

THE INCIDENCE OF PSEUDARTHROSIS WITH DIFFERENT METHODS OF TREATMENT IN A FAIRLY LARGE FRACTURE SERIES

By

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The incidence of pseudarthrosis has been investigated in a fracture series from Drammen Hospital. Out of all the diaphysis fractures treated in the department during the decade 1943-52, in all 1468, 8 certain pseudarthroses were discovered; this gives a pseudarthrosis incidence of 0.7 %, a low figure if compared with the figures from other and similar researches.

It should be especially noted that in this series the diagnosis of pseudarthrosis is determined on the lines laid down by Watson-Jones. Clear roentgenological signs, sclerosis of the medullary cavity and evidence of rounding of the fracture ends are required. In consequence 3 cases, which in the department were judged clinically to have pseudarthrosis were rejected. The following table illustrates this.

TABLE 1

	Clinical diagnosis	Roentgen diagnosis
Crus	6	4
Humerus	3	3
Radius	2	1
Total	11	8

The three cases omitted must be placed in the category of delayed union, since no roentgenological signs of pseudarthrosis were found. In this series then the time factor is disregarded.

TABLE 2

	Total no. of fractures treated	Number of pseudarthroses	% pseudarthroses
Crus	460	3	0.7
Tibia	221	1	0.5
Humerus	189	3	1.6
Radius	317	1	0.3
Femur	281	0	0

Table 2 shows the distribution of the pseudarthroses in the long bones, and also the total number of fractures treated in each localisation. With regard to the total number of fractures treated the heading radius fractures refers to both radius and antebrachium fractures.

TABLE 3

The distribution of methods throughout the whole series.

	Total no.	Closed treatment		Open treatment			
		Plaster	Traction	Parham	Küntschers	Other osteosyn.	Open reduct. no osteosyn.
Radius & antebrach	317	294			11	5	1
Tibia & crus	681	394	182	69	10	20	1
Femur	281	32	222		17	6	2
Humerus	189	113	55	1	4	16	

Here the following groups, osteosynthesis with Parham's band and Küntschers intramedullary nailing together with open reduction without osteosynthesis, are arranged separately, since pseudarthrosis was found to develop in each group. Other osteosynthesis methods are placed in one group, as with these methods no pseudarthrosis occurred.

TABLE 4

	Method of treatment	No. of fract. treated	The pseudarthroses							
			Fracture type			Local. in crus			Complic.	No. of pseud.
			Transverse	Obliq.	Commin.	Mid.	Lower $\frac{1}{3}$	Transit. M-L $\frac{1}{3}$		
Open treatment	Open red. . . .	1	1				1		+	1
	Küntscher ..	10	1					1	—	1
	Parham	69		1				1	—	1
Closed treatment	Plaster	394	1			1			—	1
	Traction . . .	182								0

Regarding the *crus pseudarthroses* table 4 shows the method of treatment in every single case, in addition the total number of fractures treated by the same method, and as for the pseudarthroses,—the type of fracture, the localisation in the bone, stating also whether the fracture was complicated or not.

The following data is given in this table:

3 arose with open treatment, 1 with closed treatment.

3 arose with transverse fractures, 1 with an oblique fracture.

3 arose with a fracture localised to the lower third, 1 to the middle of the crus.

3 arose with uncomplicated fractures, 1 with a complicated fracture.

Thus a preponderance exists of fractures treated with open reduction, of transverse fractures and of fractures localised to the lower third of the crus. It should be noticed that the one intramedullary-nailed fracture resulting in pseudarthrosis was a fracture solely of the tibia.

Table 5 gives the same information concerning the humerus pseudarthrosis:

TABLE 5

	Method of treatment	No. of fract. treated	The pseudarthroses						
			Fracture type			Local. hum.		Complic.	No. of pseud.
			Transverse	Obliq.	Commin.	Lower 1/3	Transit. M-L 1/3		
Open treatment	Cerclage	17			1		1	—	1
	Küntschner . . .	4	1				1	+	1
Closed treatment	Abd. frame or plaster	168		1		1		—	1

Here one can say that there is a preponderance of fractures treated with open reduction in so far as 2 were treated with open and 1 with closed reduction. All three were localised to the lower third of the crus while no one type of fracture predominated.

As for the treatment it is not stated how many of the fractures were treated by abduction frame, but this was not used consistently. The fracture treated by closed reduction which resulted in pseudarthrosis was given abduction frame treatment, however.

Out of 317 radius and antebrachium fractures treated 1 pseudarthrosis resulted (a radius fracture). These figures and tables show that in this series of shaft fractures there is a preponderance of pseud-

arthroses in fractures treated by open reduction, but amongst these an even spread of the various methods employed.

The series also reveals that in all the pseudarthrosis cases special circumstances regarding the execution of the treatment seem to have favoured the arising of the pseudarthrosis.

I shall briefly indicate these in every instance of pseudarthrosis.

The Crus pseudarthroses.

Case 1: A transverse fracture in the lower $\frac{1}{3}$ of the crus with some splintering. Complicated. It was primarily treated with operative freshening of the fracture site, traction and plaster.

NB. Owing to severe contamination radical chiselling of the fracture ends was undertaken and also some whittling of the periosteum.

The plaster was shortened to below the knee from the 9th week and weight-bearing began from the 11th week with plaster *below* the knee.

Case 2: A transverse fracture in the middle third. It was refractured 3 times in 2 years. Plaster treatment was used all that time.

NB. On the first occasion it was immobilised for 6 weeks. On the 2nd occasion it was immobilised for 10 weeks. On the 3rd occasion it was immobilised for 20 weeks.

On refracture for the 2nd time (after 36 weeks) sclerosis was found with almost complete closure of the medullary cavities, together with $\frac{1}{2}$ cm. diastasis. In spite of that conservative treatment was continued. At the 3rd time the plaster was in addition shortened to below the knee during the last part of the immobilisation period.

Case 3: A short oblique fracture with a large detached fragment, at the transition to the lower third of the crus. It was treated primarily with 2 Parham bands. The Parham bands were not removed until 9 weeks later (removal normally takes place after 6–7 weeks; this may not be of much significance).

NB. The plaster broke during the 14th week, the patient went about for a long time with the plaster broken.

After 22 weeks weight-bearing was allowed for three weeks without plaster in spite of the patient's feeling of weakness and pain at the fracture site.

Afterwards he wore a poor immobilising plaster for 12 weeks constantly feeling clicking at the fracture site.

Case 4: A transverse fracture at the transition between the middle and the lower third of the tibia, with the fibula intact. It was treated with Küntscher nailing after 5 days.

NB. During the operation a large three-cornered detached fragment

was removed so that the surfaces of contact between the fracture ends became very small. In addition after the intramedullary nailing an approx. 2 mm wide diastasis was revealed. In spite of the persistent diastasis no osteotomy was performed on the fibula.

The Humerus pseudarthroses.

Case 1: A complicated transverse fracture at the transition between the middle and lower third of the humerus.

NB. Intramedullary nailing was performed in spite of considerable contamination. The nail was kept for 34 weeks in spite of manifest osteomyelitis with destruction of the bone ends, resulting in a growing defect.

After the nailing a 2 mm diastasis was found primarily. The nail was brought only 3 cm beyond the fracture site. Redislocation of the fracture occurred after 1½ weeks and this resulted in another operative intervention.

Case 2: An oblique fracture in the lower third.

NB. It was only fixed for 10 weeks on an abduction frame with traction. The patient refused further immobilisation, and was not re-examined until 3 years later, when a pseudarthrosis was present.

Case 3: A comminuted fracture at the transition between the middle and lower third of the humerus. After 1 week cerclage was performed with 3 metal wires. After 40 weeks intramedullary nailing was carried out.

NB. In the cerclage operation the fragments were poorly enclosed. The arm was not fixed on an abduction frame, but was fixed throughout the whole course of the treatment with plaster to the axilla and the arm in a mitella. Constant positional changes of the fragments were demonstrated when checks were made. The nail was only brought 3 cm beyond the site of the fracture.

The Radius pseudarthrosis.

There was a short oblique fracture in the middle third and in addition a large detached fragment. It was treated with metal wire cerclage.

NB. The metal wire encircled only the topmost main fragment and the detached fragment.

Later the metal wire caused resorption in the loose fragment.

DISCUSSION

It should be particularly noticed that in most of the cases the conditions involved in the fractures themselves or other complicating factors compelled the adoption of the appointed methods of treatment which led to pseudarthrosis. These complicating factors affected a number of cases to the extent that the treatment chosen could not be carried out according to the routine required.

The series shows that there is a considerable preponderance of fractures treated operatively amongst the pseudarthrosis cases (6 out of 8). There is however no preponderance of any single open method of treatment.

No definite significance can be attributed to this preponderance after the exposition of pseudarthrosis-favouring factors in the treatment of the individual cases.

CONCLUSION

The incidence of pseudarthrosis is lower in this series than it is in most other statistical accounts. On studying the series it will be found that is not the choice of the method of treatment, but its execution and pursuance which have had a decisive effect in every single case on the arisal of pseudarthrosis.

SUMMARY

In a series of 1468 diaphysis fractures over a period of 10 years 8 certain pseudarthroses were found in all, i.e., a pseudarthrosis incidence of 0.7 %. The pseudarthroses were distributed as follows, 4 on the crus, 3 on the humerus and 1 on the radius. In both the crus and humerus pseudarthroses the fractures given operative treatment predominated, and the one radius pseudarthrosis was treated operatively from the beginning. The methods employed were: open reduction without osteosynthesis, Küntscher's intramedullary nailing, Parham's band, and metal wire cerclage. On studying the course of treatment for each individual case of pseudarthrosis one or more pseudarthrosis-favouring factors were found to result from the treatment itself. It must be stated however that there were almost constantly certain conditions concerning the fractures which forced the adoption of the actual lines of treatment. Owing to the above mentioned reasons no special significance can be attached to the preponderance of pseudarthroses amongst the operatively treated fractures. In this series it is more the execution and the pursuance of the treatment than the choice of method itself which has led to the development of pseudarthrosis.

RESUME

Sur un matériel comprenant 1468 fractures de diaphyses durant une période de 10 ans, on a trouvé au total 8 pseudarthroses certaines, c'est-à-dire une fréquence de pseudarthrose de 0.7 %. Ces pseudarthroses se répartissaient comme suit: 4 du tibia, 3 de l'humérus et 1 du radius. La majorité des cas de pseudarthroses du tibia et de l'humérus étaient ceux dans lesquels les fractures avaient été traitées opératoirement et le cas de pseudarthrose du radius avait été au début soumis à un traitement sanglant. Les méthodes opératoires utilisées avaient été: reposition sanglante sans ostéosynthèse, fixation médullaire par clous Küntscher, ruban Parham et cerclage en fil d'acier.

En examinant les résultats du traitement pour chacune des pseudarthroses, on constate dans tous les cas des facteurs du traitement prédisposant aux pseudarthroses. Il est précisé d'ailleurs que c'est très souvent des facteurs circonstanciels des fractures qui ont rendu nécessaires de telles méthodes de traitement. On ne peut donc pas attacher une importance spéciale au fait que c'est parmi les fractures traitées par la voie opératoire que l'on trouve la majorité des cas de pseudarthrose. Dans les cas examinés, c'est plutôt la manière dont le traitement a été appliqué que le choix de la méthode de traitement qui a conduit à la pseudarthrose.

ZUSAMMENFASSUNG

In einem Material von 1468 Diaphysenfrakturen während einer 10-Jahrsperiode wurden insgesamt 8 sichere Pseudarthrosen, d.h. eine Pseudarthrosenhäufigkeit von 0.7 %, gefunden. Die Pseudarthrosen verteilten sich auf 4 Unterschenkelbrüche, 3 Oberarmsbrüche und 1 Radiusbruch. Die Mehrzahl der Unterschenkel- und Oberarmspseudarthrosen waren operativ behandelt worden und die eine Radiuspseudarthrose war primär operativ behandelt worden. Die operativen Behandlungsmethoden, die verwendet wurden, sind: Blutige Reposition ohne Osteosynthese, Küntschers Marknagelung, Parhams Band und Stahldrahtumschlingung. In der Verfolgung des Behandlungsverlaufes jeder einzelnen Pseudarthrose fand man in jedem einzelnen Falle einen oder mehrere Faktoren in der Behandlung selbst, die zur Pseudarthrosenbildung beigetragen haben konnten. Man hebt jedoch hervor, dass es grösstenteils die besondere Beschaffenheit der Brüche war, die diese bestimmten Behandlungswege erzwungen hat. Der überwiegenden Häufigkeit von Pseudarthrosen in den operierten Fällen kann daher aus den erwähnten Gründen kein wesentliches Gewicht beigelegt wer-

den. Es ist in diesem Materiale mehr die Art der Ausführung und Durchführung der Behandlung als die Wahl der Methode, die zur Pseudarthrosenbildung geführt hat.

REFERENCES

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