FROM DRAMMEN HOSPITAL, DRAMMEN AND ULLEVÅL HOSPITAL, OSLO

PSEUDOARTHROSES OF THE HUMERUS

By

H. S. NISSEN-LIE

Whether a fracture will heal within a reasonable time depends to a considerable degree on the treatment. Bad fixation or fixation of too brief duration may lead to pseudoarthroses, but perhaps too strong traction is a more frequent cause. Pseudoarthroses are also seen after unsuccessful operative treatment due to infection or imperfect fixation.

The type of fracture and its localisation play a decisive part in the healing, however. Transverse fractures and short oblique fractures are often difficult to unite, but splintered fractures and long oblique fractures unite quickly and surely whatever the treatment. When diastasis arises between the fragments or when the latter are subjected to pressure parallel with the line of fracture, bony union will always be doubtful.

The relative frequency of pseudoarthroses is reported somewhat variously.

Georg Brandt (1) refers to a number of earlier accounts in which the fracture of the upper arm is stated to lead most frequently to pseudoarthroses. He himself had mostly had cases with pseudoarthroses of the leg and relatively few with pseudoarthroses of the upper arm.

Campbell (2) declares that non-union after upper arm fractures is seen "in a fairly large number of cases".

Robert M. D'Aubigne (3), in a larger series from the last world war, found as many pseudoarthroses occurring on the upper arm as on the leg, and these two groups formed more than half his total number of pseudoarthroses.

In the course of a few years I personally have seen 9 upper arm pseudoarthroses and during the same period only 2 leg fractures and 1 forearm fracture with non-union.

(Paper read at the meeting of the Nordisk Ortopedisk Forening in Härnösand, June, 1950).

The reason why transverse fractures of the upper arm lead relatively often to pseudoarthroses is partly that these fractures are difficult to immobilise, and partly that they are easily over-extended. Rotation at the site of the fracture prevents bony union and the upper arm is provided with strong muscles which pull right across the upper arm's longitudinal axis. These muscles rotate the upper fragment, while the lower is stabilised by the forearm.

In older people fractures of the upper arm are found most frequently at the proximal end (fr. colli humeri), and in children, at the distal end (fr. humeri percondylica).

Fractures of the shaft are relatively rare. Reduction does not demand the same amount of meticulous care as in fractures of the lower extremity. The main task is to secure rapid union, with full, active mobility in the adjacent joints. Non-union renders the arm unusable; a decrease in mobility quickly appears, persists a long time, and often becomes a great trouble to the patient.

The following methods of treatment have been tried out.

1. Suspension by means of traction. For this treatment a lengthy stay in hospital is necessary, proper immobilisation is difficult, and the fracture may easily be over-extended. For this reason transverse fractures or short oblique fractures unite late, or not at all.

2. Fixation on an abduction frame, with or without traction is widely employed. The frame is difficult to place in position and troublesome to carry. For old patients it is a serious strain.

3. An abduction plaster cast provides the best possible form of external fixation but has the same drawbacks as the abduction frame.

4. The simplest treatment is to let the patient walk about with his forearm in a sling. With this method there is little or no fixation of the fracture site and thus it sins against the most elementary requirements of good fracture treatment. However, many upper arm fractures unite quickly and well, when given this simple treatment.

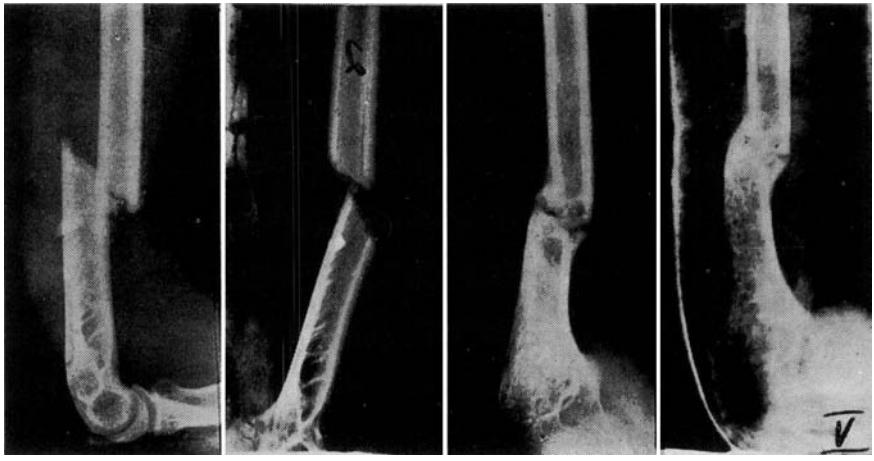
5. Operative treatment may become necessary for transverse and short oblique fractures. As to the oblique fractures one may content oneself with applying a simple wire loop, but the arm must then be immobilised in abduction. The best fixation is obtained by means of an intramedullary nail inserted downwards from the greater tuberosity.

With delayed healing or fibrous pseudoarthroses union can be obtained through a Z-shaped resection and cerclage; in pseudoarthroses with bone defects, intramedullary nailing accompanied by cancellous bone grafting would seem to be an excellent procedure (3-4).

In both cases, however, the arm ought to be immobilised in abduction plaster for 2-3 months.

Finally, the case histories of several patients with fractures of the humerus are recorded here, in which the primary treatment did not bring success, but in which secondary treatment succeeded in securing bone union.

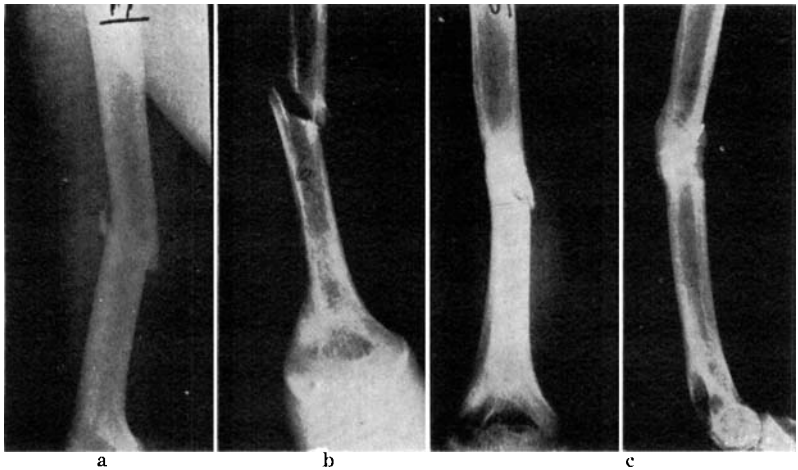
Case I. A schoolgirl aged 14 years with a short oblique fracture of the left upper arm (fig. 1a). The arm was suspended at once and wire traction applied (4 kg.) Roentgen examination (fig. 1b) revealed overextension and the traction was reduced to 2 kg. 3 weeks later, traction was discontinued and replaced by plaster bandage. 11 weeks after the injury the fracture was still not stable and roentgenograms showed initial pseudoarthroses (fig. 1c). The fracture was immobilised in abduction plaster and was stable after 3 more months (fig. 1d).



a b c d

Fig. 1.

Case II. A 26 year old lumberman with a short oblique fracture in the middle of the right upper arm (fig. 2a). He was treated by "hanging cast". 5 months after the injury there was still abnormal mobility (fig. 2b). Upon operative exposure fascia and musculature were found interposed and marginal sclerosis of the fragment ends was noted. A Z-shaped resection was performed, and the fracture was immobilised by two circumferential wire loops. The arm was placed in an abduction plaster. 2 months later the fracture was stable and the plaster bandage was removed. After a further 3 months, 10 months after the injury, the patient was at work in his earlier occupation, possessing full, active mobility in the shoulder, elbow, hand, and fingers. Roentgenograms showed certain union with bridging callus formation (fig. 2c).

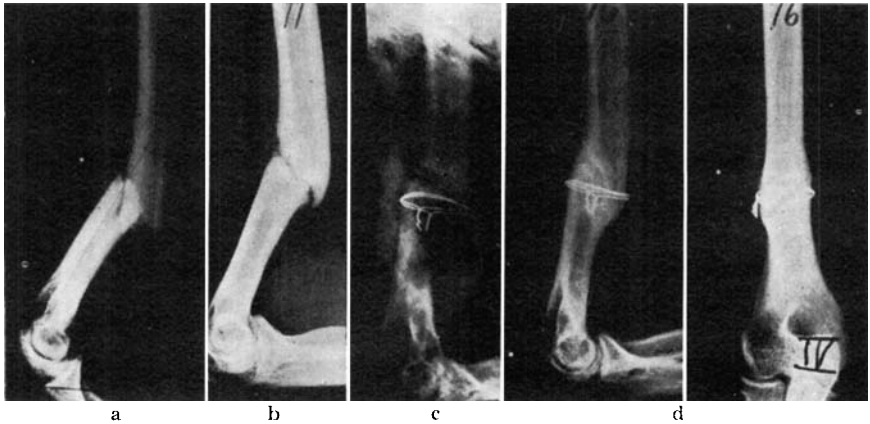


a b c

Fig. 2.

Case III. A 26 year old farm-worker with a short oblique fracture of the lower part of the right upper arm (fig. 3a). The fracture was an open one, with radial paresis. After excision and suturing, the arm was immobilised on an abduction frame and traction was exerted through the olecranon. The radial paresis disappeared after 2 months, but the fracture did not become stable. 2 years later the patient was still completely unfit for work and had pain and weakness in the right arm. There was marked angulation and instability at the site of the fracture.

Roentgenograms revealed pseudoarthroses (fig. 3b). A Z-shaped resection with wire loop fixation was undertaken (fig. 3c). The arm was placed in abduction plaster. After 2 months the fracture was stabilised in a good position and the plaster was removed. 3 months later—5 months after the osteosynthesis—the patient was working normally. The arm was free of pain, there was full mobility and unimpaired strength in the shoulder, elbow, hand and fingers. Roentgenograms showed bony union in an anatomical position (fig. 3d).

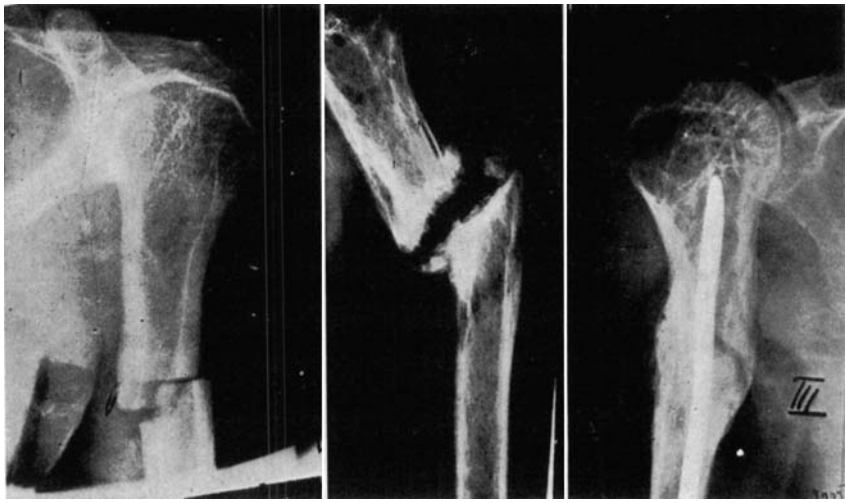


a b c d

Fig. 3.

Case IV. A 52 year old director with uncomplicated transverse fracture of the upper part of the left upper arm (fig. 4a). He was treated by different doctors with "braces and splints".

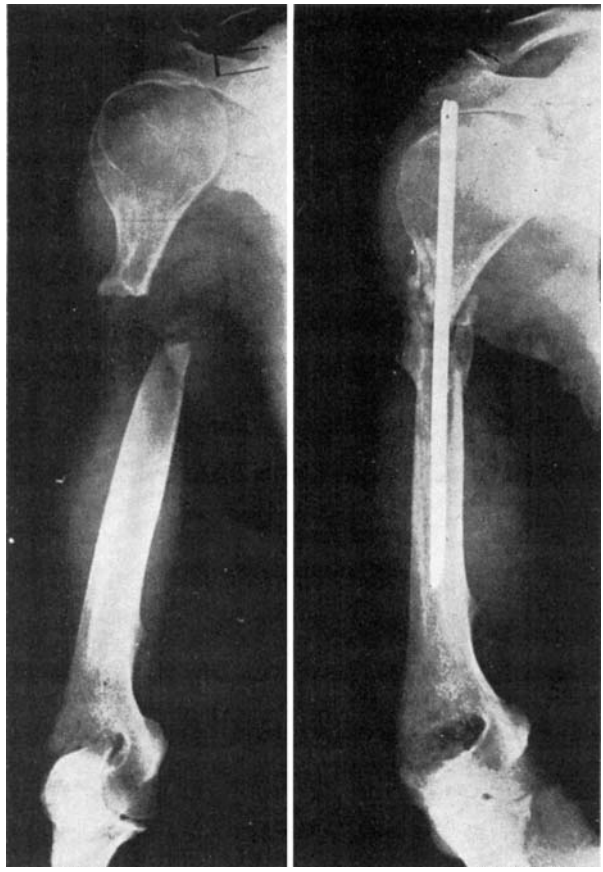
A year after the injury a quite loose pseudoarthrosis was noted. Roentgenograms showed marginal sclerosis with considerable diastasis (fig. 4b). Resection of the pseudoarthrosis was undertaken, after which the fracture was immobilised by an intramedullary nail. Cancellous bone from the iliac crest was set around the site of the fracture. The arm was placed in an abduction plaster. 2 months later the fracture was stable. 3 months after the osteosynthesis the patient was fully at work possessing complete, active mobility. Roentgenograms showed osseous healing in a good position (fig. 4c).



a b c

Fig. 4.

Case V. A 45 year old brewery worker with an open fracture of the upper part of the right upper arm. Primary osteosynthesis was undertaken but the fracture did not unite. Later, operative fixation was twice attempted, once with Lane's plate and once by bone grafting, but each time without result. 6½ years after the injury a quite loose pseudoarthrosis was remarked, with circular scar formation in the soft tissue but with normal sensation and mobility in the hand and fingers. Roentgenograms showed a large defect with pointed sclerotic fragments (fig. 5a). The upper part of the humerus was exposed. All scar tissue was removed; the bony ends were splintered and immobilised by intramedullary nailing. The defect was packed with cancellous bone from the iliac crest. The arm was put in an abduction plaster. 3 months later the fracture was stable and the roentgenograms (fig. 5b) showed bridging callus formation. The patient was at work 6 months after the osteosynthesis, but mobility in the shoulder-joint was henceforth somewhat reduced.



a b

Fig. 5.

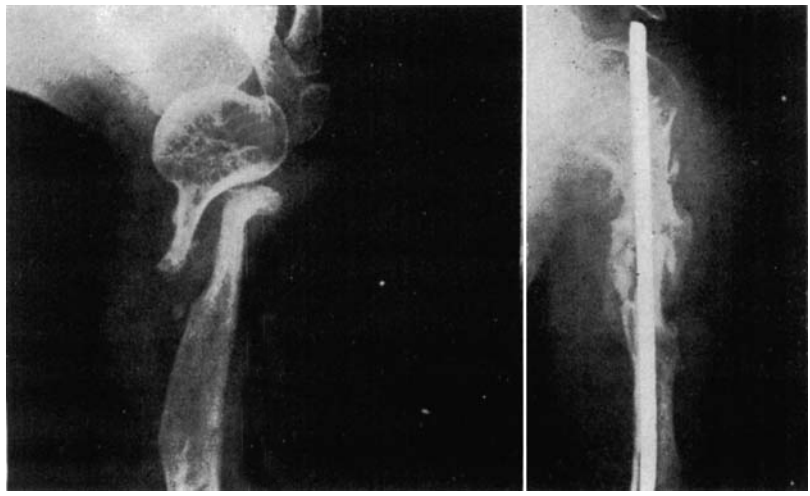
Case VI. A 50 year old man with a short oblique fracture of the lower part of the right upper arm (fig. 6a). Treated by traction on an abduction frame. Since the fracture had not united after 4½ months osteosynthesis was tried with Lane's plate. Radial paresis and infection resulted. The radial paresis disappeared after 8-9 months and the secretion also disappeared after Lane's plate had been removed. 16 months after the injury he was operated on for the pseudoarthrosis (fig. 6b). The radial nerve was isolated from scar tissue, the fracture ends were freshened, covered with cancellous bone from the iliac crest and immobilised by intramedullary nailing. The arm was placed in an abduction plaster. 2 months later the fracture was stable (fig. 6c). 3 months after the osteosynthesis the patient was at work in his earlier occupation, but henceforth mobility in the shoulder and elbow was a little limited.

a b c

Fig. 6.

Case VII. 37 year old woman. 25 years ago, at the age of eleven, the upper part of her left humerus was resected (diagnosis sarcoma humeri). The defect was grafted with a fibula transplant. After a short time the transplant fractured and resulted in a pseudoarthrosis.

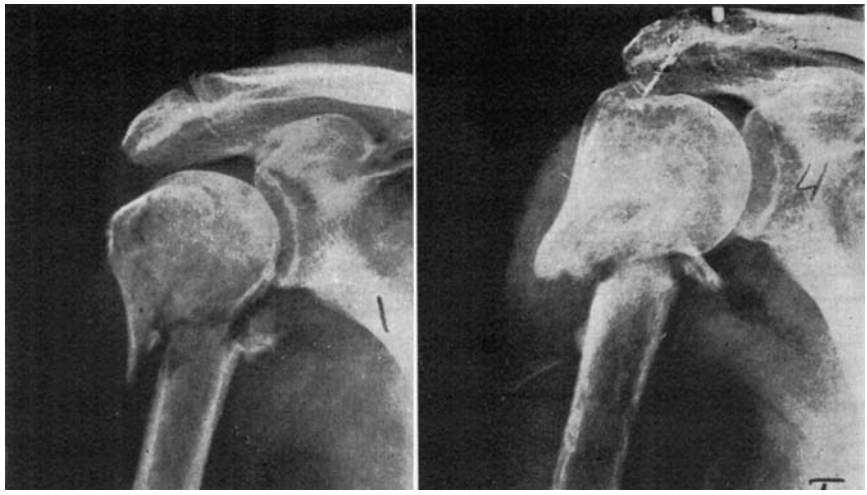
An X-ray Sept. 1, 1950 (fig. 7a) demonstrates the thin upper part of the humerus with the pseudoarthrosis. Operation Sept. 19, 1950. Splintering of the thin sclerotic bone ends, fixation with a medullary pin and transplantation of iliac bone grafts. The arm was fixed in an abduction plaster cast. 3 months later sound fusion. X-ray Dec. 25, 1950 (fig. 7b).



a b

Fig. 7.

Cases VIII and IX. Two old women, 70 and 76 years old. Unimpacted fractures of the neck of the humerus (fig. 8a). Treated with metella. Pseudoarthroses after 12 months (fig. 8b and fig. 9). No pain and relatively good function. Owing to the patients' age no further treatment was undertaken.



a b

Fig. 8.

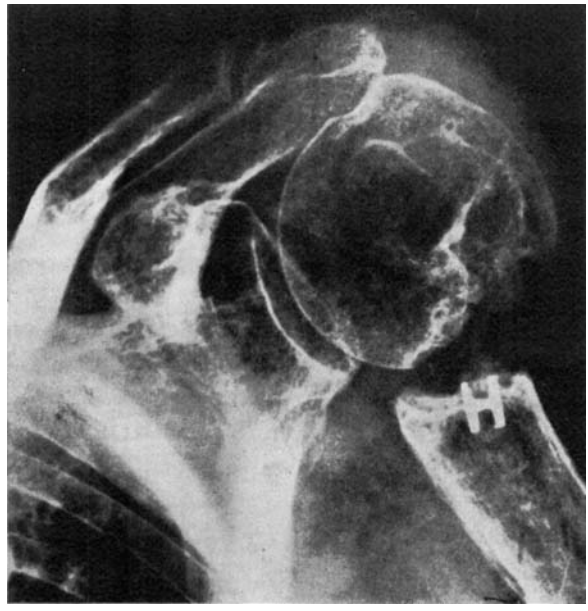


Fig. 9.

SUMMARY

The healing of a fracture depends, to a considerable degree, on the treatment. The nature of the fracture has great importance, however. Long oblique fractures or splintered fractures as a rule heal with every treatment, transverse fractures may result in pseudoarthroses.

Pseudoarthroses are seen relatively often on the upper arm. The various procedures for treatment of upper arm fractures are described, and warning is given against extension treatment in transverse fractures. These fractures ought to be fixed in an abduction plaster. Often operative fixation is necessary.

In fibrous pseudoarthroses Z-shaped resection with Cerclage will fuse the bone quickly. In pseudoarthroses with bone defects, intramedullary nailing with cancellous bone graft is the best method. In either event, the arm is kept in an abduction plaster for 2-3 months.

Finally, 9 cases of humerus pseudoarthroses are referred to, in which osseous healing occurred 2-3 months after operation.

RESUME

La consolidation des fractures dépend à un haut degré du traitement appliqué, mais la nature de la fracture présente aussi une grande importance. Les fractures comminutives ou les longues fractures obliques guérissent à la suite de n'importe quel traitement, tandis que les fractures transversales peuvent donner lieu à des pseudarthroses.

On observe relativement souvent des pseudarthroses de l'humérus. Il est donné la description des différentes méthodes de traitement des fractures du haut du bras et l'on recommande de ne pas appliquer le traitement par traction dans les cas de fractures transversales. Celles-ci doivent être fixées en position d'abduction dans un bandage plâtré. La fixation opératoire est souvent nécessaire.

Dans les pseudarthroses fibreuses, une résection en forme de Z avec encerclage donne une soudure rapide. Dans les pseudarthroses défecteuses, la meilleure méthode est l'enchevillement avec greffe osseuse. Dans les deux cas, le bras est fixé en position d'abduction dans le plâtre pendant 2 ou 3 mois.

Enfin, il est rendu compte de 9 cas de pseudarthroses de l'humérus. Dans tout ces cas on a obtenu une bonne consolidation de l'os au bout de 2 à 3 mois.

ZUSAMMENFASSUNG

Die Heilung der Brüche hängt im wesentlichen Grad von der Behandlung ab. Die Art des Bruches ist jedoch von wesentlicher Bedeu-

tung. Splitterbrüche oder lange Schrägbrüche heilen im allgemeinen bei jeder Art von Behandlung, während Qüerbrüche in Pseudarthrosen ausgehen können.

Relativ häufig sieht man Pseudarthrosen am Oberarm. Die verschiedenen Behandlungsmethoden der Oberarmsbrüche werden beschrieben und vor der Streckbehandlung von Qüerbrüchen wird gewarnt. Diese Brüche soll man im Abduktionsgips fixieren. Operative Fixation ist oft notwendig.

Bei fibrösen Pseudarthrosen gibt Z-förmige Resektion und Cerclage rasche Heilung. Bei Defektpseudarthrosen ist die Marknagelung verbunden mit der Transplantation von Knochen die beste Methode. In beiden Fällen fixiert man den Arm 2—3 Monate im Abduktionsgips.

Zum Schluss wurden 9 Fälle von Humeruspseudarthrosen demonstriert. In allen Fällen kam es zu sicherer Knochenheilung im Laufe von 2—3 Monaten.