

On necrosis at the extremity of the diaphysis, and in the epiphysis of growing bones / by F.S. Eve.

Contributors

Eve, Frederick Samuel, Sir, 1853-1916.
Royal College of Surgeons of England

Publication/Creation

[London] : [publisher not identified], [1879]

Persistent URL

<https://wellcomecollection.org/works/v6gjz47>

Provider

Royal College of Surgeons

License and attribution

This material has been provided by This material has been provided by The Royal College of Surgeons of England. The original may be consulted at The Royal College of Surgeons of England. where the originals may be consulted. This work has been identified as being free of known restrictions under copyright law, including all related and neighbouring rights and is being made available under the Creative Commons, Public Domain Mark.

You can copy, modify, distribute and perform the work, even for commercial purposes, without asking permission.

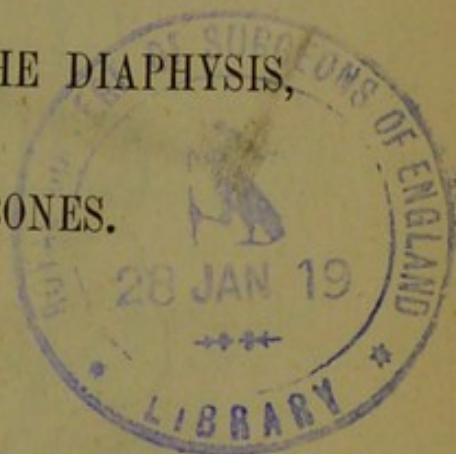


Wellcome Collection
183 Euston Road
London NW1 2BE UK
T +44 (0)20 7611 8722
E library@wellcomecollection.org
<https://wellcomecollection.org>

17

ON
NECROSIS AT THE EXTREMITY OF THE DIAPHYSIS,
AND IN
THE EPIPHYSIS OF GROWING BONES.

BY
F. S. EVE.



During the past year my observation has been directed to cases of circumscribed necrosis at the extremities of the long bones of young subjects, and necessarily occurring during the period of growth. The necrosis was in some cases circumscribed to the extremity of the diaphysis or the epiphysis, but most frequently involved the extremity of the diaphysis, epiphysial cartilage, and adjacent portion of the epiphysis.

I am induced to publish them under the impression that the special liability to inflammation of the growing portions of bones has attracted but slight attention, and has not, so far as I have been able to ascertain, been fully explained.

CASE I.

Necrosis confined to the extremity of the diaphysis of the lower end of femur—Separation of the epiphysis—Destruction of the knee-joint.

Julius J., aged 11 years, was admitted to Abernethy Ward, under the care of Mr. Savory, March 4, 1878. A week before he sprained his knee in coming from school. A few days afterwards he complained of pain on the inner side of the joint. On admission the lower extremity of the left thigh was uniformly swollen; and there was increase of heat, pain, and tenderness above the knee on the inner side.

Morning temp. 101.6° ; evening temp. 103° .

The lower part of the thigh became more swollen; the knee-joint filled with fluid; pus formed around the upper part of the articulation, which was let out by incisions; the febrile symptoms continued.

Dec. 6.—The following note was made:—

The knee-joint is now destroyed. The tibia is displaced backwards, and the leg is in a position of extreme inversion. The position of the leg varied, sometimes being everted. The febrile symptoms were now severe, and amputation was only postponed until the acuteness of the inflammation had subsided.

Jan. 14.—Amputation of the thigh was performed in the upper third. The patient made a good recovery.

Examination of lower extremity of femur.—The condition is roughly shown in the woodcut Fig. 1. The epiphysis is separated from the diaphysis, and displaced backwards, occasioning the deformity of the leg observed. About three-quarters of an inch of the extremity of the diaphysis is necrosed. (This is shaded in the woodcut.) The lower third of the

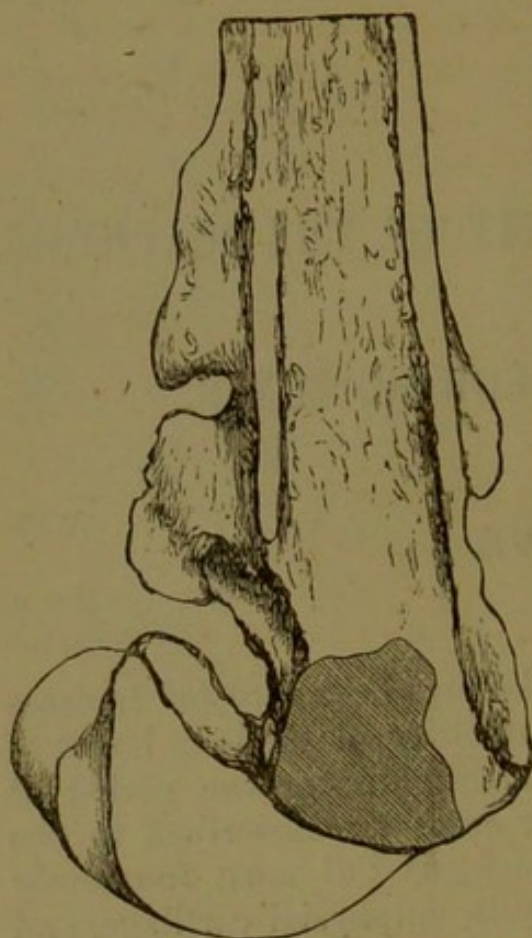


Fig. 1.

shaft is covered by a deposit of new bone, which is thickest on the posterior surface. A small portion of the compact layer on the posterior surface at the extremity of the shaft is bare and dead. The medulla was infiltrated with the products of inflammation. The knee-joint contained pus, and the cartilages were destroyed.¹

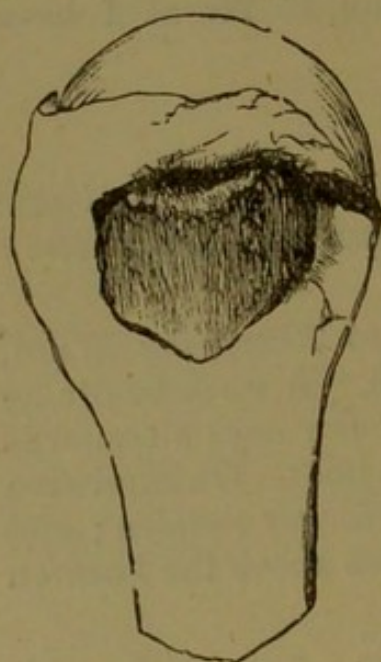


Fig. 2.

The inflammation in this case appears to have primarily attacked and spent its violence on the newly-formed bone at the extremity of the diaphysis. With the exception of the slight necrosis of the compact layer, which might have been produced by separation of the periosteum with the displaced epiphysis, the dead bone is circumscribed to the portion of cancellous tissue indicated.

¹ Dry and moist sections of the specimen are preserved in the Museum, Series I., Nos. 384 and 384 a.

There is a similar specimen in the Hospital Museum.¹ The upper part of the humerus of a child, in which the epiphysis is separated, and there is necrosis of about a quarter of an inch of the extremity of the diaphysis. The epiphysis is still connected to the shaft by one or two bands of thickened periosteum. See woodcut, Fig. 2. The sequestrum is shaded.

CASE II.

Necrosis at the extremity of the diaphysis and in the epiphysis of the upper extremity of the tibia, causing destructive disease of the knee-joint.

Charles C., aged $2\frac{1}{2}$ years, was admitted to Sitwell Ward, under the care of the late Mr. Callender, April 13, 1879. He had had inflammation of the knee-joint for no longer than a fortnight. No cause for it could be assigned. The left knee was hot and tender, the synovial membrane pulpy and distended with fluid. The leg was in a position of extreme flexion. There was a discharging sinus in the upper part of the calf.

The joint altogether presented the appearance of long-standing destructive disease.

May 10.—Amputation through the lower third of the thigh was performed, as the child's general condition was becoming worse. He made a rapid recovery.

Examination of limb.—The synovial membrane of the knee-joint was pulpy; the articular cartilage of the tibia almost completely destroyed, and that of the femur deeply absorbed in places. On making a section through the tibia, a piece of necrosed bone, about the size of a walnut, was found; it occupied the extremity of the diaphysis, passed across the epiphysal line, and involved a small portion of the ossific nodule in the epiphysis. The sequestrum is shaded in the woodcut, Fig. 3.²

The necrosis extended to the wall of the bone on the posterior surface, which was here penetrated by a small sinus. There was no communication between the cavity containing the sequestrum and the knee-joint.

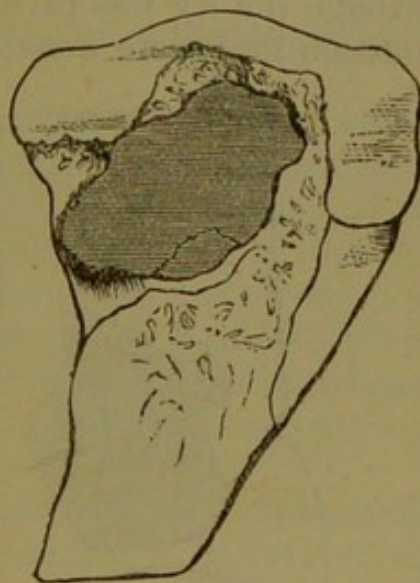


Fig. 3.

¹ Series I., No. 261.

² The specimen is preserved in the Museum, Series I., No. 390.

This case is an excellent example of circumscribed necrosis in the neighbourhood of the epiphysial line giving rise to destructive joint-disease. The process appears, from the short history of the case, to have been an acute one.

The existence of the necrosis was not in the least suspected, a section being made by myself in searching for this form of disease.

CASE III.

Necrosis in the lower extremity of the tibia.

A girl, aged 14 years, was admitted to the Hospital. The tissues above and around the ankle-joint were thickened and inflamed. There was a sinus just above the internal maleolus leading into the tibia, within the extremity of which necrosed bone was felt. The disease was supposed to have resulted from a sprain of the ankle four weeks previously. A sequestrum lying loose within the lower end of the tibia was removed by operation.

No great improvement apparently taking place, amputation through the leg was performed three months later under the impression that there was destructive disease of the ankle-joint.

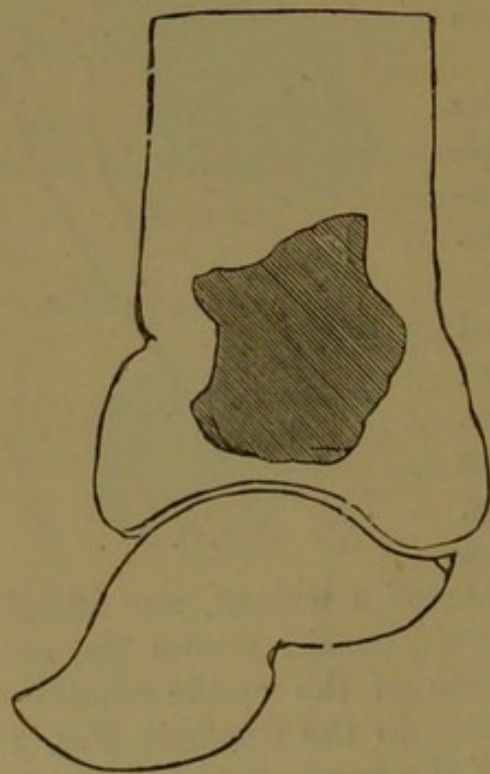


Fig. 4.

Examination.—On making a section through the lower end of the tibia and ankle-joint, a cavity large enough to contain a walnut was found in the lower end of the tibia completely filled up with gelatinous granulation tissue, but still communicating with the surface by the sinus above the internal maleolus. The cavity, as in the preceding specimen, occupied the epiphysis and extremity of the diaphysis (Fig. 4).¹

The upper portion of the articular surface of the tibia was united to the astragalus by a layer of fibrous tissue. The cartilages were otherwise intact, but slightly thinned at the edges. The joint did not contain an excess of fluid.

Apart from the situation of the disease, the case is interesting from the repair which has followed the removal of the sequestrum.

¹ The specimen is preserved in the Museum, Series I., No. 394.

CASE IV.

A precisely similar specimen was removed by amputation from a man aged 37, who was lately admitted to the Hospital for caries of the lower end of the tibia. When a boy he had disease in the same situation attended with the discharge of small pieces of bone. The part had remained sound until three weeks before his admission,¹ when the same general appearances were presented as in the preceding case.

CASE V.

Circumscribed necrosis at the extremity of the diaphysis of femur
—*Disease of knee-joint—Unsuccessful resection.*

The specimen was removed by amputation from Edith J., aged 4 years. Thirteen months before the right knee-joint was excised in the country for disease of 1½ years' duration. On her admission to Stanley Ward the knee was flexed to a right angle, and there was a discharging sinus at the inner angle of the operation scar.

Examination.—A median vertical section of the bones presented the following appearances: ²—

The tibia was at right angles to the femur, and the interval between them was filled up by granulation tissue. No osseous union had taken place between the bones. Within the end of the femur, at the point corresponding to the extremity of the diaphysis, was a cavity containing a sequestrum of cancellous bone as large as a hazel-nut. A narrow sinus passed from the cavity to the free extremity of the femur. The bone around the sequestrum was sclerosed for a quarter inch or more. The epiphysis of the femur had been almost completely removed.

This case has, apart from its pathological, an important clinical interest, since it indicates one of the causes of failure of resections.

The necrosis, I think, must have been the original cause of the disease; the considerable amount of sclerosis around the sequestrum, showing long-continued irritation, lends some support to this view. But granting, on the other hand, that the necrosis was caused by resection, we have, in the limitation of the disease to the extremity of the diaphysis, the strongest evidence of the liability of the growing portions of bones to inflammation.

I will here quote a specimen in the Museum, Series II., No. 86, from a case of Sir James Paget's, as it further illustrates the facts

¹ The specimen is preserved, Series I., No. 385. See also similar specimen in the Museum, Series I., No. 319.

² The specimen is in the Museum, Series II., No. 101.

suggested by the last case. The description of the specimen in the MS. Catalogue is as follows:—

“A section of the bones of a knee on which excision was performed. The femur and tibia, where in contact, are firmly united by bone. A large sequestrum lies loose in the upper end of the tibia. The patient, a lad 14 years old, and in feeble health, underwent excision of the knee-joint, which was affected with strumous disease of long duration. Many months after the operation the knee remained large; the skin covering it was inflamed, unhealthy, and many sinuses discharged pus. Several operations for the removal of dead bone were performed from time to time; at length amputation became necessary.”

The necrosis, which appears to involve the epiphysis and extremity of the diaphysis, was believed to have followed the resection.

Among other specimens in the Museum, the following illustrates well the disease under consideration. It is described in the Catalogue as follows:¹—

“The lower end of a femur. A large canal passes obliquely through the bone from before backwards, just above the condyles, and communicates widely with a cavity occupying nearly the whole of the interior of the internal condyle. From a man aged 35 years, who had had disease of the knee-joint for twenty-five years.”

The canal, also described, occupies the position of the epiphysal line. This appears to have been originally a case of necrosis of the epiphysis and extremity of the diaphysis.

A prominent feature in the cases detailed, and in too many specimens in various London museums to enumerate, is the distinct limitation of the necrosis to the growing and recently formed bone in the immediate neighbourhood of the epiphysal line; sometimes limited to the extremity of the diaphysis, as in Cases I., V., and the specimen shown in Fig. 2, much more commonly involving the bone on either side of the epiphysal line, as in Cases II., III., IV., and more rarely the bony nodule in the epiphysis; occasionally an isolated necrosis of the bony nodule in one of the apophyses takes place, as is shown in a specimen, F. 50,² in the Children's Hospital Museum.

From the circumscribed character of the necrosis in not infrequent cases, a special liability of the growing tissue of bones to inflammation may be assumed. Of this I shall give additional proof further on. The more extensive necrosis which occurs in

¹ Series I., No. 201.

² The following is the description given in the Catalogue:—

“Section of the head of the femur from a case of ankylosis after hip-joint disease. In the great trochanter is a cavity communicating with the digital fossa. The cavity contains the necrosed ossified nucleus of the trochanter lying loose in the interior. It is separated by a wide interval from the previously diseased portion of the head.”

other and more numerous cases is not opposed to the view that the inflammation originated in the neighbourhood of the epiphysial line, as the morbid process, when once set up, has necessarily a tendency to spread. Granted, then, the special liability, there must be a common cause inherent in the tissue of the part which renders the growing bone the seat of election of inflammatory processes. This is clearly the active nutritive changes incident to the growth and development of the bone—the multiplication of cartilage cells, development of blood-vessels, and hyperæmia at the line of growth.

It is evident that the normal balance of nutrition would be more easily overturned, and the unrestrained activity, which is so characteristic a feature of inflammation, more readily excited in an actively growing than in a fully developed tissue.

Further, that a portion of developing bone, in which the vascular supply had not yet been perfected, would readily suffer necrosis.

The liability to inflammation of bone in young subjects from slight exciting causes, such as a blow, sprain, chill, or febrile attack, is thus explained. And further, I may suggest that the almost unaccountable way in which diffuse periostitis is set up in young subjects by exposure to cold or a blow is due to the active nutritive changes attending the circumferential growth of the bone.

Case I., and specimen (Fig. 2) referred to with it, suggest an explanation of the not uncommon cases of acute inflammation of joints, especially the hip and shoulder, in which the epiphysis is found lying loose in the articulation, since the first result of inflammation at the extremity of the diaphysis would be destruction of the epiphysial cartilage and separation of the epiphysis.

The inherent liability to inflammation of the growing tissue of bones is most strikingly illustrated by a disease of the bones in infants. Mr. Thomas Smith¹ first drew attention to cases of acute joint-disease in infants, the result of abscess in the articular ends of the bones, bursting in most cases into the articulation, but rarely external to it. Sometimes the epiphysis was found lying loose in the cavity of the joint. In all the cases related there is evidence that the inflammation commenced in the neighbourhood of the epiphysial line. In six cases, in which the exact position of the abscess could be made out from the descriptions and plates, it occupied the extremity of the diaphysis and encroached on the epiphysial cartilage; in one only it was situated in the epiphysis. In seven cases out of twenty-one related, the disease attacked more than one joint, and in three of the seven cases four joints were attacked.

¹ "On Acute Arthritis of Infants." St. Bartholomew's Hospital Reports, vol. x. p. 189.

The occurrence in these cases of disease in the extremities of several bones at the same time, and in precisely the same relative position, indicates clearly the special predisposition of that portion of the bone to inflammation; the portion affected being, as mentioned above, the growing and recently-developed osseous tissue in the immediate neighbourhood of the epiphysial line.

In most cases of abscess of bone in older children and young adults, the abscess will be found to occupy the same position as that described above.

In connection with this subject, it is interesting to remark the fact, pointed out by Mr. Parrot, that the syphilitic lesions in the long bones of infants occur at the extremities of the shaft.

Necrosis in the situation described appears to be not an infrequent cause of joint-disease in young subjects. In all the cases related the joint was affected. In Case IV., the removal of the sequestrum was followed by marked evidence of repair; and there is every reason to believe that in such cases the early discovery and removal of the disease would, in many instances, save the joint.

Thickening of the bone at the level of the epiphysial line preceding the inflammation of the neighbouring joint might, in some cases, lead to a diagnosis, while in others, in which the disease was further advanced, the existence of a sinus leading into a cavity containing dead bone would reveal the condition of the parts.

The cases described have all recently occurred in the Hospital, and the specimens have since been placed in the Museum.

I am indebted to the Surgical Registrars for the clinical notes.

Since writing the preceding I have found the following papers, in which the authors confirm some of the opinions deduced from the cases related :—

Professor Helferich, in a paper "On Disturbance of the Growth of the Long Bones after Necrosis of the Diaphysis,"¹ explains the frequency of disturbance of growth by the fact, at which he has arrived, that necrosis most commonly occurs at the extremity of the diaphysis.

He further adds that the frequency of necrosis in the several bones bears a fixed relation to the amount of growth in each, and not only to the growth in length,² but also to the growth in thickness.

¹ Deutch. Zeit. f. Chir., Band x.

² The amount of growth is determined by a table, quoted from C. Länger, giving the co-efficient of growth in the following bones :—

Femur,	4.38		Tibia,	4.32
Humerus,	3.97		Radius,	3.83

The tendency of either articular end of the same bone to disease bears the same proportion to the amount of growth at either extremity. He gives a table, compiled from cases, showing the relative liability of the shaft and extremities of the several long bones to necrosis.¹

The table supports his views, except in the case of the tibia, the greater liability of the shaft of which to disease may be explained by its exposure to injury.

Vogt, in a prior paper on "Acute Inflammation of the Bones during the Period of Growth,"² points to the neighbourhood of the epiphysial line as the most common situation of the inflammatory lesions of young bones, and relates a case of acute osteitis at the extremity of the diaphysis of the femur.

As slight additional proof of the liability of the extremities of the bones to necrosis, I may mention that, a few days ago, I examined the situation of all the cases of necrosis in the Hospital not due to fracture.

Unfortunately there happened to be but thirteen cases in the wards at the time. Of these, two were men; the remainder were under nineteen years of age.

In the men, the upper and lower ends of the femur were respectively affected; they had both had disease in the same situations when young.

In the younger patients the necrosis occurred in the following situations:—

Lower end of femur, 2 cases; in one of these there was necrosis at the extremity of the diaphysis, with separation of the epiphysis.

Upper end of tibia, 2; inflammation of the knee-joint in both cases.

Lower end of tibia, 2; inflammation of joint in one, absent in the other, but the necrosis was quite at the extremity of the bone.

Upper end of humerus, 2; inflammation of joint in one case.

There was necrosis of both extremities of the humerus in one case, with rigidity of the joints; but the shaft did not appear to have been affected. In another, the upper ends of the radius and ulna respectively on both sides were necrosed, with inflammation of both elbow-joints.

One patient had necrosis of the shaft of the tibia following diffuse periostitis. This was the only case in which the necrosis approached the middle third of a bone; in all the others the necrosis evidently affected either the articular end or extremity of the shaft.

¹ TABLE SHOWING THE RELATIVE FREQUENCY OF NECROSIS.

Tibia, upper end,	. 29	Humerus, upper end,	. 16
„ lower end,	. 18	„ lower end,	. 3
„ shaft,	. 19	„ shaft,	. 1
Femur, lower end,	. 40	Fibula, lower end,	. 2
„ upper end,	. 3	„ upper end,	. 1
„ shaft,	. 2	„ shaft,	. 1
		Radius, lower end,	. 6

² Volkman's Klin., Band i., Chir. No. 23.

The first part of the investigation was devoted to the study of the influence of the various factors on the development of the disease. The results of this part of the investigation are given in the following table:

The table shows that the influence of the various factors on the development of the disease is as follows:

1. The influence of the various factors on the development of the disease is as follows:

2. The influence of the various factors on the development of the disease is as follows:

3. The influence of the various factors on the development of the disease is as follows:

4. The influence of the various factors on the development of the disease is as follows:

5. The influence of the various factors on the development of the disease is as follows:

6. The influence of the various factors on the development of the disease is as follows:

7. The influence of the various factors on the development of the disease is as follows: