THESIS

Periostitis & Necrosis
as Sequelae of Typhoid Fever.

by

David Macmillan M.A.
M.B., C.M., 1891.

Prestwich
Manchester
April 1894.
WON'T THERE BE 60 cf
this cheque? Alfred

MONSALL LODGE
PRESTWICH

24 the 26th
APRIL 16, 1894.

Manchester.

This is to state that I am 26 years of age, that
the work of the accompanying thesis has been done, and
the thesis composed
entirely by myself.

D. Macmillan.
Monsall Lodge, Prestwich.

April 19, 1894.

Professor Y. R. Fraser.

Sir,

I am in receipt this morning of the notice respecting fees and certificates to accompany thesis. The bank charge on cheques I am sending, addressed to J. Done, Asst. Clerk.

Dr. Leslie Jones' certificate regarding sufficient duration of practice subsequent to graduation has been returned to me. I
I fear that it is not sufficiently detailed, and therefore enclose in addition Dr. W. R. A. Stewart's certificate of three months' hospital work in London, and Dr. Keilharz's certificate of 10 months' assistantship with him.

I also enclose Matriculation form filled up.

Yours truly

D. Macmillan.
Monsall Lodge,  
Prestwich.

Right!  Manchester  
Apr. 23, 1894.

Mr. Gilbert,

Sir,

I received from you a few days ago the enclosed matriculation form.

In sending up my thesis last week I sent with it the fee for matriculation, and I have since returned my matriculation form duly filled in.
Matriculation Card, which is 2821.

I am filling in and returning the second form you sent me that there may be no mistake, and that the proper entry may be made in the Album.

Mr. Doran will tell you about payment of £1.

Yours truly,

D. Macmillan.
Periostitis & Necrosis
as Sequelae of Typhoid Fever.

This subject receives such scant notice in the text books that, having observed no less than three cases in point during the last year, I have thought it a fit subject for investigation and for discussion in this thesis.

While the more extensive works on medicine and surgery note the occurrence of Periostitis and Necrosis as sequelae of Typhoid Fever, and while some of them even record cases, I find in none any attempt to estimate its frequency. Nor do they discuss questions which naturally arise in connection with the relation of these sequelae to the foregoing disease, such as:—what classes of typhoid patients are liable? how do the sequelae arise? at what stage do they arise? in what do they differ from periostitis and necrosis due to other causes?—and other points as to the etiology,
course, diagnosis, prognosis, and treatment of these affections. This seeming omission is the more remarkable as the recognition of the sequence is of no very recent date; and time after time cases have been recorded, the observers at the same time remarking in surprise on the scarcity of literature dealing with the subject.

It is late in the day to draw attention to the great variety of the complications and sequelae of enteric fever, and the great majority of these we may pass over in silence. But it may be well here to call to mind Dr. Willis's view of the nature of repletion of the large in typhoid fever, as presented in the Medical Times and Gazette of 1862. His views may tend to throw some light on the etiology of pericarditis and necrosis occurring after typhoid fever, indicating as he does a wide and comprehensive scope for the action of the typhoid poison. He says that some years previously in the Crimea it had been noticed that cases of typhoid became complicated with encephalitis. In explanation of these
cases he expresses his belief that the true cause is to be found in the larynx, and that the disease in the larynx goes through the same stages as the disease in the Peyers' patches — first deposit of typhoid matter, then ulceration, and, as a further step, occasionally perforation.

Again Sir William Gull, in the Lancet of 1872, says, “Altho' the ileum is the focus of the operation of the poison, yet it does not end here, for it is reflected to every organ of the body.” He cites such unusual results as typhoid ulceration of the vagina and ulceration of the prepuce from typhoid fever, and adds that any organ may become affected thru' the action of the nervous venous, or other systems.

In the text books we find instances recorded where ulceration of the larynx in typhoid has led to pelachondritis and necrosis of the cartilages, and even to necrosis of cartilage without previous ulceration, — cases closely analogous to the periostitis and necrosis of bone which we have now to consider. While these affections
of the laryngeal cartilages in typhoid have been carefully considered, the affections of bone and periosteum have hardly been discussed at all. We shall see presently that Erichsen makes allusion to these sequelae and cites two cases. Erichsen had observed necrosis of the tibia in the same connection, and also a case where necrosis of the temporal bone supervened in a patient convalescent from typhoid. He also makes reference to a case where necrosis of the femur occurred.

While the text books are almost silent on this subject, we have a brief and concise statement, without actual records of cases, by Sir James Paget of the observations he made and the conclusions he arrived at in a number of cases which came under his notice. This appears in the St. Bartholomew's Hospital Reports for 1876, and the article is entitled 'Some of the Sequelae of Typhoid Fever.' His observations and conclusions will be compared later on after further cases have been stated which will be found to present many features of
agreement and difference with his.
In France, while many authors, including Roussaux, make no mention of the subject, many writers have recorded cases in the French medical journals. Notable among these is L. Lusieri. In the Revue de l'Institut de l'Institut de l'Epidemiologie et de Chirurgie of Jan. 10, 1879, he records seven cases and discusses the subject at some length. These cases, given by him in great detail, will be reproduced here in abbreviated form, and his conclusions on etiology will receive consideration in their proper place.
In America, Dr. Keen of Philadelphia read to the Smithsonian Institute of Washington in 1878 a memoir on the surgical complications of the continued fevers and more especially of typhoid fever. In it he gives a brief résumé of periostitis and necrosis as they appeared in relation to typhoid in a number of cases collected by him.
The 31 cases which here follow are taken partly from published records and partly from my own experience. A number
of them are lacking in detail which would have made them more valuable for the present purpose, but all seem suited to help towards general conclusions. It will be my endeavour now to present these cases, and to draw from them such conclusions as the facts seem to warrant.

Case 1. This case, while not strictly one of peristitis and necrosis of bone, yet presents a close analogy, and will serve as a type of the cases of implication of the laryngeal cartilages in typhoid referred to above. The case was shown by Dr. Hilton Tagge to the Pathological Society of London, and is reported in the Lancet ii, p. 593, for 1875.

The patient, a sailor, age 23, was seized with typhoid on board ship. There was a copious eruption of rose spots, diarrhoea, high temperature, and bronchitis. The voice was hoarse, the throat sore, and latterly there was dysphagia. In this case the intestinal implication was very slight, but laryngeal mischief extensive, the right arytenoid cartilage being deeply ulcerated and containing unhealthy pus. The vocal cords
and epiglottis were also elevated. Cases 2, 3, and 4 are described in the Brit. Med. Journal of May 9, 1885 by Dr. Affleck of Edinburgh. They were observed by him in the typhoid wards of the Fever Hospital of the Edinburgh Royal Infirmary. He notes the scant notice taken of the sequelae in books and states that his three cases occurred in a total of 119 typhoid patients who were under treatment in 1884. While he agrees that the sequelae supervene in the majority of cases at an advanced stage of convalescence, he shows that, as in his cases, periostitis may occur at the height of the fever or when convalescence has no longer than begun; and thinks that it may be regarded as a complication no less than as a sequela of the fever. He says, "In a not inconsiderable experience of this fever it has occurred to me to see periostitis far oftener than 'swelled leg' about which much more has been written."

His cases are as follows:—Two of them occurred in young men of twenty-one,
Case 2. One of whom was admitted in the third week of the fever with periostitis commencing in the right tibia. This produced a re-eruption of the fever and prolonged the case for about four weeks after admission, but he made a good recovery.

Case 3. The other (young man of 21), who was admitted at the commencement of the fever, showed symptoms of marked periostitis in the right humerus in the third week, and this was followed by a similar condition in the right tibia. Convalescence in this patient was slow, and after the periostitis had apparently departed, it reappeared in the right humerus, and an abscess formed which was subsequently opened. The patient ultimately completely recovered.

Case 4. The next case, that of a girl, age 9, was admitted with a very severe attack of typhoid, which reduced her to such a degree of exhaustion that for a time it seemed scarcely possible she could survive. In the fifth week and just as the temperature had begun to sub-
side, she was attacked with periostitis of
the right humerus, which set up fever
again and caused her intense suffering.
Contrary to expectation she recovered.
No abscess formed, but the painful swell-
ing of the shaft of the humerus con-
tinued for full six weeks after its first
appearance.

The local treatment in these three cases
consisted in hot opium fomentations
during the continuance of acute pain,
and subsequently the application of iodine.
Points of interest in these three cases
are, the large proportion of typhloid cases
affected, the early appearance of the
periostitis, and the multiple affection
of bones.

For the next five cases I am indebted
to Dr. John D. Hayward of Liverpool.
Three of them are described in the Brit.
Med. Journal p. 16, of 1885; the other
two have come under his observation
since then. He believes that periostitis
as a sequel of typhloid fever is more
common than is generally supposed—a conclusion which seems warranted by the large number of cases he has himself observed. His cases were all in young persons, and he suggests that the active condition of the periosteum in youth may predispose to inflammation of the part. He remarks also that the cases of typhoid in which he has seen this sequestra have been severe ones.

Case 5. With regard to this case he simply states that the periostitis, supervening on typhoid, did not suppurate and the patient did well.

Case 6. In another periostitis appeared in several of the long bones: suppuration ensued with external discharge; but after new attacks of periostitis had ceased to occur and the scissures had healed (which they did readily) the patient succumbed under acute pleuritis of which, previous to the enteric attack, there had been no evidence.

Case 7. The next history he gives is that of M. Y., a girl of 16, first seen on Aug. 23. There
had been fever and diarrhoea for the preceding week, previous to which she had been a strong healthy girl. She was found to have well marked typhoid. The case was a typical one of typhoid fever, but of a severe and prolonged type. After diarrhoea and abdominal tenderness had ceased the tone was almost normal and the appetite good. But all the intestinal lesions appeared to be recovered from, it was noticed that the temperature ran up every day to 104° or thereabouts, and was never normal. Night sweats, anoxea, occasional chills, and increased loss of flesh were observed. Some local cause for the pyrexia was searched for in vain: the lungs were normal, and there was no cough. Periostitis, being quite unsuspected, was not inquired after. The case was puzzling till Oct. 11, when the patient mentioned that her leg was painful and swollen. A swelling the size of half a small orange was found in front of the left tibia, tender and blastic. On the 13th the swelling
fluctuated and was opened, when about half an ounce of pus escaped. The leg was
policed and about an ounce of pus escaped before the abscess and sinus were
healed, which was the case in three days.
The girl recovered appetite and strength,
but on Oct. 19th the other leg was painful.
A similar swelling was found over the
middle of the right tibia. This also was
opened, discharged about an ounce of pus
and was well in three days. On Nov. 3rd a
similar fluctuating tumour was observed
at the lower end of the right tibia, quite
distinct from the preceding. This contained
blood clot and a little pus. It is now (and
discharging and contracting. There is no
sign of inflammation or tenderness over
dry or other bone or joint, and the patient
is slowly improving in health. The peri-
ostitis has not been of a serious nature
locally, and indeed early opening was
never urgently required. It seemed as if
only the outer layer of the periosteum were
involved. No necrosis took place.

Case 8. Dr. Rayward has quite recently had a case
of severe typhoid in which one finger commenced to swell and became painful about a month after recovery, and has remained swollen, enflamed, painful, and useless for over a year. He attributes the condition to chronic periostitis.

Case 9. He has also seen a case in which necrosis of the jaw occurred after typhoid fever. In this case there was also a history of dental inflammation.

Important features in Dr. Hayward's cases are that one was complicated with fatal phthisis; in two the periostitis was multiple; and in another the periostitis was extremely chronic, remaining stationary for more than a year.

Case 10. Reported by Dr. Henry King of Chester in the Brit. med. Journ. of May 9th. 1885. The patient, an artisan, aged 29, had left the hospital after 8 weeks of typhoid fever, and returned on Nov. 29th after a few days' absence. For a week he had felt his right leg heavy, stiff, and painful. The whole of the right leg was oedematous from knee to
ankle, and there was a red inflamed patch over the inner surface of the tibia at the junction of the middle and lower thirds. There was much pain of a throbbing nature felt at times, and there had been some involuntary starting. No fluctuation could be detected. A straight incision was made over the painful spot, about 1 1/2 inches long and nearly as deep, along the anterior border of the tibia. There was a little blood but no pus seen. Hot punctuations were applied to allay the pain. the leg was placed on pillows and frequently partriced. A mixture of Acet. of Iron and Chlorate of Potash was given every 4 hours. Great relief followed, but considerable oedema remained. A few days later, as there was still some uneasiness and the redness did not disappear, the deeper part of the wound was enlarged with a probe and a drainage tube inserted for two days. This acted favourably: the peak oedema around the wound gradually subsided, and the subsequent progress was quite satisfactory. On Dec. 18th the wound was reported nearly
planned over and the patient was getting out a little.
Dr. King emphasised early incision as the proper treatment in such a case.

His patient, age 42, was first seen on Nov. 17, 1878, and during the following week developed the usual symptoms of enteric fever, which ran a severe and unusually prolonged course. On the 35th day there was a relapse with return of all the symptoms, and the temperature became finally normal on the 60th day of illness. He went to the seaside on March 3rd, and on the 18th reported himself well with the exception of pain in front of the chest on the left side. He recalled the fact that he had felt a soreness there on use of the stethoscope towards the end of the time he was in bed. In April he was examined but only slight thickening at the spot was detected. There were no constitutional symptoms and the patient had grown stout. In June 3rd there was an obscure
newly fluctuating, slightly reddened swelling over the front of the third rib. By July 3rd, this had become well marked, tender rather than painful, of a dusky red colour, and there was doubtful fluctuation. During the following week suppuration was evident, and at the end of that time began to discharge. The discharge continued for several weeks, and the wound finally closed about Nov. 5th. A deep depressed scar resulted.

It will be noted that this case was very severe and protracted as regards the typhoid; periostitis showed late in convalescence, was extremely chronic, and suppuration supervened very slowly. The sequela had an indiscernible effect on the general convalescence.

Case 12.

This case I take from the 'Transactions of the Academy of Medicine in Ireland' for 1886, where it is recorded by Dr. H. C. Lueddy of Dublin. The patient was a grocer, age 33, admitted to hospital on Dec. 5, 1885, with well-marked symptoms of enteric fever—smart diarrhoea, tenderless and quaking, characteristic tongue, and a temperature of 103.5°.
He was stated to have been ill for 6 days before admission, and the truth of this was borne out by rose spots appearing two days after. The case proved simple and uncomplicated, progressed favourably, and on Jan. 2, the evening temperature was 99°F., and continued so with slight variation for some days during which time the patient wished to get up, saying he felt quite well, and was continually clamoring for animal food which was allowed for the first time on Jan. 9th. On the following day there was a rise in the evening temperature but no further constitutional disturbance. Owing to fear of recrudescence of the fever the patient was carefully watched, but though the temperature continued to rise there was no other symptom of relapse. The lungs were examined, but no innsolubility was detected. He now himself drew attention to a tender spot about the size of a crown piece just below the right sterno-clavicular articulation. There was not however any redness or tenderness to be found at this time. On the evening of Jan. 13 the temperature had risen to 103°F. and continued high for ten days.
There was now a well marked oval swelling clearly discernible underneath the sternal attachment of the great pectoral muscle, and extending from the 2nd to the 4th costal cartilage. It was extremely painful and the pain was much augmented on use of the muscle. The tumour was elastic to touch, and some fluctuation could be felt, especially in the transverse direction. But there was no redness or discolouration of the skin, and there was no history of syphilitic taint. The only treatment was constant poulticing as well as the continuance of the ordinary iron and quinine mixture of the hospital which the patient had previously been taking for some days. The temperature began gradually to fall on the 20th and was normal on the 25th, continuing so from that out. The tumour gradually subsided, became less painful, and finally disappeared altogether before the man left the hospital.

I append Dr. Leedy’s chart of this case as showing the course of pyrexia when pericarditis set in, as is most usual, in the convalescence. This case bears out Paget’s
experience that in the case of the ribs necrosis
does not result, but another case to be de-
scribed later will show that this is not an
invariable rule.

Case 13

The patient, a youth of 16, was shown to the
Brighton Sussex Medical-Chirurgical Society
in 1885. He came under treatment in the
third week of enteric fever. Periostitis first
showed itself on the upper part of the sternum
but subsided without suppuration. After-
wards it appeared in succession on the
outer side of the left thigh, which place
suppurated: on the outer side of the right
femur and outer end of the right clavicle,
where matter also followed. The patient was
improving, but had a stenuous appearance
and a history of bone disease previously.

This short account presents features which
are absent in the other, in that the patient
had a stenuous appearance and had
a previous history of bone disease. The
periostitis here was markedly multiple.

Case 14. The following case is from the Lancet, p. 766,
of 1889, as stated by Dr. Hillier Calpin.

The patient, a lad of 16, became ill on Aug. 31, 1888. This was a well marked case of typhoid, which for the second half of September was in a semi-conscious state, and had to be nursed to take food. On Oct. 10th the left half of the lower jaw was observed to be swollen, with foul smelling breath and foetid mouth and gums. On Oct. 14th the two lower left incisors came out, and other adjoining teeth were loose, whilst the alveolar process was loose and evidently necrosed. The alveolar process with the sockets of all the teeth of the left lower maxilla were taken away.

Note here again the occurrence following on severe typhoid.

Case 15. Another case of necrosis of the lower jaw after typhoid was reported to the Pathological Society of Dublin by Dr. Bennett, and is published in the Brit. Med. Journal ii, p. 1058 for 1881. He chewed portions of the lower jaw of a strong, previously healthy country girl, age 25. The patient had typhoid
fever in 1879. Necrosis set in during convalescence. Large sequestra were removed from the lower jaw, and attempts to save the teeth, which were healthy, failed. They became loose one by one and had to be removed.
Large sequestra are the notable point here.

Case 16. This case, recorded by W. G. C. Franklin in the Lancet 7 p. 353 for 1879, differs from all the others in its extremely malignant course. The patient was a boy, age 6, first seen on Jan. 10th after being unwell for about a fortnight with slight diarrhoea and feverishness at nights. He had well marked typhoid and was beginning the third week. On Jan. 19th considerable swelling was observed on the left side of the face and the breath was very foul. It was supposed a large gum boil or abscess was forming. On the 22nd the incisor teeth became loose and were removed by the fingers or fell out. On the following day the whole alveolar process on the left side was bare; the gum had
separated, and also a part of the alveolar process on the right side was necrosed. On the 25th, the end of the 4th or beginning of the 5th week of the fever, a slough began to form in the left cheek, a blister spot the size of a sixpence spreading in 24 hours nearly all over that side of the face. The patient died on the 26th. Now the swelling it was difficult to examine the mouth thoroughly, but it is probable that the whole superior maxilla had necrosed in five days. The boy had previously been healthy; the parents and other children very healthy.

Franklin calls this a "real and fatal complication in typhoid fever", and if his case be taken by itself it certainly is so.

Case 17. This and the following case are extracted from Enucleati's Surgery, Vol. II, p. 291 (8th Ed.). The patient, a girl of 14, was sent into hospital for a tinea, supposed to be an enucleodroma, just below the crest of the ilium. On cutting down this proved to be a chronic abscess with very thick
wells, containing a sequestrum about the size of a split pea which had been separated from the clinius. She had recently recovered from typhoid fever.

Case 18. The other patient was a man, age 35. He complained of a slowly growing tumor, about 2½ inches in diameter, under the right nipple, which had appeared some months after typhoid. He was sent into hospital by an accomplished practitioner as a case of seirrhous of the male breast. There was one small enlarged gland in the axilla. He was admitted under Marcus Beeck, and there seemed no doubt about the diagnosis. To avoid possibility of error a diagnostic incision was made into the growth, which grated under the knife, and felt and looked like seirrhous. The growth was removed, and a small cavity half an inch in diameter found containing some necrosing granulation tissue. The fidget passed through this discovered a small sequestrum on the fifth rib.

These two cases illustrate the difficulty of diagnosing necrosis after typhoid, a
difficulty that is implied in many of the other cases above. The latter of the two is also an example of the extreme chronicity which characterises a number of them. It also forms an exception as being a case where periostitis after typhoid went on to necrosis in a rib.

Cases 19 & 20. Were those of two patients whom I saw on a single occasion in the Wellington Hospital, New Zealand. Both were girls about 14, who had passed through an ordinary attack of typhoid, and were at the commencement of convalescence attacked with periostitis in the upper third of the tibia. At the time I saw them both were nearly well, and the periostitis had been slight. This hospital is crowded with typhoid patients during the autumn months every year, and I understand that periostitis is but of very rare occurrence as a sequela.

Case 21. This case was a very prolonged one, and presents many points of interest. As I had the patient under my immediate observation during the later months of his illness, I am giving the
history with considerable fulness.

The case is that of R. H. L., a man of strong
physique, age 29, leading the outdoor life of
a New Zealand farmer. Eight years ago he
suffered from a bursal cyst which developed
slowly, and formed a small rounded swelling
in the right buttock, which ultimately
discharged by a single opening in the gluteal
fold. After a few weeks discharge, during
which there was little or no general dis-
turbance, this cicatrizied and healed, giving
no further trouble.

The family history is good, and there is no
intestinal history. The patient himself is
also free from any sign of tubercle or of
syphilitic taint.

In 1887 the patient passed thro' an ordinary
attack of typhoid fever. He made a good re-
cov ery without any immediate sequel, but
never recovered all his weight. A few months
later he began to feel occasional sharp pains
in the right buttock on sitting down, riding
or, but these never interfered seriously with
his work. These attacks of pain continued
to recur, sometimes at long intervals, but
inconvenience from stiffness after riding he continued to increase. The patient dates the actual commencement of his present illness from about April 1892, but says the onset was so gradual that exact location in time is impossible. About the beginning of April discharge began at the position of the old sinus. The discharge continued, and under expectant treatment the condition became aggravated with increased inflammation in the buttock and bagging down the thigh. At the end of July he was admitted to the Wellington Hospital. Here thorough examination discovered a sinus leading up deeply by the side of the tuberculinum. For 3 weeks there was no high temperature. On Aug 21st operation having been decided upon, dead bone was discovered in the upward extension of the sinus. Decisions were made in the buttock on the point of the probe at several places, and seven pieces of dead bone, from the size of a sixpence downwards, lying detached, were removed and appropriate through drainage established. After this operation the temperature begins
to show a fairly marked hectic type, sometimes reaching a rather high point at night. The discharge continued to be profuse, thick, and purulent, the bagging of the thigh again appeared and developed into a hard, brawny swelling extending more than half way to the line.

On Sept. 11th the thigh was treated by free incision and more thorough drainage, following which one of the sinuses a small piece of necrosed bone was found lying well up under the gluteus maximus, and this was removed.

On Sept. 18th a further operation was undertaken, and the diseased surface of the tubercle was thoroughly scraped. This proved effective. The temperature began to show lower maxima and lessered range, until the evening record showed only 101° above normal, and from this time onwards the rise of temperature was only occasional, and due to temporary bagging of the thigh. The discharge became slight and less thick and the whole condition improved.

Still the sinuses did not granulate satis-
factorily, and on Nov. 23rd the walls were pumped to induce more healthy action. A few high temperatures are recorded just after this, but in a few days the temperature became and remained of quite a normal character.

Good appetite and ample fees air led to great general improvement, but the sinuses made slow progress until the voyage to England was undertaken. This completed the cure: the patient in a few months was perfectly strong and well, and could walk many miles without a trace of lameness.

This case presents some interesting features: the necrosis was in a peculiar site, the autolysisbursal sinus led long after to the occurrence of periostitis and necrosis, typhoid being apparently the active cause: there was a long interval after the typhoid during which an extremely chronic periostitis gave only occasional reminders, yet was destined to develop after 5 years into a troublesome case of necrosis. It also exemplifies the great difficulty of early diagnosis, and the resulting evil of delay in treatment.
The next seven cases are those previously
incorporated in his article as mentioned
above. In the original they are stated at
great length, and in many the daily
progress is recorded. It is necessary here
to present them in a shorter form.

Case 22.

No. 1. Typhoid fever — Acute localized peri-
ostitis with severe local symptoms without
systemic disturbance, attacking on the
left side the middle of the tibia, the
fibula, and the supraspinous fossa of the
scapula; on the right, the lower extremity
of the humerus and of the tibia. As
follows: —

B., age 22, [illegible], admitted Aug 16, 1877.
His health had never been bad, but he was
pale and not over strong. He never had
pneumonia, nor has he any indication
of scrofula or syphilis. Hereditary history
unimportant. He had been passed as fit
for hard work. Early in August 1877 he
showed the symptoms of typhoid fever.
He had all the symptoms of typical typhoid
of a severe type. The evening temperature
on Aug. 16 was 38°45, but by Aug 21° had
reached 40° C. and varied between 39°0-40° C till Aug. 25, and after variations of pyrexia it fell on Sept. 19 below 37° C. Convalescence was fairly established by Sept. 23 and he began to get up: by the end of the month he was getting out of doors, but he remained thin and weak. He complained of pains in the knees, legs and feet, and the left leg became heavy and swollen. In Oct. 8, after being out in the cold, he felt pain in the middle of the left leg, and this became rapidly acute, and a well marked swelling appeared at the part. He could not bear or support it without pain, nor could he bear the weight of the clothes. There was no redness or heat in the part. The subcutaneous cellular tissue was oedematous, no fever or abdominal disturbance. An ointment of Belladonna and mercuric was applied. A small periosteal abscess could be made out at the lower part of the swelling. By Oct. 21 all that remained was a thickening and hardening of the periosteum with slight pain on walking. On Oct. 26 there began to be acute pain in
the middle of the infraspinous fossa of the left scapula. diffuse swelling was present but no pyrexia. This treated as the former. Soon the pain increased, and fluctuation could be made out. By Oct 27th the symptoms were disappearing in the shoulder. But on Oct 30 similar symptoms were present in the left thigh at the lower and outer part. Under similar treatment this ran a like course. In a few days the right humerus was attacked at the lower and inner part, and the lower ends of the right and left tibia were similarly attacked. In these last Tinct. Godi was tried. The parts attacked got well in turn, one of the tibial abscesses having opened spontaneously and healed. There remained slight peristated thickening and slight limitation of movements. The patient left the hospital finally on Aug 1 1878.

Case 23. K. Epidemic fever. — Acute localised periostitis with intense local symptoms without general disturbance, and attacking the middle of the right tibia and lower part of the left radius.
B, age 22, a soldier, admitted Oct. 21, 1877. The patient was big and strong, showed no sign of acropaia, and asserts he has always had good health. There is no previous history and he has never had pneumonia. His mother has long suffered from chronic articular pneumonia. He began with typhoid early in October, and the only unusual feature was obstinate constipation and the long duration (40 days) of the fever. For a week the temperature varied between 38°C and 40°C, and came down to 37°C on Nov. 1. Then the patient became convalescent. On Nov. 15 he began to feel pain at the junction of the middle and lower thirds of the right tibia. This part was exquisitely tender, and the whole limb was swollen. The treatment was as in the previous case with the addition of blisters. Pulsation was again detected here, but the limb was nearly well by Dec. 4. On Dec., shooting pains began in the left radius, and increased so that soon the fingers could hardly be moved. Belladonna and mercury were applied and the part was poulticed.
Later Potassium Iodide was given internally. The patient was discharged convalescent on Dec. 24. He returned on Apr. 5, 1878 with ulcers at the sites of the old periostal swellings, but not much inconvenience from them. Iodide of Potassium gave no improvement, and the patient was finally discharged on June 1st.

Case 24. Obs. III. Typhoid fever. — Periostitis localised to the middle of the left tibia; —

V, age 24, a clerk, entered hospital on Nov. 2, 1876. He had never had cerebro, pleuritis or typhoid. He was seized with typhoid fever in the end of October 1876. The fever lasted long and he did not begin to convalesce till the beginning of December, and then his left leg was all swollen and he could scarcely use it. He complained of it and next day there was observed on the anterior surface of the tibia a swelling very painful on pressure without change of colour in the skin. Under treatment by mercurial injection and belladonna and enveloped in cotton wool the swelling declined gradually. On Dec. 18 the leg still swelled.
after walking much, the periostea was raised and swollen, but caused no pain except on firm pressure. There was no improvement under treatment, and twenty day after the patient left the hospital.

Case 25. Obs. 17. Typhoid fever. — Acute periostitis affecting the lower end of the right femur:—
A., age 31, a soldier and formerly a farmer, was not of very robust appearance. He entered hospital on Jan. 3, 1877. He was attacked with typhoid in the end of November 1876. The fever lasted 7 weeks. Up to then his health had always been good and there was no hereditary history worth noting. Towards the end of convalescence he had a fall on the floor that did not directly injure the leg. That day he felt a tiredness and swelling in the right leg. Next day he felt rather acute pain at the lower end of the femur. There was no other fever nor abdominal disturbance, and after six days he was able to go away. From that date, Dec. 25, the pain increased and some swelling came on, but without interfering with his general health. During the few days after he left, the pains became
very acute, and he had to return to the hospital. The pain got to the knee and well marked effusion was present in the joint. He was treated by Vigo's plaster and Infusion of Potassium with good results. The swelling and effusion declined: the swelling of the femur got less and the effusion entirely disappeared, and in this state the patient left the hospital.

Case 26. Obs. V. Typhoid fever and diffuse supplicative peritonitis of the left femur simultaneously.

A young soldier, pale, broken down and very miserable-looking, entered hospital in the end of November 1876, showing all the signs of typhoid fever of a week's standing. He had headache, sleeplessness, a hot dry tongue, and the abdomen was swollen and painful on pressure. There was gurgling in the right iliac fossa, copious diarrhoea, markedly enlarged spleen, and high fever (40°C). Two days after admission there were rose spots on the abdomen. He complained of acute pain in the left thigh: the limb was semi-flexed and could not be extended on account of the
acute pain. The thigh was markedly swollen, hot, and oedematous. Marked fluctuation was present, especially at the lower part of the thigh near the knee joint. An incision was made at the outer surface of the thigh and 1/2 litres of pus removed, thick reddish and odourless. Great relief followed, but six days after the patient died from the worst complete exhaustion. The P.I.E. examination showed the Peyer's patches ulcerated and the spleen soft, but no metastatic abscesses. The periosteum of the left femur was raised, of a wine-red colour, and the projections on the surface of part was separated or ulcerated, but it was easily detached from the bone. The bone itself was quite healthy, although a little consolidated, and the Haversian canals emitted drops of blood.

Case 27: Typhoid fever. — Acute periostitis affecting the middle of the left fibula. — Acute supplicative periostitis affecting the supraspinous fossa of the left ulna. — L., a soldier of 22, was brought to hospital on Aug. 24, 1878. He had formerly been cu-
gaged in agriculture, and was strong and healthy, never having been ill. He had at times had some slight glandular swellings in the groin and neck. He never had rheumatism or syphilis, but admits excess in alcohol. Eight days before admission he began to notice his strength failing, felt tired and had slight rigor. All the symptoms of typhoid fever followed and rose spots appeared on Aug. 26. The patient was seven more reduced by the fever than is usual, and the evening rises of temperature were high and accompanied by rigor. Emaciation and weakness reached a severe degree, and on questioning the patient it was found that for several days the left shoulder had been swollen; he attributed the swelling and pain to constantly lying on the part. The shoulder movement became painful and were somewhat impossible. The infraspinous fossa and the borders of the scapula were the seat of well marked edema. Pressure over the infraspinous fossa was exquisitely painful and fluctuation could be detected. A blister was
applied. By Sept. 23 the pain and swelling had much decreased. By this time he had been feeling slight pain in the left leg; the limb seemed heavy and could scarcey support the weight of the body. At the middle and outer part of the left leg there was found a hard, rounded swelling very painful on pressure, but there was no throbbing. This swelling seemed to be connected with the anterior surface of the fibula. Mercury and belladonna ointment and cotton wool were applied. Soon fluctuation could be detected. Meanwhile the shoulder had become nearly well, and full mobility was restored. He perspired freely at night.

Still the subacromial abscess remained and on Oct. 3 this was evacuated by a trocar forcing right down to the bone, after which a compress was applied. By Oct. 5 the leg was cured and only slight swelling of the fibula remained. But there was a relapse in the shoulder with constant sweating and severe general disturbance. Incision and drainage resulted in improvement in a few days.
and by Oct. 14 the cure was complete. A. Kerec's last case is given to illustrate the influence of tracmacinum which he considers a most important factor in the causation. It is as follows:—

L., a soldier of 24, strong and robust, had been free from previous illnesses. He had no trace of areofolia or syphilis and had never had scarifications. On November 1876 he had typhoid fever which lasted a month and was very severe. It was 6 weeks before he began to recover his strength. Then he had a fall, and a block of wood struck the middle of the back of his forear. At the time he felt acute pain and next day the part was quite black. The forear was swollen up to the elbow and the pain was so acute that he could not move the forear. The inflammation and pain lasted about 7 days, and then a localised swelling formed at the spot struck. This was painful, the skin was glared, and three weeks after the accident the swelling pointed and discharged about half a glass of blood-stained pus. This gave
relief and the part could be moved without pain, protrusion and expulsion being limited. The opening closed, but opened again to give vent to some reddish pus: closed once more and opened again later. On the inner posterior surface of the right ulna there was found a swelling the size of a small orange. At its upper part was a small opening discharging drops of pus. The ulna was the seat of a marked hard, uneven thickening especially on the posterior internal border. Protrusion and expulsion were slightly restricted. Salicylate of Potassium was given for 5 months without any improvement. The only treatment which seemed to give improvement was Vigo's plaster. In Sept. 1878 the condition of the bone was much the same, but the general condition was excellent.

The remaining three cases are extracted from Dr. Keen's memoir as referred to above.

Case 29. H. W., a youth of 16, who had been strong and in good health, was seized with typhoid on Oct. 17, 1871. The fever lasted 4 weeks,
but the patient was confined to bed for 4 months, and did not fairly recover till May 1872. At the end of 1872 he began hard work, using a tete-pound hammer and this caused great exhaustion of the right arm and leg. The right arm began to ulcere: four abscesses discharged, remained fistulous, and after giving outlet to several pieces of necrosed bone and suppuring for a year, they were completely cured. Resuming work again the right thigh became affected, ran the same course as the arm, and finally the fistulae driedised. In July 1873 five fistulous tracts were found leading down to the right femur, one reaching very near the knee joint and threatening it. In this a piece of necrosed bone was found. In 1874 an abscess formed over the tibia, but no necrosis was detected. In 1876 abscesses and separation of sequestra occurred in the left arm. In the right thigh Dr. Reed enlarged the sinuses, removed the diseased bone, and in 4 months the cure was complete. Except that one of the sinuses opened afresh
the patient became quite strong and robust.

Dr. Keen notes that in the arms the abscesses were situated near the insertion of the deltoid muscles, and in the right thigh under the insertion of the gluteus maximus and in the left thigh near the small trochanter. He remarks that these points are the most strained in the body on account of the muscles to which they give insertion.

Case 30.

A very delicate young girl of 16 was attacked with typhoid fever on May 10, 1846. After 3 or 4 weeks in bed she wished to get up and go about, but was obliged to desist on account of weakness and pains in the left tibia. Two abscesses pointed and burst on the left leg, but closed without discharging any pieces of dead bone. In Dec. Dr. Keen probed the sinuses but found no sequestrum. He gave tone and cod liver oil. In Feb. 1847 he made an incision down to the bone, opened the medullary canal, and removed a small spike of necrosed bone. Cure was complete by March 5th.

Case 31.

A student, age 19, had typhoid in 1868.
He did not make way in his convalescence, and suffered much from headaches. Four months from the end of the fever there was found to be an abscess in the right temporal region. It was opened and the bone was found to be necrosed. On Oct. 5 an incision three inches long was made and extended backwards to give free access. A portion of the frontal bone was removed and at the anterior inferior angle of the temporal bone the inner table was found to be necrosed. A portion of the great wing of the sphenoid was removed, and in it was found the anterior branch of the middle meningeal artery filled with broken down clot. The Dura mater was slightly congested. The wound was closed and in 15 days the cure was almost complete. Eight days after the operation the patient resumed his studies. Two small pieces of necrosed bone caused some threatening symptoms, but after their removal the cure was complete.

In 1869 he had two epileptic attacks, but these never recurred.
These later cases of du. lucierii and de. Head go to support the others in many important points—notably so as to absence of constitutional cause, the frequent occurrence of multiple attacks, and the possibility of very early and very late incidence.

The Sequelae a reality.
The first question that calls for an answer, on consideration of the group of records given above, is—are we justified in concluding from them that persistence and secessions are sequelae proper to the typhoid that precedes them, or is their occurrence after typhoid accidental, and are they mere sequelae of typhoid than of other illnesses which are followed by profound exhaustion and depression of tissues? Sir James Paget, from a review of his own cases, builds that probably these are sequelae proper to the typhoid, and suggests that each fever may have its own sequelae, and in this sense, though perhaps in less degree, be so.
specific as in its fever period. I think that consideration of the cases recorded above makes such probability even stronger, and that we must allow that not only a post hoc but also a propter hoc relationship does exist between typhoid and these sequelae.

In support of this conclusion there is strong evidence both positive and negative. I take the negative evidence first. We find a practical absence of peritonitis and necrosis after the other fevers, the exceedingly rare exceptions only pointing to the accidental nature of the occurrence. Thus while scarlet fever frequently leaves behind it suppuration, otitis, etc., rarely its respiratory complications, and diphtheria its various paralyses, it is difficult to find even single instances in which these diseases are followed by peritonitis and necrosis. On the other hand, the occurrence of these following on typhoid, although certainly not among the commoner sequelae, has led steady to speculate on the probability of a positive causal relationship.
between them and the fever. As indicating such a relationship we have many facts: independence of the ordinary causes of periostitis: occurrence of typhoid at an age when that disease is rare and ro bones not usually attacked: uniformity of cases as to time of incidence of the sequelae and similarity in the progress and termination of the disease when established: and other points to be discussed later. There would seem therefore every ground for believing that the periostitis and necrosis which have been shown to follow typhoid in a number of cases are sequelae proper to the typhoid, and depending in some way more or less directly on the conditions of the typhoid as the main determining factor, whatever else may contribute as subsidiary causes to modify particular cases. While the exact nature of these determining conditions is, and their mode of action remain for investigation.

Class of Cases liable.
It would be valuable to know if possible in what varieties of cases of typhoid to expect the occurrence of periostitis. But on this point the evidence available does not seem to offer much help. We shall see presently that the constitutional peculiarities of the patient offer no indication of the probability.

But one point seems certain: that severe cases of typhoid are more liable than mild ones to be followed by periostitis. This is only what might be expected, and it is a conclusion repeatedly verified by the cases recorded. In the same way we might expect the occurrence more often after relapsing typhoid, but this has not been much mentioned in records of cases.

Periostitis. The occurrence of periostitis after typhoid, although not common, would seem to be more frequent than is generally supposed.

There is not sufficient material on which to found an accurate percentage calculation, but we have general statements that may guide us to a certain extent.

Sir James Paget groups periostitis after
typhoid with phlebitis and paralysis of muscles, and says he has seen of these, more than 70 cases in one year. As he goes on to speak more especially of pericarditis it is probable that a considerable proportion of these 70 cases come under this head. Dr. Affleck had 3 cases out of a total of 117 typhoid patients in one year. Dr. Hayward has seen about half a dozen, and I have myself seen three within the past year. Dr. Mercer has had 7 cases in a large experience of typhoid fever. Probably 1 per cent would not be far off the mark.

Age & sex.

The age at which pericarditis following typhoid is most common corresponds closely with the age at which typhoid is most common: that is, between 15 and 30 or 35. There does not seem to be greater proportional liability in patients about the age of puberty as might have been expected from the fact that pericarditis from ordinary causes is more prone to attach the developing membrane about that time.

There seems to be a less marked difference of liability between the sexes than in ordinary pericarditis.
Time of Incidence.

When we come to consider at what time periostitis supervenes we find some considerable variety. Pajot, speaking from his own experience, would conclude that the occurrence is always of the nature of a sequela: that is, that the periostitis declares itself only after complete desfeverence when the patient is moving about and getting stronger. Dr. Lecquic speaks to the same effect as to the time of incidence in the great majority of cases. It is true that this is the history of the great proportion of cases. But it is equally true that in some periostitis occurs during the course of the fever, and is then more accurately regarded as a complication rather than as a sequela. This is the character of Dr. Afflecks three cases, in two of which periostitis occurred in the third week of the fever, and in the other just when the temperature had begun to subside. Dr. Lecquic records a similar case, and mentions another (not recorded) in which the typhoid and the periostitis actually began at the
Same time. Some of the other cases also come more naturally under the head of complication rather than sequela.

As regards time of incidence I would classify the cases under these types:

(1) Where periostitis supervenes during the continuance of the fever, more or less acute, and prolongs the pyrexia without a break.

(2) Where periostitis comes on in the convalescence, the temperature having been normal, and where the periostitis is disposed of within two or three months. The temperature chart of Dr. Svedy's case illustrates this the most usual course.

(3) And a third group, where a lurking periostitis left after typhoid only becomes troublesome several months or years after. Of this sort is one of Dr. Hayward's cases, and my case of P. H., where 4 or 5 years elapsed, when the chronic periostitis advanced to become a case of sequela.

**Bones affected.**

While the tibiae are still the bones most frequently attacked, they do not claim
anything like the large proportion of cases they do in ordinary surgical periostitis and necrosis. When these follow typhoid they locate themselves often in unusual positions. Sir James Paget's cases were distributed over the tibia, fibs, femur, ulna, and parietal bones. In the cases above we have examples also in the sternum, clavicle, scapula, humerus, radius, a finger, the ilium, tuberosity, superior and inferior maxilla, frontal, temporal, and sphenoid bones—a much wider range of affection than one looks for in an equal number of cases from other causes. In Ducret and Dr. Kaye are agreed on the greater frequency of the sequelae in the limbs, and especially in the lower limbs.

Another feature of these cases is the frequency with which we see the simultaneous or consecutive unification of more than one bone. Paget thinks this is of exceptional occurrence, and mentions that he has only seen one case in which more than one bone was affected. We have seen above, however, that multiple affection
of bones is of common occurrence. This was 20 in 30 per cent. of the cases given above, and the parts implicated were frequently far apart; for instance, in one the right humerus and right tibia were attacked; in another the sternum, right and left femur, and the right clavicle. Lucierie records one case in which no less than five different bones were affected.

The periostitis is generally limited in extent and is often not of a very severe type. When necrosis occurs it also is limited both in area and in depth. Lucierie's experience leads him to the same conclusion, although Dr. Kew says the occurrence of central necrosis is frequent, as illustrated in one case above observed by him.

The early treatment of the periostitis renders the occurrence of any necrosis improbable. The sequestrum which usually results is as a rule independent of any osteomyelitis. Only the subperiosteal plate of bone suffers, and the portion which separates is a thin shell often not larger than a sixpence. In this respect the sequestrum resembles
that which results from a traumatic periostitis in a healthy person. It is worthy of note that the only exceptions to this rule have been in cases where the jaw bones were affected; possibly this may be accounted for by their greater liability to crippling influences.

Paget had never seen a case in which periostitis in a rib went on to necrosis. I find only one instance in which this occurred, that recorded by Erichsen.

**Etiology.**

The etiology of those cases in which periostitis and necrosis follow typhoid fever has given rise to much discussion, and many widely different views have been expressed. Let us look in the first place at some of the theories advanced in explanation of these complications of this fever.

Muscular degeneration is considered by Zunke to form an integral part of typhoid fever just as much as do the intestinal ulcerous and septicemic states. Siebenmeister refers it to the pyemia. Others maintain the degeneration is due to infiltration
of special typhoid cells and alteration in the nutritive fluids.

Again some analogy is found in the cases of abscess of the lungs and recession of laryngeal cartilage. These are more frequent in winter, and follow as a rule upon severe cases of typhoid. Among these cases we have some in which the submucous tissue is the starting point, but in others the affection originates in the perichondrium and cartilage. The original source is referred by some to a typhoid infiltration similar to that which obtains in the Peyer's patches. Others explain it by hypostatic congestion in the most dependent parts and the constant pressure and friction due to the incessant laryngeal movements.

Gangrene of the soft parts is referred to the initiated state of the blood and the enfeebled circulation.

Again cases of phthisis after typhoid are explained by the septic state of the blood and the general lowering of vitality.

We may now proceed to consider in detail the various possible causes of periostitis and necrosis as sequelae of typhoid.
In the first place, that in the peritendinous
of the tendon as well as adjacent tissues.
A tendinitis may be a secondary reaction if the history of the case is not consistent.
The history of the case is not consistent if the condition has been treated previously.
It is evident that the peritendinitis is a complication of the wound after surgical treatment.
or acquired, would play an important part in determining the occurrence of periostitis and necrosis as sequelae of typhoid fever in cases where these defects were already present. Such predisposing states one would look for in rheumatic subjects, and in those of a seropulmonary tendency or with splenic taint. So far as the cases recorded in the British journals are concerned, splenic taint is not mentioned. It is most unlikely that such a factor would altogether escape notice if its existence were of any account in determining the occurrence of the sequelae. We may conclude that such taint is no part of the causation. Nor does the tubercular or strumous diathesis seem in any degree to influence the occurrence of periostitis and necrosis after typhoid fever. Dr. James Page 6 practically asserts the absence of these diatheses in the cases he has observed, and notes that in many of them the patients were of so robust and apparently unblemished constitution that it would seem absurd to attribute seropulosa to them. Then to take the further cases cited above, we find that in only one there was a strumous
appearance and a previous history of bone disease: while in one other case—the only one in which phthisis is mentioned—the phthisis would seem to have followed along with periostitis on the heels of the typhoid as a concomitant sequela. Considering the wide spread nature of tubercle in general the above small proportion is remarkable.

Turning to Lucariello’s cases we find even stronger evidence of the absence of constitutional influence, for he states definitely that in none was there either trace or history of tubercle, syphilis, or rheumatism. We are therefore justified in concluding, as far at least as the cases observed guide us, that constitutional defects do not play any important part in the causation of the sequelae of typhoid fever under consideration.

Vexed vitality. Several observers, remarking on their cases are inclined to ascribe much importance to the profound exhaustion and the lack of vitality in all tissues which follow typhoid. It is pointed out that the cases of typhoid which leave periostitis behind are mostly
Severe and prolonged as that typhoid more than any other fever leads to profound nutritive changes from the longer insistence on low diet and the extensive intestinal changes limiting assimilation long after the subsidence of the fever. And again, prominence is given to the influence of typhoid in producing actual degenerations, as in the granular and vitreous degeneration of muscles and similar changes in other organs of the body.

While recognizing the importance of these facts it seems to me that they come far short of being a full explanation of the origin of this class of cases we are considering. Certainly they must go to establish a condition of diminished resistance in periosteum and bone as in all other tissues. But typhoid is not alone in producing this great lowering of tissue vitality and these degenerative changes. Other febrile diseases produce these same conditions, yet are not followed in the same way by periostitis. And again, while severe and prolonged typhoid is the rule in these cases, there are many instances above where
the fever was of quite moderate severity and duration.

It seems to me, therefore, that these conditions should be placed among the negative causes of the sequelae, creating a diminished resistance to a more active process, and probably often rendering such process operative where otherwise it would fail to take effect.

We come next to consider in what way and to what extent traumatism may be responsible for the periodicity which follows typhoid. If we take trauma to mean an actual injury in the sense of a blow or crush &c., we shall not find much in the cases recorded to support the view that this is an important cause; in fact, there is an absence of traumatic history in the notes of nearly all of them. But if we take the wider and more scientific view of the meaning of traumatism and include such unobserved facts as pressure of bedclothes and contraction of muscles, it is possible that its sphere of influence may be more extensive than at first sight appears. Routh believes that the sequela is always the result of traumatism,
and argues that this need only be very slight in a patient debilitated by typhoid.
Mr. Lucieer also makes out a strong case for traumatism, which he believes to have a very important influence in these cases. He explains that he does not refer to gross injuries, as patients in bed are not liable to those; but he notes that the bones attacked are just those most exposed to constant pressure and friction, and draws instances from his cases to show that the parts affected are those most exposed to external influences. Thus he shows that the middle of the tibia and its anterius surface, being placed on the edge of the bed while the patient gets in, is exposed to pressure which constitutes a sufficient trauma. So with the shoulder blade from constant lying on it, and he has noticed that the side on which the patient lies is the one to be attacked. He also draws attention to the fact that the part of a bone affected is often the part subjected to the greatest muscular strain: for instance, at the insertion of the deltoid in the upper, and of the glutaeus maximus in the lower limb.
But the same argument applies here as has been used above,—why should not the same result follow upon other febrile diseases equally debilitating? The argument in favour of the importance of traumatization in ordinary surgical periostitis is the greater frequency with which males are the subjects, and the preponderance of cases in which the tibia is attacked as being the bone most exposed to injury. But in the periostitis which follows typhoid the relatively large proportion of males is much less marked than in ordinary periostitis, and, while the tibia is still the bone most frequently attacked, the periostitis following typhoid is very much more widely distributed over the bones of the body than in these ordinary cases.

It may be fairly concluded that, while traumatization is still an important factor in the causation of the special class of cases considered, it does not in them play so important a part as it does in ordinary surgical periostitis.

Pyæmia. It has been repeatedly suggested that the real cause of periostitis and necrosis as
sequelae of typhoid is to be found in septicaemia or puerperal fever. The large number of cases in which several bones were affected in the same individual supplies a strong argument in favour of this origin and against traumatism.

We have seen above Dr. Willis's opinion that laryngeal ulceration, when associated with typhoid, goes through a similar and parallel course to the disease in the Peyer's patches—first deposit of typhoid matter, then ulceration, and occasionally perforation. We have also seen that Dr. William Gull emphasises the occurrence of typhoid processes in the most unusual sites. It is possible then, that the periosteal inflammation may be a specific typhoid affection, having a common origin with the intestinal lesions, just as Zuckerkandl considers muscular degeneration to be a real part of the typhoid invasion. In that case the ultimate cause would be found in the peculiar condition of the blood which exists in typhoid: and this may be so.

But the late stage at which periostitis generally supervenes would seem to make it more probable that the poison is gener-
ated secondarily to the primary lesions of typhoid; that is, from the intestinal ulcers. The period of possible dissemination would, or that necrosis naturally be from the period of ulceration up to the time of complete cicatrisation of these intestinal ulcers: that is, in the later stages of the fever and early in the convalescence—a condition that agrees pretty closely with the facts in most of the cases. This explanation receives support from instances of the spread of poison in other diseases as well as typhoid. Thus we have pyaemic abscesses in the liver from intestinal ulceration and from cranial bone disease; and from typhoid itself we have occasionally suppurating infarcts and acute infective arthritis. It seems quite probable that the bones and periosteum may be affected in a like manner.

While such seems to be the probable cause in these cases, it is not clear exactly in what way the cause operates. It may be a neurovascular effect, or the result of embolism or thrombosis, or one or other of these in different cases. As regards the former it is
easy to understand how a poison circulating in the blood might act on the efferent motor nerves as to produce local congestions; and that these in turn might go on to inflammation in a tissue so easily depressed as periosteum. Against the starting point of inflammation and necrosis may be supplied by small particles of morbid products, derived from a distance, blocking up a vessel and constituting septic embolism in the periosteum, with its train of symptoms. A thrombotic origin is supported by Dr. Keen. He says that during and after the convalescence from typhoid large cells range themselves along the vessel walls, the circulation thus, the vessels is very slow and weak, nutrition is much impaired, and granular degeneration attacks the vessels. The blood is altered by the typhoid poison. As he says, it is not surprising that with these conditions present thrombosis should be possible.

Having come to the conclusion that peri-ostitis and necrosis after typhoid are specific sequelae proper to the typhoid, it follows that there is a constant effective etiological factor.
present in these cases. We have not found this in constitutional conditions, nor in the lowered tissue vitality which results from typhoid: nor did we find traumatism all sufficient. But in septicaemia and pyaemia we have a constant factor which is also effective, although evidence is wanting to show exactly in what way these act. It seems a legitimate conclusion that these constitute the effective cause of the sequelae while the other circumstances discussed may be fairly allowed as contributing causes, one or more of which, when present, will modify particular cases.

Symptoms of Course.

Sir James Paget mentions that his cases of periostitis and necrosis after typhoid were not of a severe type, and many of the other cases were mild and healed early without much affecting the convalescence. But others of them go to show that there is considerable variety in this respect. There were cases in which nothing more than slight subacute periostitis occurred: others
more acute which made a rapid recovery, whether by spontaneous absorption or evacuation or after operation: and we have seen that there is a considerable number of cases having a tendency to extreme chronicity, perioditis remaining chronic and causing only occasional or trifling inconvenience for months or even years. As a rule all that is left is a slight periosteal thickening which does not greatly interfere with the use of the part. We have already remarked on the frequent implication of several bones simul-
taneously or consecutively.

Observers differ widely as to the proportion of cases in which perioditis supervenes, but we may safely say that it occurs in only a minority of cases. We have seen that it is liable to occur in cases the most chronic as well as in the most acute. When it does come on it of course acts to prolong the illness, often to a serious extent. We have, then, all degrees of severity and duration.

**Prognosis.**

We should have expected that such serious
and exhausting diseases as periostitis and necrosis, following on typhoid fever which is
in most of the cases of a severe type, would be followed by disastrous consequences much
of t en ean than is actually the case. As it is, the
prognosis for life is distinctly good, with
many of the cases showing an early and com-
plete recovery. In only two have we seen
that there was a fatal issue. One in a
child, the history of whose illness with its
rapidly fatal result is in marked contrast
with all the others: so much so that the
history of the disease seems to accord much
more closely with that of Carcinum Ovis
that with the periostitis and necrosis that
concerns us here. The other was the case
recorded by Mr. Beesly, in which treatment
by incision was followed by a fatal issue
in a few days from acute septicemia.
The prognosis as to recurrence and as to
subsequent health is also good. Page notes
that the healing in his cases was, so far as
he could learn, permanent. There is no
history of recurrence in any of the other
cases. In my case of R.H. A., where active
Necrosis had been at work for a year, the patient was in perfect health within 2 months from the time of closing of the ulcers.

As tending to this satisfactory outcome we may note the slight and superficial extent of the implication of periosteum and bone, which is the rule in these cases, and the absence of those constitutional taints which when present in a patient suffering from periostitis and necrosis, increase the gravity of the disease, and make for its recurrence even when recovery seems to be an established fact.

Diagnosis & Treatment.

On this subject of diagnosis there is not much to be said. The diagnosis will differ in no respect from that of periostitis and necrosis in general. But the onset is often very insidious. Dr. Kean says that often the beginning of the disease escapes notice until the surgeon's attention is called to the symptoms by the patient after several days of suffering—a means of diagnosis on which, as he remarks, one cannot always count.
Treatment.

When, after typhoid, symptoms are present which at all resemble those of periostitis it would be well to remember that this disease finds a place among the sequelae of the fever. The incidence of the sequelae may come times and to some extent resemble a relapse of the original fever. Local symptoms and the character of the pyrexia will usually distinguish between these.

Nor is there any treatment special to these cases which does not apply under ordinary circumstances. The early treatment of the periostitis is of the utmost importance for shortening the attack and diminishing its severity. Sustaining general treatment will apply to all cases. A blister is good in the chronic cases. Bleeding at the onset of an acute attack. Poulticing and incision in acute cases will often prevent the deeper implication of bone. Mr. Lewicke's objection to incision arises from the fact that one of his patients died under this treatment from acute septicemia. But we have seen how often it has been practiced with good results, and antisepsis is now so perfect.
that the objection could hardly be supported. For the residual thickening, Tinct. Iodi may be painted on the part, and Potassium Iodide given internally.

When necrosis has occurred with suppuration, free drainage must be established, and the sequestrum removed if separation have occurred. Where separation proceeds very slowly, the small extent of bone diseased would in many cases justify active interference by scraping, and we have seen above that this practice has been carried out with success.