ACUTE APPENDICITIS

A STATISTICAL STUDY

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Three hundred and thirty cases of acute appendicitis, acute appendicitis with abscess and acute appendicitis with perforation were studied. These cases were admitted to the State of Wisconsin General Hospital between January 1, 1932 and January 1, 1936. The following chart shows the distribution of cases:

Acute appendicitis	277
Acute appendicitis with abscess	21
Acute appendicitis with perforation	32
Total	330

SEX: The disease appears by this small series to be slightly more common in males. The incidence of appendicitis with perforation is considerably higher in males, being 25 to 7, according to our figures. The death rate in males was more than twice that in females. No reasons were apparent from the study of the records.

	Males	Males-Deaths	Females	Females-Deaths
Acute appendicitis	159	4	118	2
Acute appendicitis with abscess	11	2	10	1
Acute appendicitis with perforation	25	9	7	3
Total	195	15	135	6

AGE: The following chart shows the age incidence in decades. 71.48 per cent of the acute cases occurred in the second and third decades with a gradual reduction through the seventh decade. Only 2.52 per cent occurred in the first decade. 52.4 per cent and 59.375 per cent of those with abscess and perforation respectively occurred in the second and third decades but far greater percentages in the first decade (14.3 and 15.625 per cent) as

compared with simple acute cases.

	Acute appendicitis	with abscess	with perforation
0-10	2.52%	14.3%	15.625%
10-20	35.74	38.1	31.25
20-30	35.74	14.3	28.125
30-40	12.64	14.3	3.125
40-50	6.5	9.5	6.25
50-60	4.69	9.5	3.125
60-70	2.17		9.375
70-80			3.125

SEASONAL VARIATION: The following chart shows that no significant variance exists regarding the time of year admitted.

	Acute appendicitis	with abscess	with perforation
January	35	0	2
February	25	2	1
March	20	2	4
April	22	0	1
May	21	1	4
June	26	2	1
July	19	2	3
August	20	4	9
September	23	2	2
October	24	0	3
November	20	3	2
December	22	3	0

DAY OF DISEASES: 42.12 per cent of all cases entered the hospital on the first day of their disease, 13.33 per cent on the second day. It is of importance that the remainder of the cases were not hospitalized until after several days had elapsed. In fact, thirty cases of acute appendicitis, three with abscess and three with perforation were not admitted until more than fourteen days after the onset of the disease. Surprisingly only one of these cases (acute appendicitis with perforation) succumbed.

	Acute appendicitis	with abscess	with perforation
1st day	120	8	11
2nd day	34	1	9
3rd day	19	1	2
4th day	14	1	1
5th day	4	1	1
6th day	3	4	0
7th day	13	1	2
8th day	0	0	1
9th day	1	0	0
10th day	5	1	0
11th day	2	0	0
12th day	1	0	0
13th day	2	0	0
14th day	16	0	2
More than 14 days	30	3	3
Questionable	13	0	0

PREVIOUS ATTACKS: Approximately one-half of the cases suffered previous attacks. No relationship appears to exist between previous attacks and death for only four of the twenty one cases that died gave histories of previous attacks. No relationship is apparent between previous attacks and incidence of abscess formation or perforation.

	One to many attacks	Questionable	No attacks
Acute appendicitis.....	131	47	99
Acute appendicitis with abscess.....	12	0	9
Acute appendicitis with perforation.....	12	1	19
Total	155	48	127

SYMPTOMS: Right lower quadrant pain, generalized abdominal pain, nausea, vomiting and epigastric pain were the most frequent symptoms charted, as the following chart will show.

	Acute appendicitis	with abscess	with perforation
Nausea	62	9	10
Vomiting	61	13	26
General abdominal pain	83	11	22
Epigastric pain	44	2	0
Right lower quadrant pain	218	14	22
Left lower quadrant pain.	9	0	0
Diarrhea	17	2	5
Constipation	5	0	0
Dysuria	5	0	1
Dysmenorrhea	4	0	0
Gas	2	0	2
Chills	16	0	2
Mass noticed	1	0	2
Anorexia	3	0	0
Headaches	4	0	1
Cough	2	0	0
Sore throat	1	0	0
Urinary frequency	3	0	0
Jaundice	2	0	0
Fainting	2	0	0
Hemoptysis	3	0	0
Trauma to abdomen	4	1	1
Indefinite	0	1	0

PHYSICAL SIGNS: Right lower quadrant tenderness, McBurney's point tenderness, spasm and rigidity were the most common signs recorded. A palpable mass was considerably more common in cases with abscess and with perforation than in simple acute appendicitis.

	Acute appendicitis	with abscess	with perforation
General tenderness	18	2	5
Rt. lower quadrant tenderness.	140	10	19
McBurney tenderness	138	6	9
Lt. lower quadrant tenderness..	5	1	0
Spasm	89	14	13
Rigidity	66	9	17
Rebound tenderness	13	2	8
Mass, rt. lower quadrant	13	10	10
Mass, lt. lower quadrant	4	0	0
Hyperesthesia	13	0	0
Distention	13	1	5
Toxicity	4	0	0
Legs flexed	4	0	0
Dehydration	3	0	0
Hypoactive peristalsis	0	3	0

	Acute appendicitis	with abscess	with perforation
Visible peristalsis.....	0	1	0
Shifting dulness.....	0	1	1
Fulness right lower quad.	0	2	1
Indefinite.....	3	0	0

CATHARTICS: A definite history of catharsis was obtained in 57 cases, or 17.27 per cent. Of those patients taking cathartics 12.28 per cent died as compared with the general mortality of 6.36 per cent. Of those who took cathartics 24.55 per cent had perforated appendices, which is more than two and one-half times the general perforated average of 9.69 per cent. These figures agree in general with those of other statistics and show the great effect of cathartics upon the seriousness of the disease and its mortality.

	Acute Appendicitis	Acute Appendicitis with abscess	Acute appendicitis with perforation	Total all Cases
Total - all cases.....	277	21	32	330
Had cathartics.....	38	5	14	57
No cathartics.....	239	16	18	273
Cathartics with death.....	0	1	6	7
Cathartics with no death....	38	4	8	50
No cathartics with death....	6	2	6	14
Total deaths.....	6	3	12	21

DIAGNOSIS: The admission diagnosis is compared with the pathological diagnosis to give the statistics for the accompanying chart. We have considered only acute, acute with abscess and acute with perforation, including subacute and acute gangrenous under the term acute appendicitis. Thus in 277 cases of acute appendicitis the clinicians agreed with the pathologists in 76.9 per cent of the cases. In 61 cases of those classified as incorrect

diagnoses, there was essential agreement. Thus in only two cases was there gross disagreement. Therefore, the diagnostic error in the cases of acute appendicitis was but 0.72 per cent. In the 21 cases with abscess there was agreement in 76.19 per cent. In four cases the abscess was not diagnosed until operation. In one case adhesions present led the clinicians to believe an abscess had formed. 90.625 per cent of the diagnoses on those cases with perforation were correct. One case was confusing so that a renal calculus was considered along with acute appendicitis. Two cases diagnosed as acute appendicitis proved at operation to be perforated.

	Correct	Incorrect
Acute appendicitis.....	76.9%	23.1%
Acute appendicitis with abscess.....	76.19	23.81
Acute appendicitis with perforation....	90.625	9.375

In 53 cases diagnosed as acute appendicitis histological sections revealed chronic appendicitis. Eight cases diagnosed as chronic proved to be acute appendicitis. In one case a normal appendix was found. In one case diagnosed as chronic inflammatory pelvic disease, in operation an acute appendicitis was revealed.

In 4 cases diagnosed as acute appendicitis an abscess had formed. In one case diagnosed as acute appendicitis with abscess an acute appendicitis with adhesions was found.

Two cases diagnosed acute appendicitis had at operation perforated appendices. One case diagnosed as renal calculus was an acute appendicitis with perforation.

TREATMENT AND MORTALITY: The forms of treatment are classified as immediate operation, conservative and conservative with operation later. Those receiving the latter form had their operation any time from one day to several weeks after admission. Some patients were sent home to return a few months later for operation.

	No. of Cases	No. of Deaths	Percentage Death
Acute appendicitis:			
Immediate operation	153	3	1.96
Conservative	31	1	3.22
Conservative with operation later	93	2	2.15
Total	277	6	2.76
Acute appendicitis with abscess:			
Immediate operation	0	0	0
Conservative	14	0	0
Conservative with operation later	7	3	42.85
Total	21	3	14.28
Acute appendicitis with perforation:			
Immediate operation	6	3	50.00
Conservative	18	8	44.44
Conservative with operation later	8	1	12.50
Total	32	12	37.50
Total all cases:	330	21	6.36

The reasons for conservative treatment in those cases of acute appendicitis were upper respiratory infection (by far the chief cause), pyelonephritis, massive collapse of the lung, alcoholism, pulmonary tuberculosis, scarlet fever and severe distention.

CAUSES OF DEATH: These cases are simply the usual run of cases admitted to any state or charity hospital. Private, Clinic and State Patients are included in this group, but by far the greatest number are Clinic and

State cases. Many of the people were required to travel two to three hundred miles for care. It is of interest that two patients were in uremic coma on admission. One developed appendicitis while being treated for a muscular dystrophy. He died of this rather than appendicitis. In one case an adenocarcinoma of the cecum was discovered at operation for appendicitis. Following the scheme above the individual deaths are summarized.

Acute Appendicitis:

Immediate operation.
1. Developed general peritonitis two days postoperatively
2. Bilateral massive collapse
3. Pseudo-hypertrophic muscular dystrophy - appendicitis incidental while in hospital.

Conservative treatment.
1. Broncho-pneumonia - died in nine days
2. Cardiac decompensation

Conservative treatment with operation later.
1. Patient had an ileus - operated on fourth day - developed uncontrollable distention
2. Cardiac decompensation on admission - operated on second day - developed general peritonitis.

Acute Appendicitis with Abscess:

Conservative with operation later.
1. Patient refused immediate operation - developed an abscess. Twelve days later operated because was going bad. Then developed subdiaphragmatic abscess and right empyema.
2. Uremia on admission - operated on ninth day because going bad - died in uremic coma.
3. Retroperitoneal abscess drained - developed septicemia.

Acute Appendicitis with Perforation:

Immediate operation.
1. Developed subphrenic abscess
2. Uremic coma and death
3. Generalized peritonitis

Conservative.
1. Seven patients developed generalized peritonitis two of which also had broncho-pneumonia and one a pyothorax.

2. Septicemia with multiple abscess formation.

Conservative with operation later.

1. Atypical case which proved to be an adenocarcinoma of the cecum.

MORBIDITY: The following chart shows the length of time spent in the hospital. The apparently great number of acute appendicitis cases confined for more than twenty days is accounted for in that many developed their appendicitis while being treated for something else. Others developed complications such as pneumonia, scarlet fever, urinary tract infections and so forth, making their stay longer. Then, too, many patients were treated conservatively for several days and then operated. The average length of time for all patients was 17.1 days. For acute appendicitis the average was 15 days. For appendicitis with abscess the average was 26.5 days and with perforation, 23.6 days. These figures are of little significance because of the comparatively few cases under consideration and the fact that several died shortly after admission.

Days	Acute Appendicitis	Acute appendicitis with abscess	Acute appendicitis with perforation
Under 8	25	0	8
8	9	0	3
9	25	1	1
10	21	0	0
11	18	0	1
12	13	1	0
13	22	0	0
14	18	0	0
15	14	1	0
16	17	1	0
17	11	2	0
18	14	1	0
19	8	0	0
20	3	1	1
Over 20	60	13	18

REVIEW OF LITERATURE: Summarizing the forms of treatment we find that all agree that immediate operation is in order when the pathology still remains within the appendix. The real problem arises when the pathology has gone through the wall of this viscus and set up its inflammatory processes in adjacent structures. Here the opinion varies a great deal. At the Wisconsin General Hospital the conservative treatment of Ochsner is used in such cases. Our figures show the results.

Ochsner[1] states in his Surgical Diagnosis and Treatment that we should remember "every case of appendicitis should be operated before the infection has had time to penetrate the wall of the viscus." It will be well to recall this as we discuss further the treatment. The well known quotation of Sir William Osler that "the general practitioner does well to remember - whether his leanings be towards the conservative or the radical methods of treatment - that the surgeon is often called too late, never too early," should also be kept in mind. If such teachings were more closely followed we would have little more to consider. However, the various treatments are still discussed and have their proponents and opponents.

Horsley[2] in his recent text (1937) tells of his treatment. He prefers to operate all cases immediately, closing those that are uncomplicated. Those with abscess and peritonitis he drains leaving the wound open. His report of 669 consecutive cases operated upon with only four deaths is quite remarkable. Even these deaths are accounted for; one being a pulmonary embolus, two neglected cases and one an elderly man with a perforated retrocecal appendix of several days duration when admitted. He stresses postoperative treatment. Not many, if any, have been as fortunate with this

treatment. Most authors report quite high death rates.

In contrast to Horsley's opinion, Bower[3], of Philadelphia, in an interesting study says a good rule to follow when in doubt as to what to do is "wait. Take the pulse rate and temperature every hour and the leucocyte count every four hours to determine the management. To operate in the presence of a spreading peritonitis invites catastorphe. The day has passed when an intelligent surgeon interferes with nature's localization of a skin or subcutaneous infection by making incisions over lymph channels that are clearly delineated by their redness. The patient is given an opportunity to immunize himself against the infection and when the temperature and pulse rate have subsided, the lymphangitis has disappeared and the abscess is well walled off, a small opening is made in the center for drainage. The management of general peritonitis is identical; one cannot see what takes place; there is only a slight indication of the extent of the pathologic process; how the patient reacts tells a great deal more."

A report by Stanton[4] of 1,004 acute cases of which 113 had well marked peritonitis seems to confirm Bowers' statements. Thirty one of the 113 were operated on immediately with a mortality of 42 per cent. Eighty two were treated by Ochsner's conservative method with a mortality of but 8.5 per cent.

Love[5], of London, found that with expectant treatment 65 per cent resolved with the subsequent mortality under one per cent, and twenty five per cent formed local abscess with a mortality of 4.5 per cent. In the remaining 10 per cent expectant treatment was abandoned with a mortality of 6 per cent. Thus he compares the average mortality with expectant treat-

ment of 3 per cent with that observed when immediate operation was performed of 5.8 per cent.

From the Year Book of General Surgery of 1935[6] a summary of recent data from the literature gave the following report:

	Cases	Deaths	Death Rate
Operated upon first day of attack.....	1,507	20	1.3
Operated upon second day of attack.....	912	33	3.6
Operated upon third day of attack.....	663	56	8.9
Operated upon fourth day of attack.....	356	46	12.9
Operated upon fifth day of attack.....	442	49	11.6
Operated upon sixth day of attack.....	346	29	8.4
Operated upon 7th,8th or 9th day of attack.....	178	5	2.8
Operated upon 10th and later day of attack.....	288	7	2.4

It can be seen from this interesting chart that if immediate operation is selected as the treatment of choice, it should be performed as early as possible.

SUMMARY

A study of 330 cases of acute appendicitis, acute appendicitis with abscess and acute appendicitis with perforation in the State of Wisconsin General Hospital from 1932 to 1936 shows:

1. Males predominate slightly
2. The male death rate is more than double that of females
3. Three-fifths of the cases occurred between the ages of 10 and 30 years.
4. Approximately 15 per cent of those cases with abscess and with perforation occurred in the first decade.
5. There appears to be no seasonal variation.
6. Less than one-half of the cases were admitted on the first day of the disease.
7. Previous attacks appear to have no influence on the seriousness of the disease or its mortality.
8. Right lower quadrant pain, general abdominal pain, nausea, vomiting and epigastric pain were the most frequent symptoms.
9. Right lower quadrant tenderness, McBurney's point tenderness, spasm and rigidity were the most common signs.
10. Catharsis has a definite influence on mortality as well as on incidence of abscess formation and perforation.

11. The clinician's diagnoses were correct in more than three-fourths of the cases.

12. Treatment of acute appendicitis is of three types:

    a. Immediate operation

    b. Conservative treatment

    c. Conservative treatment with operation later.

13. The mortality for acute appendicitis was 2.76 per cent, for abscess 14.28 per cent and for perforation 37.58 per cent. Conservative treatment in complicated cases of acute appendicitis is shown to surpass other forms of treatment.

14. General peritonitis was the most frequent cause of death.

15. The average stay in the hospital for all cases was 17.1 days; 15 days was the averagefor acute appendicitis, 26.5 days for those with abscess and 23.6 days for those with perforation.

16. From our study and a very brief survey of the literature, we feel that the treatment of appendicitis should involve individualism. The radical method of treatment has its adherents and in the hands of some this form proves very successful. In general, however, catastrophe may often be averted if the surgeon practices conservatism.

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