

Bulletin of the
University of Minnesota Hospitals
and
Minnesota Medical Foundation



Subphrenic Abscess

BULLETIN OF THE
UNIVERSITY OF MINNESOTA HOSPITALS
and
MINNESOTA MEDICAL FOUNDATION

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Address communications to: Staff Bulletin, 332M University of Minnesota Hospitals,
Minneapolis 14, Minnesota.

I.

UNIVERSITY OF MINNESOTA MEDICAL SCHOOL
CALENDAR OF EVENTS

Visitors Welcome

May 17 - May 22, 1948

No. 203Monday, May 17

- 9:00 - 9:50 Roentgenology-Medicine Conference; L. G. Rigler, C. J. Watson and Staff; Todd Amphitheater, U. H.
- 9:00 - 10:50 Obstetrics and Gynecology Conference; J. L. McKelvey and Staff; Interns' Quarters, U. H.
- 9:15 - Fracture Rounds; A. A. Zierold and Staff; Ward A, Minneapolis General Hospital.
- 10:00 - 12:00 Neurology Ward Rounds; A. B. Baker and Staff; Station 50, U. H.
- 11:00 - 11:50 Physical Medicine Conference; Vocational Rehabilitation in Minnesota; Ben R. Brainerd; E-101, U. H.
- 11:00 - 11:50 Roentgenology-Medicine Conference; Staff; Veterans' Hospital.
- 11:00 - 12:00 Cancer Clinic; K. Stenstrom and D. State; Eustis Amphitheater, U. H.
- 12:15 - 1:20 Obstetrics and Gynecology Journal Club; M-435, U. H.
- 12:50 - 1:20 Pathology Seminar; A Case of Schuller-Christian Disease; James Cardy; 104 I. A.
- 12:00 - 1:00 Physiology Seminar; Subject to be announced; William E. Petersen; 129 M. H.
- 12:30 - 1:50 Surgery Grand Rounds; A. A. Zierold, Clarence Dennis and Staff; Minneapolis General Hospital.
- 1:30 - 2:30 Pediatric-Neurological Rounds; R. Jensen, A. B. Baker and Staff; U. H.
- 2:00 - 3:00 Surgery Problem Case Conference; C. Dennis and Staff; Small Class Room, General Hospital.
- 4:00 - 5:00 Pediatric Seminar; The Excretion of Drugs and other Substances in Breast Milk; Ralph Papermaster; 6th Floor Seminar Room, U. H.
- 4:00 - 5:00 School of Public Health Seminar; Subject to be announced; Clarence Klaffen, Chief Engineer, Illinois State Health Department; 113 MeS.
- 5:00 - 6:00 Urology-Roentgenology Conference; D. Creevy and H. M. Stauffer and Staffs; M-109, U. H.

Tuesday, May 18

- 8:30 - 10:20 Surgery Reading Conference; Lyle Hay; Small Conference Room, Bldg. I, Veterans' Hospital.
- 9:00 - 9:50 Roentgenology Pediatrics Conference; L. G. Rigler, I. McQuarrie and Staff; Eustis Amphitheater, U. H.
- 10:30 - 11:50 Surgical Pathological Conference; Lyle Hay and Robert Hebbel; Veterans' Hospital.
- 12:30 - 1:20 Pathology Conference; Autopsies; Pathology Staff; 102 I. A.
- 2:00 - 2:50 Dermatology and Syphilology Conference; H. E. Michelson and Staff; Bldg. III, Veterans' Hospital.
- 3:15 - 4:20 Gynecology Chart Conference; J. L. McKelvey and Staff; Station 54, U. H.
- 3:30 - 4:20 Clinical Pathological Conference; Staff; Veterans' Hospital.
- 4:00 - 5:30 Surgery-Physiology Conference; O. H. Wangensteen and M. B. Visscher; Eustis Amphitheater, U. H.
- 4:00 - 5:00 Pediatric Rounds on Wards; I. McQuarrie and Staff; U. H.
- 5:00 - 5:50 Roentgenology Diagnosis Conference; L. G. Rigler and Staff of University Hospitals; Powell Hall Amphitheater.
- 5:00 - 5:50 Urology Pathological Conference; C. D. Creevy and Staff; Todd Amphitheater, U. H.

Wednesday, May 19

- 8:00 - 8:50 Surgery Journal Club; O. H. Wangensteen and Staff; M-515, U. H.
- 8:30 - 12:00 Neurology Rehabilitation and Case Conference; A. B. Baker and Joe R. Brown; Veterans' Hospital.
- 11:00 - 11:50 Pathology-Medicine-Surgery Conference; Diabetes; Myocardial Infarction; Pulmonary Emboli; O. H. Wangensteen, C. J. Watson and Staff; Todd Amphitheater, U. H.
- 4:00 - 5:00 Infectious Disease Rounds; Todd Amphitheater, General Hospital, Veterans' Hospital.

Thursday, May 20

- 8:15 - 9:00 Roentgenology-Surgical-Pathology Conference; Walter Walker and H. M. Stauffer; M-109, U. H.
- 8:30 - 10:20 Surgery Grand Rounds; Lyle Hay and Staff; Veterans' Hospital.
- 9:00 - 9:50 Medicine Case Presentation; C. J. Watson and Staff; Todd Amphitheater, U. H.

- 10:00 - 11:50 Medicine Ward Rounds; C. J. Watson and Staff; E-221, U. H.
- 10:30 - 11:50 Surgery-Radiology Conference; Daniel Fink and Lyle Hay; Veterans' Hospital.
- 11:00 - 12:00 Cancer Clinic; K. Stenstrom and D. State; Eustis Amphitheater, U. H.
- 11:30 - 12:30 Clinical Pathology Conference; Steven Barron, C. Dennis, George Fahr, A. V. Stoesser and Staffs; Large Class Room, General Hospital.
- 12:00 - 12:50 Physiological Chemistry Seminar; Secretion of HCl by the Stomach; Rex Neihof; 214 M. H.
- 1:00 - 1:50 Fracture Conference; A. A. Zierold and Staff; Minneapolis General Hospital.
- 4:00 - 4:50 Bacteriology Seminar; Subject to be announced; 111 MeS.
- 4:30 - 5:20 Ophthalmology Ward Rounds; Erling W. Hansen and Staff; E-534, U. H.
- 5:00 - 5:50 Roentgenology Seminar; Intravenous Cholecystography with Tetraiodophthalic Fluorescein; M. J. Smith; Powell Hall Amphitheater, U. H.

Friday, May 21

- 8:30 - 10:00 Neurology Grand Rounds; A. B. Baker and Staff; Station 50, U. H.
- 9:00 - 9:50 Medicine Grand Rounds; C. J. Watson and Staff; Todd Amphitheater, U.H.
- 10:00 - 11:50 Medicine Ward Rounds; C. J. Watson and Staff; E-221, U. H.
- 10:30 - 11:20 Medicine Grand Rounds; Staff; Veterans' Hospital.
- 10:30 - 11:50 Otolaryngology Case Studies; L. R. Boies and Staff; Out-Patient Department, U. H.
- 11:00 - 12:00 Surgery-Pediatric Conference; C. Dennis, A. V. Stoesser and Staffs; Minneapolis General Hospital.
- 11:30 - 12:50 University of Minnesota Hospitals General Staff Meeting; Malignant Lesions of the Anal Canal; Dr. William C. Bernstein; New Powell Hall Amphitheater.
- 12:00 - 1:00 Surgery Literature Conference; Clarence Dennis and Staff; Minneapolis General Hospital, Small Class Room.
- 1:00 - 1:50 Dermatology and Syphilology; Presentation of Selected Cases of the Week; H. E. Michelson and Staff; W-312, U. H.
- 1:00 - 2:50 Neurosurgery-Roentgenology Conference; W. T. Peyton, Harold O. Peterson and Staff; Todd Amphitheater, U. H.

Saturday, May 22

- 7:45 - 8:50 Orthopedics Conference; Wallace H. Cole and Staff; Station 21, U. H.
- 8:00 - 9:00 Pediatric Psychiatric Rounds; Reynold Jensen; 6th Floor West Wing, U. H.
- 8:00 - 9:30 Psychiatry and Neurology Grand Rounds; Staff; University Hospitals.
- 9:00 - 10:30 Pediatric Grand Rounds; I. McQuarrie and Staff; Eustis Amphitheater, U. H.
- 9:00 - 9:50 Surgery-Roentgenology Conference; O. H. Wangenstein, L. G. Rigler, and Staff; Todd Amphitheater, U. H.
- 9:00 - 9:50 Medicine Case Presentation; C. J. Watson and Staff; E-101, U. H.
- 10:00 - 11:50 Medicine Ward Rounds; C. J. Watson and Staff; E-221, U. H.
- 10:00 - 12:50 Obstetrics and Gynecology Grand Rounds; J. L. McKelvey and Staff; Station 44, U. H.
- 11:00 - 12:20 Anatomy Seminar; Some Points on Anomalies of the Central Nervous System, A. T. Rasmussen; Anatomical Basis of Prefrontal Lobotomy and Lobectomy, Ronald A. Dolan; 226 I. A.

II. SUBPHRENIC ABSCESS

Arnold J. Kremen
Donald J. Ferguson

The problem of subphrenic abscess presents a real challenge to the staff of the University of Minnesota Hospitals. During the years of responsibility for care of these cases by various members of the surgical staff, certain concepts of diagnosis and treatment have evolved and crystallized. It is the purpose of this report to review all of the cases of subphrenic abscess occurring in the University of Minnesota Hospitals during the ten year period antedating January 1, 1948, to study their records critically, and in the light of our experience to reaffirm or discard concepts of diagnosis and therapy depending upon how they bear up under the scrutiny of impartial analysis.

Historical Aspects

The first clinical diagnosis of subphrenic abscess and its complications is recorded in 1845 by Barlow¹, who reported a case of a 39 year old woman with a history of a perforated gastric ulcer, who went on to develop physical findings of amphoric respiration with metallic tinkles in the left chest. Barlow correctly surmised the sequence of events--ruptured ulcer, left subphrenic abscess with extension to the pleural cavity--and these were confirmed at autopsy. Leyden¹³ in 1879 described the differential diagnosis of subphrenic abscess from pyopneumothorax, laying particular stress on an antecedent history of abdominal disease. He reports the first treated case in whom at his insistence two liters of pus were drained by von Langenbeck. The patient subsequently died, but at post mortem examination the abscess was almost healed. In 1898 the now classical comprehensive review of the problem by Martinet¹⁴ appeared wherein he quotes the first case of subphrenic abscess to be cured by incision and drainage in 1895 by Debove and Remond.

In 1887 Lannelongue¹¹ described an extraserous approach to the subphrenic space through the bed of resected anterior costal cartilages. In 1905 Clairmont

and Ranzi⁷ described the anterior, subcostal, extraperitoneal drainage of subphrenic abscess and cautioned against the transpleural route of drainage unless empyema was already established. Barnard^{2,3} in 1908 clearly described the anatomy of the subphrenic spaces and warned against the common practice of attempted needling of abscesses for diagnostic purposes. He reported 12 unoperated cases, all of whom died, and a group of 64 operated cases, 37 per cent of whom died. In a thorough anatomical study of the costophrenic sinus, Melnikoff^{15,16} in 1923 has provided the anatomical foundation for extraserous drainage operations. Posterior extraserous drainage of subphrenic abscess through the bed of the twelfth rib was described in 1923 by Nather and Ochsner¹⁷. Ochsner^{19,20} stressed the importance for the posterior route through the bed of the twelfth rib, at the level of the first lumbar vertebra.

Anatomy

In this study anatomical relationships as outlined by Barnard^{2,3} have been followed. The falciform ligament divides the area into right and left compartments. These in turn are separated into anterior and posterior spaces by the liver and its attachments to the diaphragm. On the right, the anterior and posterior spaces communicate laterally. Inferiorly they also may communicate both anteriorly and posteriorly via the subhepatic space, although here there is no contact with the diaphragm. As was pointed out by Barnard, the right anterior space is considerably larger than the posterior space and extends up over the dome of the liver. Empirically one can state that large abscesses will almost uniformly involve the anterior space. On the left side, because the left lobe of the liver occupies only a small portion of the area and because its attachment to the diaphragm is more mobile than on the right, and because the stomach, spleen and splenic flexure of the colon also occupy the area, the boundaries are less definite. In general, one speaks of a left anterior space, anterior, lateral, and superior to the liver, which is accessible from the front, and a posterior space

occupying the confines of the lesser omental bursa. In addition to the intraperitoneal spaces described above, mention should be made of the extraperitoneal subphrenic space which corresponds to that area where the liver is in direct contact with the diaphragm, the so-called bare area of the liver.

Diagnosis

The diagnosis of subphrenic abscess is ordinarily not difficult if one is alert to its occurrence. Any patient having had an antecedent abdominal operation or inflammatory process who exhibits an unexplained temperature elevation should be suspected of having a subphrenic abscess. Temperature elevation to 102° or more was noted in 87 per cent of the cases studied. Leukocytosis over 12,000 was present in 80 per cent of the group. Table 1 reveals that diagnostic symptoms and physical findings are not consistent accompaniments of the disease, and if one waits for such expressions to alert him regarding the disease, he will be tardy in most cases and miss the diagnosis entirely in over half of the cases.

X-ray examination, on the other hand, has been an extremely valuable and reliable aid in establishing the diagnosis. Of special importance are upright chest films and over-exposed Bucky films, centering on the level of the diaphragm, taken in the anterior-posterior and lateral planes. Fluoroscopic studies to reveal diaphragmatic motion are also of considerable aid at times. In demonstrating suspected left subphrenic abscesses⁵, a swallow of thin barium followed by films taken in steep Trendelenburg position may demonstrate separation of the stomach (or residual gastric pouch in postoperative gastrectomy cases) from the diaphragm, suggesting an abscess in this area. Rarely the omentum may produce this sign. The characteristic findings have been an elevated, immobile or thickened diaphragmatic shadow, associated with obliteration of the costophrenic sinus by small pleural effusion. These findings in a febrile patient with a history of intra-abdominal disease justify surgical exploration. The presence of a gas bubble or fluid level beneath the diaphragm which can be demonstrated not to be within the

intestine is pathognomonic of the disease. It may arise from a communication with, or an antecedent perforation of, the intestinal tract, from gas forming organisms within the abscess, or from a previous laparotomy. The latter instance is not common after a week but may still be present up to 14 days. It should be borne in mind that on rare occasions the colon may ascend above the liver on the right, produce a gas shadow, and be confused with a subphrenic abscess. As will be noted in Table 2, some x-ray changes, although not necessarily pathognomonic findings, were noted in 99 per cent of the cases. One case failed to reveal any x-ray changes. This was an instance of liver abscess which shortly before death apparently perforated into the subphrenic space. However, no x-ray studies were made after the time of probable perforation. In 70 per cent of cases studied, x-rays revealed the combination of an elevated diaphragm, pleural effusion, and either gas or a mass beneath the diaphragm. Pleural effusion alone was noted in 71 per cent of our cases. Contrary to the report by Ochsner²⁰, who states that pleural effusion is a late sign of subphrenic abscess, in our series it has been one of the early x-ray changes to be noted. Our figure of 71 per cent of cases showing some pleural effusion is high in comparison to other reports by Hochberg¹⁰ of 36 per cent, and Doidge⁸ of 31 per cent. It may be that these authors did not include cases of minimal effusion evidenced by obliteration of the costophrenic sinus, which in our series was an early accompaniment of subphrenic abscess. In one instance pleural effusion was noted one day after the inciting etiologic agent, a perforated ulcer. The first evidence of pleural effusion appeared considerably earlier, when the known etiologic agent was gastrectomy or perforated ulcer, than when the etiologic agent was appendicitis. In 24 cases of postoperative gastrectomy that developed subphrenic abscess, 9 cases, or 27 per cent, exhibited pleural effusion by the sixth postoperative day, and 18 cases, or 75 per cent of cases, had definite pleural effusion by the twelfth postoperative day. The earliest onset of pleural effusion in the post appendicitis group was

the tenth day. Pleural effusion was noted principally in those cases where the abscess was in contact with the diaphragm, and as Beye⁴ has pointed out, the greater the area of diaphragmatic contact, the greater the chance of pleural reaction and extension. In the 4 cases of right subhepatic abscess where there was no diaphragmatic contact, no pleural effusion was noted. In 2 of these cases, however, the diaphragm was elevated. Also in the 2 cases of lesser bursa abscess, no pleural effusion occurred, although some elevation of the left diaphragm was observed in both instances.

Of interest in this regard is the persistence or disappearance of pleural fluid after surgical drainage, and its relation to adequate drainage. It is difficult to clarify this point because not all cases that improved directly after drainage got re-check chest x-rays to follow the course of the pleural effusion. Table 3 is presented to clarify this point. In 34 cases where evidence is available that the pleural fluid persisted or increased, 6 cases were apparently adequately drained, and 28 cases were inadequately drained. In 9 cases where the pleural fluid decreased or disappeared, 6 cases were clinically adequately drained, and 3 cases were inadequately drained. These data would suggest that disappearance of pleural fluid is suggestive of adequate drainage, whereas persistence or increase of the effusion is suggestive of inadequate drainage.

Treatment and Results

From Table 4 one notes the over-all mortality rate of subphrenic abscess during the ten year period to be 35 per cent. In this group there were 8 cases which were either hopeless, or in whom death was unrelated to the subphrenic abscess. These cases are listed in Table 5. Subtracting this latter group leaves a corrected over-all mortality rate of 29 per cent. Of the entire group of 100 cases, 37 already had an abscess or were developing one at the time of admission to the hospital. Four cases survived without operation, leaving their diagnosis open to question. However, in these the clinical and x-ray evidence was so characteristic that they are included

in the group. Post mortem examination was performed in 87 per cent, or 30, of the 35 deaths that occurred. Table 6 presents the mortality figures in relation to antecedent or etiologic disease. In our study the subphrenic group of abscesses secondary to perforated peptic ulcer was apparently the most benign. This may be the result, however, of greater awareness on the part of the staff of subphrenic abscess being a complication of perforated ulcer, and hence being diagnosed and treated earlier. During this ten year period, 1,121 gastrectomies of all types were performed at the University Hospitals. Of these, 24 cases, or 2.1 per cent, developed subphrenic abscess as a postoperative complication. As has been pointed out by Wangenstein²², most of these cases localize on the left side. In our group of 24 post gastrectomy subphrenic abscesses, 17 were on the left side, 5 on the right, and 2 were midline lesions. Of these 24 cases, 9 were associated with a demonstrable fistula communicating with the intestinal tract. Of the 9 post gastrectomy fistulae, 8 were on the left side, and 1 was on the right side.

Table 7 shows the over-all distribution of cases according to location. Because, from the data and records available on many of the cases, we were unable to differentiate anterior and posterior compartment infections, and because many seemed to involve both spaces, no attempt at segregation of spaces aside from right and left, and subphrenic and subhepatic has been made.

Table 8 shows the relation of mortality rate to location of the abscess. As will be noted, the left sided abscesses carried a 42 per cent mortality, whereas the right sided abscesses were associated with a 23 per cent mortality rate. This is in agreement with the report of Neuhof¹⁸, who reported in a series of 84 cases a 75 per cent mortality for left sided abscesses in comparison to 35 per cent mortality for right sided abscess. The reasons for these differences are several. Because the left lobe of the liver is considerably smaller and more mobile than the right lobe, the abscess must of neces-

sity, to become walled off, require many of the contiguous viscera, colon, spleen, and small bowel, to form part of its wall. This makes for multiloculation of the abscess. Also, fistulae from the abscess to the intestinal tract are more common on the left side, and drainage procedures may carry a greater risk of damage to adjacent viscera. In the entire group there were 22 cases associated with fistulae. Of these, 15 were on the left, 6 on the right, and 1 was associated with a bilateral abscess.

Table 9 presents data showing the relation of operation and type of operation to the mortality rate. As will be noted, the over-all mortality for all operated cases was 25 per cent, in comparison to a 64 per cent mortality rate in the unoperated group. Of even more importance to surgeons is the comparison of 14 per cent mortality rate for all extraserous operated cases, against 58 per cent for trans-serous drained cases. This comparison remains as true today, in the age of antibiotics, as when first pointed out in 1905 by Clairmont⁷. The best results in this series were in the group of 7 cases drained extraserously after resecting anterolateral segments of the 9th and 10th ribs, and dissecting beneath the diaphragm until the abscess was reached. This incision has the advantage of giving a more ready approach to high lying abscesses, and through it one can drain both anterior and posterior lesions. Also, it provides a shorter and more direct tract for drainage once the abscess is reached. However, it has the disadvantage of resulting in troublesome and often obstinate osteomyelitis or chondritis in residual ribs. For this reason we feel the Clairmont approach is probably preferable. Although such drainage violates an established principle of surgery by not providing constant dependent drainage, cooperative patients will spend long periods of time in the prone position, thereby avoiding the above mentioned objection. In 29 cases in which anterior extraserous drainage was first established, 5, or 17 per cent, subsequently required posterior drainage in addition. Of these, 4 were on the left side where, as mentioned earlier, abscesses are more difficult to drain and have a tendency to be multiloculated. This is to be compared to data

in Table 10 showing that for the entire group, 27 per cent of cases required multiple operations. In this regard it should be mentioned that patients with subphrenic abscess, even when adequately drained, may not become afebrile as rapidly as one might expect by comparison to drained, comparably sized pelvic or other intraperitoneal abscesses. In this study the average number of days from the first drainage operation until the patient was afebrile was 25 in the cases that recovered. In fatal cases death occurred on an average 21 days after the first drainage operation. In some of the cases upon whom multiple operations were done, the secondary operation did not uncover an additional abscess pocket but revealed only a chronic granulating bed in which earlier placed drains could be found. Such cases require a considerable period of time to resorb the extensive chronic granuloma that is present, during which time they may run a continual low grade fever. In cases in whom one cannot reach the abscess via the Clairmont approach, or should one fail to find an abscess by this means, the patient should be rolled over and explored posteriorly, according to the method of Ochsner²⁰. Transpleural drainage is dangerous. One should never expect the pleura in the costophrenic sinus to be sealed by the inflammatory process beneath the diaphragm even in a late stage of the disease.

Over the ten year period of this study, the group of cases divided itself fairly equally into thirds, with roughly one-third receiving no chemotherapy, one-third receiving sulfonamides, and the latter third of the cases receiving penicillin therapy. From Table 11 one notes that the mortality during these three periods has remained quite constant, suggesting that factors in addition to chemotherapy determine the eventual outcome. Evidence that penicillin is a worthwhile adjunct to therapy, however, is presented in Table 12. The group of cases associated with the highest mortality rate were those in whom a persistent fistula existed between the bowel and the abscess. The body can tolerate the insult of momentary soiling or contamina-

tion, but when this is continuous the resulting infection is often overwhelming and difficult to combat and control. In this study there were 22 such cases of which 17 died, or a mortality rate of 77 per cent. Dividing this group into those that received penicillin and those that did not receive penicillin, one sees the mortality reduced from 92 per cent to 60 per cent by penicillin therapy. The relatively large number of cases associated with fistula that occurred in the penicillin treated group explains why this group did not show up better in comparison to the other two groups in Table 11.

Complications

Complications of subphrenic abscess in addition to chronic sepsis and its related train of symptoms relate chiefly to upward spread of the process to involve the contents of the chest. Lemon and Higgins¹² demonstrated the absorption patterns of particulate matter injected beneath the diaphragm. It was picked up by lymphatics, carried through the diaphragm to the subpleural plexus of lymphatics, and thence to the substernal, paratracheal, and mediastinal lymph nodes. Paralysis of the diaphragm reduced the rate of absorption. The pleural covering of the diaphragm on the other hand did not absorb material injected into the pleural cavity and transport it in a retrograde fashion to the subphrenic area. Clinically, thoracic spread of subphrenic abscess is well documented by numerous reports^{4,8,9}, but the converse, or spread of empyema to subphrenic abscess, is rare. Beye⁴ reports only one such case in 337 cases of empyema, and Schwartz²¹ states he has never seen it in 150 cases of empyema. In addition to upward lymphatic spread of infection, extension to the pleural cavity by direct extension and perforation of the diaphragm may occur. Table 13 lists the thoracic complications in this series. Aside from pleural effusion, which is an early accompaniment of the disease, thoracic complications are usually late manifestations and are associated with neglected cases.

Summary and Conclusions

1. A report of 100 consecutive cases

of subphrenic abscess occurring during the ten year period antedating Jan. 1, 1948 is presented.

2. X-ray findings of elevated, immobile or thickened diaphragmatic shadow associated with obliteration of the costophrenic sinus by small pleural effusion have been an extremely reliable and valuable aid in establishing the diagnosis. These findings in a febrile patient with a history of antecedent abdominal disease or operation justify surgical exploration.

3. Pleural effusion in our experience has been an early accompaniment of the disease and at times has been instrumental in establishing the diagnosis. It was observed in 71 per cent of our cases.

4. The over-all mortality rate of the 100 cases was 35 per cent. In 8 of these deaths the situation was either hopeless, or death was unrelated to the subphrenic abscess. Subtracting this latter group leaves a corrected over-all mortality rate of 29 per cent. Those cases that had extraserous drainage of their abscess had a 14 per cent mortality rate, whereas in contrast those with trans-serous drainage suffered a 58 per cent mortality rate. This evidence should be added to the already overwhelming evidence in the literature to condemn trans-serous drainage of subphrenic abscesses.

5. Chemotherapy and antibiotic therapy have not materially altered the mortality from subphrenic abscess in this series, suggesting that factors in addition to chemotherapy determine the eventual outcome.

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Table I

SIGNS AND SYMPTOMS IN 100 CASES

| | |
|---|-----|
| Localized Tenderness in Area of Abscess | 47% |
| Localized Pain | 42 |
| Palpable Mass or Local Edema | 22 |
| Referred Pain in Shoulders or Neck | 19 |
| Hiccough | 5 |

Table II

X-RAY SIGNS IN 100 CASES

| | |
|---|-----|
| 1. Change in Diaphragm (Elevation, Thickening, Impaired Motion) | 93% |
| 2. Pleural Effusion | 71 |
| 3. Gas Bubble under Diaphragm | 67 |
| 4. Density at the Base of the Lung | 40 |
| 5. Mass under Diaphragm | 11 |
| 6. Cavity Demonstrated with Lipiodol (after drainage) | 11 |
| 7. Barium Meal or Enema Showing Displacement by Abscess | 4 |
| One or More of Above Signs Present | 99 |

Table III

RELATION OF PLEURAL EFFUSION TO ADEQUACY OF DRAINAGE OF SUBPHRENIC ABSCESS IN 43 CASES IN WHICH DATA WAS AVAILABLE

| | Adequate Drainage | Inadequate Drainage or No Drainage |
|--------------------------------------|-------------------|------------------------------------|
| Pleural Fluid Persisted or Increased | 6 cases | 28 cases |
| Pleural Fluid Decreased | 6 | 3 |

Table IV

MORTALITY IN 100 CASES OF SUBPHRENIC ABSCESS

| | Cases | Deaths | Mortality (%) |
|--------------------------|-------|--------|---------------|
| All Cases | 100 | 35 | 35 |
| Hopeless Cases | 8 | 8 | 100 |
| Corrected Group of Cases | 92 | 27 | 29 |

Table V

CAUSE OF DEATH IN 8 CASES WITH HOPELESS DISEASE
IN ADDITION TO SUBPHRENIC ABSCESS

| Case | Cause of Death |
|------|--|
| 1. | Ca. of Prostate with Rectovesical Fistula, Peritonitis, Pelvic and Subphrenic Abscesses. |
| 2. | Ca. of Esophagus with Metastases to Lungs, Liver, Etc. Small Subphrenic Abscess. |
| 3. | Generalized Peritonitis with Subphrenic Abscess, caused by Perforation of Gastroenterostomy Anastomosis in Patient with Unresectable Carcinoma of Stomach. |
| 4. | Pylephlebitis, Liver Abscesses, and Subphrenic Abscess Subsequent to Perforated Appendix. |
| 5. | Recurrent Ca. of Colon with Retroperitoneal Tumor Mass and Perforation into Small Bowel. Small Subphrenic Abscess Noted at Post Mortem. |
| 6. | Anastomosis of Esophagus and Duodenum to Colon, with Resection of Intervening Bowel for Carcinomatosis. Generalized Peritonitis and Subphrenic Abscess. |
| 7. | Died of Pulmonary Embolism 32 days after Drainage of Subphrenic Abscess. |
| 8. | Generalized Peritonitis and Subphrenic Abscess. Perforation of Cecum Following Gall Stone Obturation Obstruction of Sigmoid Colon. Leukemia. |

Table VI

MORTALITY IN RELATION TO ETIOLOGY
OF SUBPHRENIC ABSCESS

| Etiology | Cases | Deaths | Mortality (%) |
|--------------------------------------|-------|--------|---------------|
| Appendicitis | 13 | 5 | 38 |
| Biliary Tract Disease | 8 | 4 | 50 |
| Perforated Gastric or Duodenal Ulcer | 21 | 4 | 19 |
| Postoperative | 46 | 16 | 35 |
| Gastrectomy | 24 | 10 | 42 |
| Other Operations | 22 | 5 | 27 |
| Other Diseases | 12 | 6 | 50 |

Table VII

LOCATION OF SUBPHRENIC ABSCESS
IN 100 CASES

| Site | % |
|-------------------------|----|
| Right Side | 61 |
| Superior | 57 |
| Inferior (Subhepatic) | 4 |
| Left Side | 34 |
| Superior | 32 |
| Inferior (Lesser Bursa) | 2 |
| Bilateral | 2 |
| Midline | 3 |

Table VIIIRELATION OF MORTALITY TO LOCATION
OF ABSCESS IN 92 CASES

| Site | Cases | Deaths | Mortality (%) |
|------------|-------|--------|---------------|
| Right Side | 56 | 13 | 23 |
| Left Side | 31 | 13 | 42 |
| Midline | 3 | 0 | 0 |
| Bilateral | 2 | 1 | 50 |

Table IXMORTALITY IN RELATION TO TYPES OF DRAINAGE
OF SUBPHRENIC IN 92 CASES

| Type of Operation | Cases | Deaths | Mortality (%) |
|---------------------------------------|-------|--------|---------------|
| No Operations | 11 | 7 | 64 |
| All Operations | 81 | 20 | 25 |
| Clairmont | 19 | 2 | 11 |
| Ochsner | 13 | 2 | 15 |
| Extraserous Rib or Cartilage Resected | 7 | 0 | 0 |
| Two Incisions, Both Extraserous | 6 | 1 | 17 |
| Transpleural | 7 | 4 | 57 |
| Two or More Operations | | | |
| Extraserous | 9 | 2 | 22 |
| Trans-Serous | 8 | 6 | 75 |
| Transperitoneal | 4 | 1 | 25 |
| Drained Throth Original Incision | 5 | 1 | 20 |
| Missed Abscess | 2 | 1 | 50 |
| Unstated | 1 | 0 | 0 |
| All Extraserous Operations | 59 | 8 | 14 |
| All Trans-Serous | 19 | 11 | 58 |

Table X

MULTIPLE DRAINAGE OPERATIONS IN THE 85 CASES THAT WERE OPERATED ON FOR SUBPHRENIC ABSCESS (COMPUTED FROM TOTAL GROUP OF 100 CASES)

| | Cases | % of 85 |
|---|-------|---------|
| Total Cases Requiring Multiple Operations | 23 | 27 |
| Two Operations | 19 | 22 |
| Three Operations | 3 | 4 |
| Four Operations | 1 | 1 |

Table XI

RELATION OF MORTALITY TO CHEMOTHERAPY IN 92 CASES WITHOUT HOPELESS DISEASE

| Chemotherapy | Cases | Deaths | Mortality (%) |
|--------------|-------|--------|---------------|
| None | 29 | 9 | 31 |
| Sulfonamide | 31 | 9 | 29 |
| Penicillin | 32 | 9 | 28 |

Table XII

MORTALITY IN CASES WITH PERSISTENT FISTULA BETWEEN BOWEL AND ABSCESS

| | Cases | Deaths | Mortality (%) |
|------------------------------------|-------|--------|---------------|
| All Cases | 22 | 17 | 77 |
| Postoperative Cases | 15 | 10 | 67 |
| All Cases Receiving Penicillin | 10 | 6 | 60 |
| All Cases Not Receiving Penicillin | 12 | 11 | 92 |

Table XIII

INCIDENCE OF THORACIC COMPLICATIONS IN 100 CASES OF SUBPHRENIC ABSCESS

| Complication | % of Cases |
|-----------------------------------|------------|
| Any Type of Thoracic Complication | 83 |
| Pleural Effusion | 73 |
| Empyema | 13 |
| Pneumonia | 7 |
| Perforation of Diaphragm | 6 |
| Lung Abscess | 5 |
| Bronchopleural Fistula | 4 |
| Pericarditis | 1 |

III. MEDICAL SCHOOL NEWS

J. B. Johnston Lecture in Neurology

Dr. David P. Lloyd, of the Rockefeller Institute for Medical Research, will give the annual J. B. Johnston Lecture in the Medical Sciences Amphitheater at 8:00 p.m. on May 19, 1948. His subject will be "Monosynaptic Reflexes and the Myostatic Unit." He will also give a lecture at the Center for Continuation Study on May 20.

The Johnston Lectureship was established in 1944 in honor of John Black Johnston, former professor of Comparative Neurology. Dr. Johnston served on the faculty of the Medical School as professor of Neurology from 1907 to 1916 when he became Dean of the College of Science, Literature and Arts. He died in 1939. The lectureship was established by his wife as a memorial to Dr. Johnston. Dr. Lloyd is the fourth distinguished scientist to be brought to our campus to deliver this lecture.

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Medical Grand Rounds

Medical Grand Rounds is another weekly meeting of the University of Minnesota Hospitals to which all interested physicians are cordially invited. Every Friday at 9:00 a.m. the meeting is held in the Todd Amphitheater. Two cases which present diagnostic or therapeutic problems are related in some detail. X-ray findings are presented and discussed by Dr. Rigler or one of

his associates. Significant electrocardiographic tracings are shown with the opaque projector and microscopic slides of biopsy specimens are shown on the screen. Following the presentation of the clinical findings the medical fellow in charge of the patient gives a brief discussion of the special problems involved. A review of recent pertinent medical literature is included. Following the medical fellow's presentation the discussion is thrown open to the entire group. Both the full time and part time staff members give their opinions and their experiences in similar cases. Members of the pre-clinical departments are frequently invited to attend and discuss problems in which they are particularly interested. All general physicians and internists should find these meetings stimulating and informative.

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Dr. Wesley Spink Honored

The Society for Clinical Investigators elected Dr. Wesley W. Spink, Professor of Medicine, to its presidency at its recent meeting in Atlantic City. In addition to the usual administrative duties of this office, Dr. Spink will deliver the presidential address at the 1949 meeting of the Society.

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