximum amount of their symptoms and signs abdominal in
nature, but in three of whom pleural fluid was present in both
the left pleural cavity and abdominal cavity, and demonstrated
the fluid transmission sign. An analysis of these fluids for their
cellular contents failed to reveal the presence of any cells that
could be considered malignant. In 21 cases we were able to secure
positive pleural cellular findings, proven by surgery and biopsy
in 13, and by the clinical course in 8.

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<thead>
<tr>
<th>TABLE 2</th>
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<tbody>
<tr>
<td>PLEURAL SEROSAL IMPLANTS WITH EFFUSION</td>
</tr>
<tr>
<td>SOURCE</td>
</tr>
<tr>
<td>Breast ............. 2</td>
</tr>
<tr>
<td>Gallbladder .......... 1</td>
</tr>
<tr>
<td>Lung ............. 1</td>
</tr>
<tr>
<td>Leucosarcoma .......... 1</td>
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</tbody>
</table>

In one of these, the case of leucosarcoma, findings in the effusion
made the diagnosis unaided.

In breaking down our figures to show the types of tumor, the
following is the result:

<table>
<thead>
<tr>
<th>TABLE 3</th>
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<tbody>
<tr>
<td>TYPES OF TUMORS</td>
</tr>
<tr>
<td>No. of Cases</td>
</tr>
<tr>
<td>Primary Carcinoma of Lung ............. 22 ...... 9 (40%)</td>
</tr>
<tr>
<td>Carcinoma of the Breast ............. 16 ...... 4 (25%)</td>
</tr>
<tr>
<td>Lymphosarcoma of Lung ............. 8 ...... 4 (50%)</td>
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SUMMARY

1) In all cases of pleurisy with effusion the etiological factor
of an abdominal lesion must be considered.

2) Small amounts of fluid may be present in either pleural
cavity, and may be demonstrable only by physical signs and ex-
ploratory aspiration.

3) In a group of abdominal and thoracic taps, using a size 16
to 18 gauge 1½ to 2 inch needle, straight or short bevel, we have
had no untoward reactions, either local or general.
4) Five to ten cc. of fluid are adequate to demonstrate the presence of pathological cells.

5) The importance of the presence of fluid in the thoracic cavity with a nonmalignant mass in the abdomen must be emphasized.

6) The x-ray may show only a haziness at either base which is difficult to distinguish between a small amount of fluid, atelectasis, or pulmonary congestion, and aspiration may be the only method of proving the presence of effusion.

7) It is exceedingly rare for an inflammatory lesion in the chest to pass downwards through the diaphragm and involve the abdominal cavity.

8) We have presented a case of a Meigs' syndrome.

9) The increasing number of returned veterans with amebiasis involving the liver makes it necessary for us to remember it as an etiological factor of pleural effusion.

10) The gastroenterologist must carefully examine the thoracic cavity in many diseases involving the abdominal organs.

We are grateful to Dr. Dorothy Nagel Shaver, Dr. Charles F. Becker and Dr. Kornel Terplan for permission to use their pathological findings and to Dr. Joseph E. Macmanus for report on Amoebiasis case.

RESUMEN

1) En todo caso de pleuresía con derrame se debe considerar el factor etiológico de una lesión abdominal.

2) Pueden ocurrir pequeñas cantidades de líquido en cualquiera cavidad pleural y es posible demostrar su presencia solamente mediante los signos físicos y la punción exploratoria.

3) En un grupo de paracentesis abdominales y torácicas en las que se emplearon agujas de calibre 16 a 18, de 1½ a 2 pulgadas de largo, no se observaron reacciones contraproducentes, ni locales ni sistémicas.

4) De cinco a diez cc. de líquido son suficientes para demostrar la presencia de células patológicas.

5) Se debe recalcar la importancia de la presencia de derrame en la cavidad torácica con un tumor abdominal no maligno.

6) Es posible que la radiografía solamente muestre una leve sombra en una de las dos bases, la que es difícil de distinguir entre un derrame pequeño, atelectasia o congestión pulmonar, y la paracentesis puede ser el único método de comprobar la presencia de derrame.

7) Es sumamente raro que una lesión torácica inflamatoria pase a través del diafragma e invada la cavidad abdominal.

8) Hemos presentado un caso de síndrome de Meig.

9) El número creciente de veteranos de la guerra que han re-
Abstract

Significance of Pleural Effusions

Gresado con amibiasis que afecta al hígado nos obliga a recordar que este es un factor etiológico de derrames pleurales.

10) El gastroenterólogo debe examinar cuidadosamente la cavidad torácica en muchas enfermedades que afectan los órganos abdominales.

REFERENCES

4 Tait, Lawson: Medico-Chirurgical Trans., 75:109, 1892.