

## TYPHOID SPINE\*

WITH REPORT OF FOUR CASES

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OVER one hundred cases of typhoid spine have been reported since the publication of the first paper calling attention to this condition by Gibney in 1889. Gibney expressed the opinion that in typhoid spine there is "an acute inflammation of the periosteum and the fibrous structures which hold the spine together." The next important paper on this subject, a few years later, was by Osler, who, unfortunately, in reporting some of his own cases described the condition as a pure neurosis. The pathology of typhoid spine has been the subject of much theoretical discussion along the lines of the divergent views expressed by Gibney and Osler.

The only reported autopsy examination was not performed with sufficient detail to throw much light on the lesions present. The only complete post-mortem study of which I have any knowledge is that made by J. Torrance Rugh in a case some years after the disappearance of the acute symptoms.

The earlier cases of typhoid spine were observed before the days of the X-ray or before X-ray technic had developed sufficiently to demonstrate the spinal lesions. Even in many of the recently reported cases skiagrams were not taken. Thus far, less than 30 cases of typhoid spine have been reported in which X-ray pictures were taken and in some of these the skiagrams were negative. To this list I have added three personal cases in which the X-ray disclosed definite bone changes. Sufficient evidence has been accumulated to prove definitely that Gibney was correct in his original view that an inflammatory organic lesion does occur in these cases.

That a pure neurosis might possibly simulate, to a certain extent, the true inflammatory organic lesion of typhoid spine just as it might simulate any other organic lesion cannot be denied, but in view of our present knowledge of the subject such confusion should not occur. In other words, those cases which only simulate typhoid spine, whether because of a neurosis, a toxæmia, or any other cause, but which do not present

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organic changes should henceforth be excluded from the list of true typhoid spine cases. The fact that the skiagram has been negative in a few cases does not in itself disprove the presence of an organic lesion; the bone changes may have been too slight to be demonstrable or the pictures were either faulty, or, when taken early in the course of the disease, were negative, when later ones might have shown bone changes, as in my third case.

The statistics on the reported cases of typhoid spine have been collected and analyzed by Cutler, Silver, Halpenny, Rogers, Gaudefroy, Elkin and Halpenny, and others. It has been found that fully 85 per cent. of the cases occur in males. The youngest patient was eight years and the oldest fifty-six years, but the majority were between twenty and thirty-five years.

Typhoid spine occurs as commonly in mild cases of typhoid fever as in severe ones. In the vast majority of instances the affection is located in the lumbar spine or in it and the immediately adjacent thoracic or sacral vertebræ, although it has been reported affecting only the thoracic or cervical vertebræ, or, as in a case reported to this Society by Dr. Elmer, involving only the sacro-iliac joint. Commonly only two adjacent vertebræ are involved, though, rarely, several may be.

*Pathology.*—That the affection is located so commonly in the lumbar spine is due to various factors. Fraenkel found typhoid bacilli more frequently in the vertebræ of the lumbar region than elsewhere, due probably to the relatively larger amount of bone marrow in them. The lumbar spine is also normally subjected to greater stress and strains than is the remainder of the spinal column. Silver has further suggested that, in addition to the greater amount of cancellous tissue offering low resistance to the typhoid bacilli, there is the possibility of direct infection from the adjacent lumbar lymph-nodes. Typhoid spine is almost never a fatal affection, hence post-mortem study of recent cases is wanting.

The clinical evidence points to the lesion being a spondylitis with periostitis, enchondritis and deposit of inflammatory exudate. The X-ray has demonstrated absorption of the intervertebral disc and slight destructive changes in the bodies of the vertebræ as the earlier changes; and later, bone proliferation from the periosteum and bone deposition along the lateral ligaments producing firm bony ankylosis of the approximated adjacent vertebral bodies.

The infrequency of suppuration in the vertebræ as compared to typhoid lesions in other bones has never been satisfactorily explained.

The cause of referred pains and rhythmical contractions is some-

what problematical. They may be due to neuritis from extension of the inflammation and this seems suggested by evidence of organic nerve lesions in some cases. Again they may result from meningitis. Positive Kernig's sign has been noted but only rarely. Lumbar puncture has shown the tension of the spinal fluid increased in a few instances and normal in others. Pressure on the spinal nerves or nerve roots by inflammatory exudate seems the most probable cause. Those cases in which there are alternations of the referred pains and rhythmic muscular spasms suggest that whatever irritation is present in those cases must be located at some point where the motor and sensory fibres are separated one from the other. This would imply an exudate exerting pressure on the anterior and posterior spinal nerve roots proximal to their passage through the intervertebral foramina. The rhythmic contractions being synchronous with the pulse, would indicate they were due to pressure which would alternately be increased and decreased as the blood was forced through the pressure area.

The onset of symptoms was usually gradual, but in many was abrupt and acute, occurring in a few cases during the febrile period, most often during convalescence, and quite frequently some weeks or months, in one case four years, after recovery from typhoid fever.

There seems no doubt that the typhoid bacillus is the cause of the lesion. The presence of typhoid bacilli in bone marrow, especially of the spine, in patients dying of typhoid fever has been shown by Quincke and by Fraenkel.

Various forms of slight trauma or exposure to wet and cold were given as the immediate cause for the onset in many cases. It is quite probable, however, that the spinal lesion was already present and that the trauma merely aggravated it or first called attention to its existence. This would seem to be the case in those patients in whom acute symptoms developed within a few hours after receipt of the trauma.

The symptoms of typhoid spine can be classified as (1) constitutional, (2) local or spinal, and (3) referred.

*Constitutional Symptoms.*—The patient's temperature in one case was normal, but in all others reported in which the temperature was given it was elevated, seldom reaching 103° or 104° F., but in one of my patients going to 106° F. in the first twelve hours. Fever usually subsided in a few weeks and persisted only two months in the longest instance recorded. The pulse-rate increased with the fever. The Widal tests, when taken, have been positive. Leucocyte counts have not been reported very frequently and have varied from 6000 to less than 18,000.

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Great mental irritability has been noted in several instances, due probably to weakness from prolonged illness, present toxæmia, and harassing pain. A few patients threatened to commit suicide. This irritability in its various manifestations has been one of the main arguments in the past for regarding typhoid spine as a neurosis. As one writer has pointed out, if these patients with their painful organic lesions are treated as cases of neurosis, ordered out of bed, placed on exercises, etc., it might reasonably be expected that they would display "neurotic" symptoms.

*Local or Spinal Symptoms.*—Pain over the spine has been the most constant and prominent symptom, as well as usually the first to attract attention. The local pain, however, has sometimes been overshadowed by the greater intensity of the referred pains. Local pain over the site of the disease has usually been absent when the patient was at complete rest in bed, but was elicited by movements of the spine, whether by turning in bed or tests applied in making an examination. Downward push on the head or shoulders, jarring on the heels and efforts at bending or twisting the spine have aggravated this pain. The patients have protected themselves against exciting the pain, in the manner characteristic of cases of acute inflammatory lesions of the spine, by transferring weight through their arms and hands to their pelvis, thighs, bed, or chair; and picking articles from the floor by flexing the knees and hips rather than bending the spine. The pain has disappeared during the subsiding stage for days or weeks to recur on resumption of active exercise or labor.

Tenderness was elicited either over the spinous processes in the median line, or over the transverse processes in all cases. In some tenderness over the anterior surface of the bodies of the vertebrae could be elicited by deep abdominal palpation.

The spine in the affected region was stiff and spinal muscles were rigid in practically all cases. In some scoliosis was present, in others the normal lumbar lordosis was lost, and in a small percentage a vertebral prominence or definite kyphosis developed in the later stages. In but very few cases was there local swelling or redness. In only three or four cases did the disease result in suppuration requiring incision and drainage.

At the present day the X-ray in the later stages of the disease affords the best proof of the existence of a local spine lesion. In this connection I cannot commend too highly the method, which is not in general use, employed by Dr. Henry K. Pancoast of taking

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lateral views of the spine to bring out details unobtainable by the usual anteroposterior exposures.

*Referred Symptoms.*—Aside from the purely local pain in the spine the great majority of typhoid patients experienced severe or even excruciating pains radiating in one or more directions, as around one or both sides of the lower chest or abdomen, down one or both lower extremities, and into the testis. The referred pains were usually intermittent in character and very often were most violent and persistent at night, requiring opiates to procure sleep. The referred pains might persist from a few minutes to several hours at a time and then cease and recur after minutes or hours. These pains were commonly brought on or aggravated by any movement involving a strain on the spine, as turning in bed, lifting a leg, coughing, sneezing, etc. In a few cases the hot-water bottle was efficacious in controlling the pains. Complete fixation of the spine by a body plaster cast, spinal brace or extension apparatus usually gave prompt and marked relief.

Quite frequently tenderness was present over the same areas as the pain radiations. Occasionally muscular rigidity of an intensity which varied on different days, or even at different hours of the same day, was encountered in those cases in which pain was referred to the abdomen.

A few cases of typhoid spine have exhibited a curious rhythmical alternating contraction and relaxation of the abdominal muscles on one or both sides. These contractions usually have been synchronous with the pulse beat, and in one reported case they could be abolished by compression of the upper abdominal aorta. The contractions have arisen spontaneously with the patient at complete rest in bed, or have been started up by movements affecting the spine. They would occur rhythmically for a few moments up to three or four hours, and cease only to recur later. The individual contractions have been mild at one time and violent at another, or might start mildly and become vigorous, giving rise to discomfort varying from slight annoyance to great distress, and leaving the muscles sore, as if violently over-exercised, after the contractions cease. The contractions have occurred at intervals during which the referred pains might be either present or absent. The contractions as well as referred pain might be present on one side of the abdomen at a certain stage of the disease and on the other side at another stage. Rhythmical contractions of abdominal muscles were present in two of my patients. In one reported case muscular twitching of the thigh was noted.

The patellar reflex was increased in the majority of instances in

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which it is mentioned, was normal in a few, and rarely was diminished. Ankle-clonus was observed in several cases and Kernig's sign rarely. Hyperæsthesia or paræsthesia of areas on back, abdomen or lower extremities was noted in several cases and not found in others. Muscular atrophy sufficient to indicate nerve lesion occurred infrequently.

*Diagnosis.*—The diagnosis of typhoid spine usually should not be difficult. The existence or recent history of typhoid fever, the characteristic localized acute spinal symptoms, the suggestive referred symptoms, the constitutional disturbances, and later the X-ray findings afford an unmistakable picture in the typical cases. Difficulty as to the diagnosis, however, may arise under certain circumstances. Not all pains in the back of typhoid patients are due to typhoid spine. Doubt may arise as to whether or not early symptoms in a given case are due to the gradual onset of a typhoid spine or due to some of the more common but less serious forms of backache. Continued observation and study of the further course of the affection will soon disclose the correct answer to the question.

In cases of acute onset with predominance of the referred symptoms, the local symptoms in the spine itself may easily escape observation, unless the possibility of typhoid spine is kept in mind and these local signs are sought for. If the possibility of a spine lesion is not given proper consideration then various erroneous diagnoses may be made. The constitutional symptoms of fever, pulse-hurry and leucocytosis, plus the referred symptoms of pain, tenderness and rigidity of sudden onset present a fairly complete picture of any of the forms of intra-abdominal inflammation or suppuration.

The particular lesion which the typhoid spine will simulate under such circumstances is dependent on the abdominal region to which the symptoms of pain, tenderness and rigidity are referred. In such circumstances, however, it may be found that some special symptom of the disease under consideration is wanting, that the local signs are a little too diffuse or that there are other inconsistencies in the picture or course of the affection viewed as a whole. But even then the picture so closely simulates the conditions for which immediate operation is indicated that, unless the possibility of spinal lesion is considered, the patient is apt to be subjected to a needless laparotomy.

Again, the presence of mild spinal symptoms may be recognized and yet the constitutional disturbance plus the referred symptoms and their location be so very characteristic of an intra-abdominal lesion that two erroneous possibilities present themselves—either that a spinal and an abdominal lesion exist independently of one another or that an

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abdominal suppuration occurred first and the spinal symptoms arose secondary to a toxæmia, metastasis or direct extension from a retro-peritoneal infection. If the diagnosis is uncertain under such circumstances it will usually be wise for the surgeon to delay operation until reasonably certain of the situation. The X-ray cannot be depended upon when the early pictures are negative, as it may require weeks for bone changes to develop to the extent that they can be shown by skiagraphs.

Prognosis as to life seems entirely favorable as none of the patients died of the typhoid spine lesion. Suppuration to the extent of requiring evacuation has been very rare. It is possible that small foci of pus might form and be absorbed. Absorption of one intervertebral disc with osseous ankylosis of the two adjacent vertebræ may be expected. Occasionally changes of the same type have involved more than two vertebræ. Kyphosis may or may not develop, or, as pointed out by Silver, may be present and obscured by heavy overlying muscles. By proper support of the spine until ankylosis occurs kyphosis can be prevented. A relapse to the extent of return of pain and tenderness is not uncommon during the subsiding stage from too early resumption of activity, but, unlike inflammatory spinal affections, typhoid spine, once arrested, does not tend to recur. Symptoms disappear in a few weeks or months, as a rule, but in Brownlee's case they persisted for 21 months. The ultimate functional result is usually perfect. If only two vertebræ are ankylosed the adjacent joints apparently are able to compensate for the lost mobility.

*Treatment.*—The best form of treatment is mechanical. The spine should be placed at as near absolute rest as possible. This may be accomplished by either plaster-of-Paris cast, spinal brace, or by continuous traction from head and feet. Pain often has ceased abruptly after fixation of the spine. Excessive pain can be relieved by the local application of heat, by aspirin or sedatives, but often opiates will be needed. Elimination should be pushed to combat the toxæmia. In prolonged cases vaccines may be of service.

CASE I.—M. B. M., male, aged fifteen years. Patient of Dr. T. H. Mackenzie of Trenton, N. J. After a week of prodromal symptoms patient went to bed the day following Thanksgiving, 1907. High fever, up to 104° F., for two weeks, constipation, tympanitis and rose spots. Three or four days after first getting out of bed in February, 1908, was hit with a severe pain in the back and along the right sciatic nerve. Following day pain shifted from right to the left sciatic nerve distribution and continued there

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for one month, when it stopped and pain shifted back to right sciatic for the next month. During all this time remained in bed. Had pain in lower back, made worse by movements.

Through the kindness of Dr. George H. Parker and Dr. MacKenzie I saw the patient at his home in April, 1908, at which time he complained of pain in the back and in the right sciatic distribution, both of which were aggravated by spinal movements. Right sciatic nerve was tender to the touch. Normal lumbar curve was lost. Spine was rigid. Tenderness most marked in mid-lumbar region. Made a diagnosis of typhoid spine. A plaster cast was applied by suspension method the following day, with 50 per cent. betterment in the pain within the next few days, and at end of two weeks pain had almost completely left. By end of third week cast had softened and was removed. Pain recurred in mild form. Cast reapplied for another three weeks, after which patient got up from bed and gradually resumed his activities.

His only skiagrams were taken on December 3, 1914, nearly seven years after the onset of his typhoid spine. X-rays show complete absorption of the disc between the second and third lumbar vertebræ with ankylosis between these two vertebræ. There is a slight kyphosis in this region.

He still continues to have occasional pain in form of backache, never severe and never interferes with whatever he is doing.

CASE II.—J. M. A., male, twenty years of age. Painter by occupation. Indulges freely in athletic sports, musculature well developed. Normal weight 138 pounds. Height 5 feet 6 inches. Previous medical history negative. Had mild attack of typhoid fever beginning October 6, 1907. Normal course till November 1, when he developed right femoral phlebitis. Christmas day sat up out of bed for first time. Gradual resumption of activity. During the last week of January, 1908, fell on ice while skating, but experienced no ill effects at the time. On the following day experienced a sudden severe pain in the back on attempting to rise from a stooping position. Pain continued in less severe form till February 3, when it extended to the right side of the abdomen. The patient was then confined to bed and treated for lumbago. About this time there was an almost total suppression of urine. Only three ounces of urine were obtained by catheterization after a period of 20 hours. Urine highly acid, specific gravity 1028, no sugar, no albumen. Complained of slight headache and aching pain in the back of neck. Mind slightly confused and later muttering delirium. The temperature taken infrequently was subnormal until February 16, when it was 102.4° F. Thereafter was subnormal mornings and elevated in afternoons, but gradually subsiding



for next eight days, after which it remained normal and sub-normal. Profuse sweating occurred during febrile period.

On February 10, patient began to have what he described as rhythmic "pulsations of the abdomen." These pulsations were slight at first and had a duration of only five or ten minutes, later on becoming more violent and persisting without intermission for hours.

The patient was examined at this stage by his brother, a physician, who observed that all of the abdominal muscles participated in violent, painful rhythmic contraction and relaxation, always at the rate of 104 or 106 to the minute, and not synchronous with the pulse. These convulsive abdominal movements would persist for upwards of six hours at a time and then cease, but on patient getting out of bed would recur in all their intensity, and were accompanied by pain at each contraction. The only relief obtainable was by having some one stand over him and press down heavily with flat hands on his abdomen. The contractions were so forcible that they almost lifted the entire weight of his heavy brother. The manual pressure would not cause contractions to cease but made them bearable. After contractions had ceased any attempt to relieve pressure immediately was followed by recurrence of contractions, but after waiting a few minutes pressure could be gradually released without recurrence.

The brother came to Philadelphia February 21, seeking advice, and the diagnosis of typhoid spine was suggested to him. He returned to the patient with the expectation of applying a plaster cast and bringing him to this city. On the night of February 21, the muscular spasms were the most violent they had been at any time and persisted without remission all night long, then ceased abruptly and patient slept continuously for 36 hours thereafter and remained drowsy and stupid for several days without contractions or pain. On March 6, following a trip to the toilet, mild contractions and pain recurred for a few minutes. It was noted that the normal lumbar lordosis was lost and that spine was straight for 14 inches.

On March 10 there were noted feeble contractions on the left side with pain and a "sore spot" in left iliac region.

On March 12, 1908, he entered the University of Pennsylvania Hospital. He was 20 pounds under weight. Complained of slight pain in left flank when he began to move about, but pain ceased on further movements. Abdomen was slightly rigid anteriorly and laterally on left side; some rigidity of spine and loss of normal lumbar curve but no kyphosis. There was a point of tenderness on deep pressure posteriorly at the side of the last dorsal vertebra. Reflexes normal.

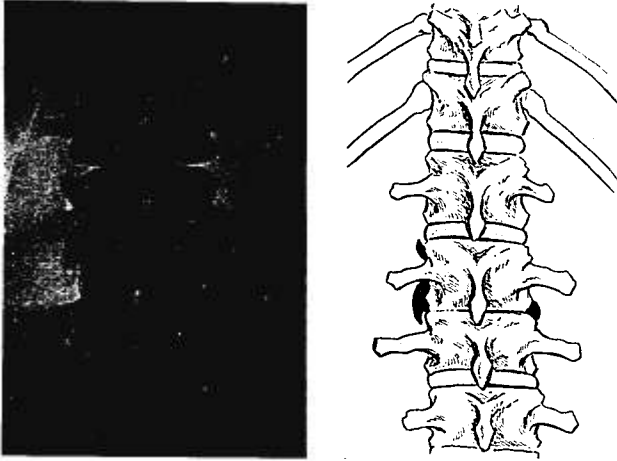


FIG. 1.—Skiagraph and diagram of anteroposterior view of Case I, taken seven years after onset of typhoid spine symptoms.

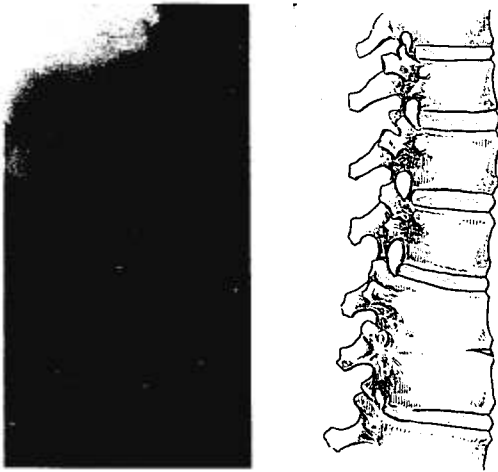


FIG. 2.—Skiagraph and diagram of lateral view of Case I.

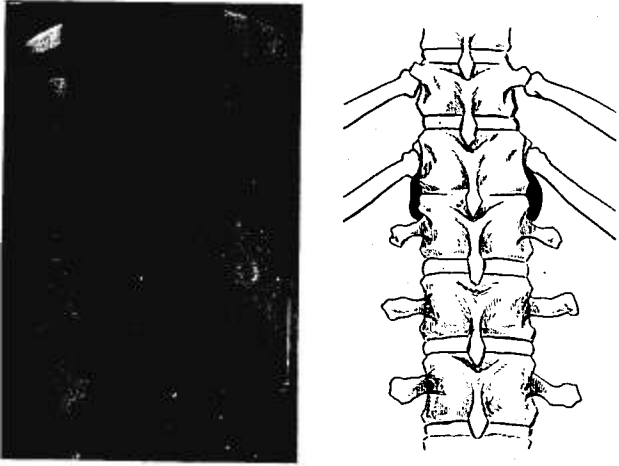


FIG. 3.—Skiagraph and diagram of anteroposterior view of Case II, taken seven years after onset of symptoms.

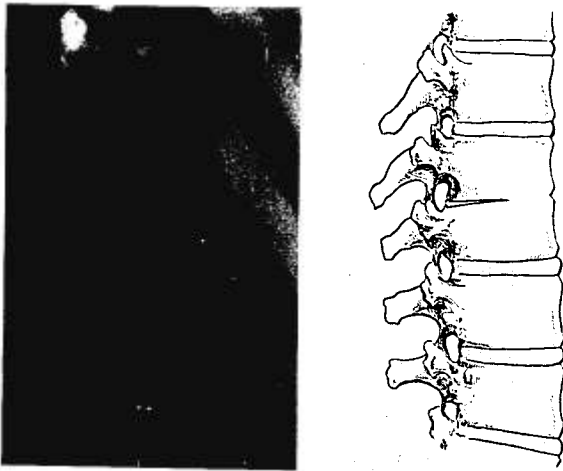


FIG. 4.—Skiagraph and diagram of lateral view of Case II.

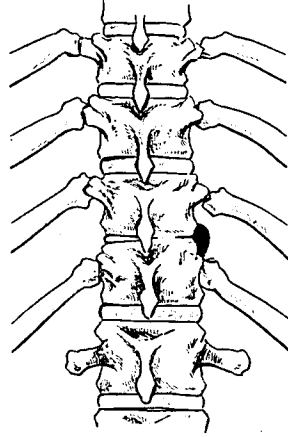


FIG. 5.—Skiagraph and diagram of anteroposterior view of Case III, six months after onset of symptoms.

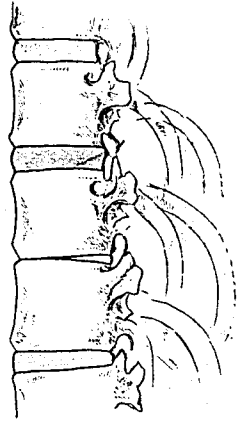


FIG. 6.—Skiagraph and diagram of lateral view of Case III.

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Skiagrams taken on March 15 disclosed a small area of osteoporosis of last thoracic vertebra and small amount of bone proliferation on the left side of body of same vertebra. X-ray pictures of the spine in those days were not very clear cut and the exact details of lesion were uncertain. Patient left hospital the following day without notice.

I next saw him November 26, 1914. He stated that he had no further trouble after leaving the hospital and was soon able to get about freely and in a couple of months returned to his occupation of painting railroad cars.

In the fall of 1908 he practised cross-country running of 7 and 8 miles daily with fellow-members of a club, and the same fall, and yearly since then, has played regularly on a foot-ball team. Although a small-sized man he is able to lift a 100-pound weight above his head with one hand. He has not experienced any difficulty whatsoever from his spinal lesion.

On examination his spine has normal outlines, is supple, and gives no evidence of kyphosis. The X-ray, however, November 26, shows complete absorption of the intervertebral disc between the last thoracic and first lumbar vertebrae, with approximation of these two vertebrae and complete bony union along their lateral ligaments.

CASE III.—J. W. C., male, aged twenty-nine. Professional base-ball pitcher. Four years ago mild catarrhal jaundice for ten days. Eight months ago mild attack of pleurisy, uncertain as to which side of chest. Venereal history negative.

March 20 to 24, 1913, violent gastro-intestinal disturbance, at Birmingham, Alabama, following ingestion of tainted food, with gradual recovery.

April 10, 1913, while in Boston, began to feel generally miserable and developed fever, because of which he returned to Philadelphia, his home city. Widal reaction negative weekly for four weeks, and then positive, at which latter time rose spots first appeared and were numerous for few days, then disappeared; mild abdominal tympany. Spleen not palpably enlarged. Temperature up to 102° and 103° F.

On May 10 temperature, having been around 99° for four days, abruptly rose to 103° coincident with onset of pain and tenderness over gall-bladder; no jaundice. Fever continued at 101° to 103° for ten days, then gradually declined, but some soreness persisted over gall-bladder.

On June 10, sufficiently recovered to go to Atlantic City. June 25, went to Maine. Soreness still present in biliary region. Applied a fly blister, and soreness ceased. August 1, rejoined his

team in Philadelphia against his physician's advice, went on western trip and gradually resumed active exercise.

September 1, while swinging bat at a pitched ball, was seized with violent pain over the lower ribs on the right side. Rested for several minutes, then was able to bat balls to the infield, although it caused him considerable pain. After going to bed that night pain recurred with increased severity and he developed a temperature of 106° F. with delirium. Pain increased by deep breathing but no friction sounds audible. Strapping of chest gave marked relief. Was ordered general sponge baths and colonic irrigations. Following day temperature 104–105°, then returned to near the normal in five or six days. Pain located at right costovertebral angle continued in lessening severity, and was made worse by motion such as turning in bed; rigidity and tenderness of upper right abdomen. His symptoms were suggestive of possible diaphragmatic pleurisy, or of infection in gall-bladder, liver or kidney, or in subdiaphragmatic or perirenal regions.

I saw the patient for the first time on September 12. Temperature was then 99.6°, pulse 90, and respiration 20. He complained of pain in upper right abdomen. Pain was most severe at night, when it would persist for hours, preventing sleep, but would disappear during day while at complete rest in bed, only to reappear on motion, as getting out of bed or turning in bed, and had diffuse tenderness over upper right anterior and lateral abdomen and hepatic area. Most marked point of tenderness was at right costovertebral angle. Lungs and pleura showed no abnormalities; deep inspiration no longer painful; reflexes normal. On sitting up in bed pain was increased and he supported his weight by his hands in the way characteristic of acute spinal cases. Being asked to raise his hands said he could not do so, as back felt "too weak" to sit up unsupported. Spinal muscles were tense on both sides and the dorsolumbar spine was rigid. Tenderness over last dorsal and first lumbar vertebræ was slight in the median line but more marked over right transverse processes of same vertebræ. Reflexes were normal. On standing erect he supported his body weight by his hands placed on pelvis. On attempting to pick up an object from the floor he kept spine rigid and flexed the hips and knees in the same way as a case of acute Pott's disease. Downward pressure on head or shoulders evoked complaints of increased abdominal pain. He was returned to bed when it was observed that he had slight rhythmical alternating contraction and relaxation of his upper right abdominal muscles for the next two or three minutes, and pain was so aggravated by the various manipulations that it persisted in severe form for a full hour. Curiously enough the local pain in the spine was so

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trivial in comparison to the referred pain in the upper abdomen that it was only with extreme difficulty that this intelligent patient could be convinced that the trouble was in the spine and not within the abdomen. A diagnosis of typhoid spine was made and the patient was sent to the University of Pennsylvania Hospital. Radiographs of the spine taken the following day (September 13) and on September 14 and 16 failed to show any abnormalities. He was kept at rest in bed. Pain was most marked at night and apparently was relieved somewhat by a hot-water bottle. On September 16 a plaster cast was applied from axillæ to the hips without relief of pain. Aspirin and bromides had no effect. Morphia was required for sleep. Three days of the cast had no effect on the pain, and in response to the patient's urging it was removed to enable him to reapply the hot-water bottle which he would place over the lateral wall of the abdomen and chest rather than over the spine. The urine repeatedly exhibited a trace of albumen, many hyaline and granular casts, an occasional red blood-cell, and great excess of leucocytes, but by October 1 the red cells and excessive leucocytes had disappeared from the 24-hour specimen. Examination of the blood showed 4,470,000 red cells, 9900 leucocytes and 80 per cent. hæmoglobin. The differential count gave 56 per cent. polymorphonuclears, 31 per cent. lymphocytes, 7 per cent. large mononuclears, 4 per cent. transitionals, and 1 per cent. eosinophiles.

On repeated leucocyte counts the highest number obtained was 11,100 on October 3. Widal test (September 27) was positive; Wassermann (September 25) and Von Pirquet (October 1) tests were negative. Blood cultures (October 3) were sterile. From a culture of the fæces (October 1 and October 10) a paratyphoid organism and non-motile, rod-like bacteria of the aërogenes type were isolated. Urine was examined bacteriologically but report has been lost. Nothing very suggestive was found.

His temperature the first five days after admission to the hospital varied daily between 98° and 99°, then showed an upward trend and for twelve days ranged chiefly between 99° and 101°, going down occasionally to 97.6° and up to 102°. On October 1, the day extension was applied to head and neck, the temperature reached 102°. The following day it did not go above 99.6°, and thereafter continued lower, being entirely normal or subnormal during his last month in the hospital.

On September 20 and November 22, 1913, exhaustive general examinations from the neurological stand-point were made by Dr. Wm. G. Spiller. The only deviation from the normal he could discover was a diminution in the intensity and promptness of the

right upper abdominal (epigastric) reflex at the first examination, but this defect was barely noticeable at the second.

Beginning on September 17 and continued daily thereafter for two weeks, colonic irrigations of from two to three quarts of normal saline solution were employed at the suggestion of Dr. Alfred Stengel, who had observed following this treatment prompt cessation of symptoms in a number of similar post-typhoidal cases. The irrigations seemed especially appropriate in this case because of a year's long constipated tendency, but they had no beneficial effect on symptoms and were discontinued because the manipulations attending their administration and expulsion aggravated the pain. Thereafter the constipation was corrected by paraffin oil aided by various laxatives.

From the time the patient entered the hospital he continued to have intermittent pain and intermittent rhythmical spasms of the muscles on the right side of the abdomen. The pain and rhythmical spasms might occur together or independently of one another, and either or both would be excited by movements in bed. When either or both were present they might persist for a few minutes only, or for hours at a time. Pain was particularly severe for hours continuously almost every night, partially relieved by hot-water bottle, but sleep often not obtained by anything short of opiates. The rhythmical spasms were synchronous with the pulse, were observed chiefly on the right side, and then would pull linea alba to the right. After cessation of a long continuance of the spasms the muscles would be sore as after vigorous exercise in one unaccustomed to it. Adhesive strapping and tight circular bandaging of the abdomen, applied during times cast was off, somewhat relieved the distress of the rhythmic contractions but did not stop them. During the intervals free from rhythmic contractions the muscles of the upper right abdomen were more or less rigid. Efforts at deep palpation excited an increase in the rigidity.

On September 26, X-rays were negative. Plaster cast was applied that day, but with no relief, and was removed two days later. Cast reapplied morning of September 30, under different conditions from former ones, but pain being made worse it was removed in the evening of the same day. On October 1, obtained a longer bed for patient and applied extension to head and legs, which was continued until November 5. This was promptly followed by relief of pain and spasms, and after two days they both ceased entirely for several days. On October 15 X-rays were negative. About this time a recurrence of marked pain, tenderness and rigidity in upper right abdomen without muscle spasm again raised the serious question which had already been con-



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sidered frequently, as to whether or not there was an intra-abdominal or retroperitoneal abscess. The history of two previous attacks of biliary trouble, the preceding urinary findings, and the negative X-rays at this late stage of the spinal disease, all contributed to the difficulty of the situation. The right-sided symptoms, however, suddenly ceased and a day or two later mild pain, tenderness, rigidity and muscular spasms appeared on the left side for the first time. The left-sided symptoms were never severe and disappeared in a few days.

On November 5 was measured for a spinal brace, but to enable him to sit up in bed at once a plaster cast was applied. The cast proved uncomfortable and sitting up in it caused mild recurrence of right-sided pain and twitching, and it was removed on November 8. Thereafter no pain except when he turned in bed. November 15, the spinal brace applied. November 18, X-rays for first time demonstrated slight changes in the form of absorption and new bone deposit along the edges and sides of the bodies of the eleventh and twelfth thoracic vertebræ. On November 26, out of bed for first time, and on November 28 left the hospital, being then able to walk with difficulty, owing to muscular weakness. An X-ray taken December 17 showed narrowing of intervertebral space and more bone deposit. He continued to wear the spinal brace till February, 1914, when parts of it were removed, and a month later began leaving brace off part of each day, finally abandoning it altogether about May 15. In July he began light exercise and at end of August was given permission to go the limit in exercise. He was not able to regain his old-time form as a pitcher before the end of the season, but this seems more likely to have been due to his not having pitched for two seasons, during which he passed through two prolonged illnesses, rather than to any difficulty existent in the spine. He could pitch fast balls satisfactorily but did not have the usual control over his curves. As he described the situation, his pitching was of his usual calibre at the beginning of previous seasons, and with more practice he felt he would regain control as he had in previous years as the season progressed.

His last X-ray was taken on March 17, 1914, and shows absorption of the intervertebral disc with ankylosis of the eleventh and twelfth thoracic vertebræ. He had no kyphosis, no pain nor tenderness and no apparent limitation of spinal movement when last examined in August, 1914.

CASE IV.—J. H., male, thirty-seven years of age; Belgian; sailor. Admitted to service of Dr. Alfred Stengel at University of Pennsylvania Hospital on September 5, 1914. Had been ill for six days. On admission, tongue coated, spleen uncertainly palpa-

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ble, considerable tympanites; temperature 102° F., pulse 124, hæmoglobin 60, red blood-cells 4,090,000, white blood-cells 4800, urine a trace of albumin, hyaline and granular casts. Widal positive two days later.

On September 20 had urticarial eruption on back and right arm which left the following day. By October 30 temperature practically normal.

On November 2 complained of pain in left iliac and left sacro-iliac regions. On November 4 sacro-iliac region was strapped with adhesive plaster. On following day it was noted strapping had not relieved pain; on November 8 was still complaining of some pain and there was some tenderness over left sacro-iliac joint.

On November 10 it was noted that pain and tenderness were not constant. On November 18 X-rays of spine, sacro-iliac joints and right hip negative. On November 20 pain variable. Patient refused to sit up though encouraged to do so.

On December 3, I first saw the patient by the invitation of Dr. Stengel, who has kindly permitted me to report this case from his service.

Patient is a Belgian, at present somewhat neurotic, and, by reason of his understanding English only imperfectly, it is rather difficult to obtain accurate information from him. He complains of pain in the lower back, right sacro-iliac region, right lower abdomen and right thigh. He presents distinct localized tenderness posteriorly over the middle and lateral aspects of the third lumbar vertebra and over the right sacro-iliac joint. Anteriorly there is no midline tenderness at or above the umbilicus on deep pressure. Below the umbilicus fairly deep pressure does not cause any distress, but on making firmer pressure so that the palpating fingers finally come in contact with the body of the third lumbar vertebra the patient cries out and squirms away from the examiner's hand.

The normal lumbar curve is lost and the lumbar spine is held rigidly. Efforts at forward or lateral flexion or hyperextension cause pain. The patient turns over or sits up in bed with difficulty because of increased pain. He apparently has ample strength to handle himself readily but on moving exhibits the awkwardness characteristic of patients having an acute spinal inflammation. On sitting up with his feet over the side of the bed he persists in supporting his weight by his hands placed on the mattress. Downward pressure on his head causes pain in the midlumbar region. His knee-jerks are present and equal on the two sides.

A second set of X-ray pictures were taken with negative results. On December 8 weight extension was applied to both legs and in 48 hours all of his pains were decidedly better. On

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December 9 daily colonic irrigations with normal salt solution were begun. On December 19, 1914, hæmoglobin 80 per cent., red blood-cells, 5,310,000, leucocytes 9000. Patient continued to improve. On January 2, 1915, leg extension discontinued because pain had practically disappeared, but remained in bed till January 19, when he was up in wheel chair for first time, and his fourth X-ray was negative. Sacro-iliac tenderness is gone. Lumbar spine still rigid. Lumbar curve still wanting. Has distinct tenderness over lateral aspects of third lumbar vertebra, but median tenderness nearly absent.

He is being skiagraphed each week both with expectation of showing bone changes ultimately in his lumbar spine and with intention of ascertaining at what stage organic changes sufficient to be shown by the X-ray take place.

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