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INFLUENCE OF EARLIER FRACTURE ON BONE-REPAIR IN RATS STUDIED BY MEANS OF RADIOCALCIUM

By

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"Clinical textbooks present the thesis that patients with multiple fractures show delay in healing of one or another of the bones" (cit. *Urist–McLean* (1950), *Speed–Smith* (1949)). Very few workers have tried to investigate this problem by making multiple fractures experimentally and the results have been partly contradictory. The methods used have implied a judgement of the histological and roentgenological signs of healing.

Thus *Fränkel* (1928–29) in his investigations with rabbits first fractured one leg and then, some time later, another. He believes that the later fracture does heal sooner than it would do, had there been no earlier fracture. He also states that the healing of the earlier fracture is retarded by the later fracture.

Urist–McLean (1950) however have shown on rats that multiple fractures do not differ from a single fracture in their mode or rate of healing.

The opinion that bone-repair is influenced by other fractures may be explained in many ways. Some have stated that a healing-stimulating factor is produced when a leg is fractured (*Fränkel* (1928–29), *Annersten* (1940)). Others have stressed that the supply available of calcium, phosphorus or certain vitamins necessary for the healing is limited (*Campbell* (1923)).

By the method described below I have studied whether the uptake of radiocalcium in a fracture is influenced by the earlier fracture of another bone. The employment of radioactive tracer substances is a method used by numerous workers for investigating fracture healing quantitatively (*Marshak–Byron* (1945), *Copp–Greenberg* (1945), *Armstrong–Barnum* (1948), *Bohr–Sørensen* (1950) and others).

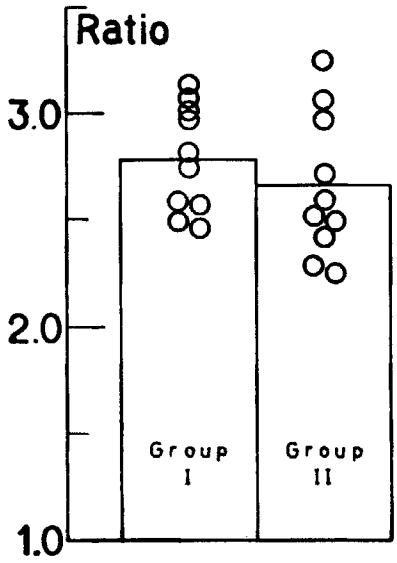

Fig. 1.

Group I : 10 rats with a fracture of the humerus previous to the fracture of the tibia.
Group II: 10 rats with no fracture previous to the fracture of the tibia.
Every ratio fractured/nonfractured tibia is recorded together with the mean values of the two groups.

MATERIAL AND METHODS

20 young inbred male rats of mixed strain weighing about 200 grams were divided in two similar groups according to body weight. In the first group of ten, each rat was submitted to a fracture of the right humerus. 15 days later one tibia was fractured in each rat of both groups. All fractures were made by bending over an edge manually. The animals were allowed to move freely in their respective cages and received a full diet both before and after fracture.

After a further 15 days the animals were killed by an overdosage of ether. 18 hours before death they received the radiocalcium in the form of an aqueous solution via a stomach tube. The fractured bones and the nonfractured bones of the corresponding extremity in each rat were dissected free from muscles, reduced to ash and the bone ash was weighed and dissolved in nitric acid. The radioactivity of this solution was then determined by means of the technique described by *Carlsson* (1951).

For every bone that was examined the counts per minute per 100 mg ash were determined. This value for each fractured tibia was divided by the corresponding value for the nonfractured tibia of the other

hindleg. The ratio fractured/nonfractured tibias of every animal in the two groups is recorded in the graph.

COMMENTS

It appears from the graph that no difference between the two groups has been found and this is confirmed by statistical anlysis. The mean value of group I is 2.78 ± 0.25 and that of group II is 2.65 ± 0.34, which makes a difference between the two groups of 0.13 ± 0.43.

As it is not certain that this result is applicable to some other point on the curve of uptake of radiocalcium in a fracture I will carry on the investigation by varying the time-periods between the fractures and between the fractures and death of the animals.

SUMMARY

The uptake of radiocalcium in a 15-day-old fracture of a tibia in young rats was found to be unaffected by a previous fracture of the humerus.

RESUME

On a constaté que l'absorption de radiocalcium dans une fracture du tibia vieille de 15 jours chez de jeunes rats n'est en rien affectée par une fracture préalable de l'humérus.

ZUSAMMENFASSUNG

Die Aufnahme von Radiocalcium in einen 15 Tage alten Tibiabruch bei jungen Ratten wurde durch vorangehenden Bruch des Humerus nicht beeinflusst.

REFERENCES

Annersten, S.: Acta chir. Scandinav. 84: suppl. 60, 1940.
Armstrong, W. D. and *Barnum, C. P.:* J. Biol. Chem. 172: 199–204, 1948.
Bohr, H. and *Sørensen, A.:* J. Bone & Joint Surg. 32 A: 567–574, 1950.
Campbell, W. C.: Am. J. Surg. 37: 1–3, 1923.
Carlsson, A.: Acta pharmacol. et toxicol. 7: suppl. 1, 1951.
Copp, D. H. and *Greenberg, D. M.:* J. Nutrition 29: 261–67, 1945.
Fränkel, R.: Arch. f. klin. Chir. 150, 170–192, 1928.
– Arch. f. klin. Chir. 154, 398–417, 1929.
– Arch. f. klin. Chir. 155, 215–231, 1929.
Marshak, A. and *Byron Jr.; R. L.:* J. Bone & Joint Surg. 27: 95–104, 1945.
Speed, J. C. and *Smith, H.:* Campbell's Operative Orthopedics, Chapter X, p. 608, St. Louis 1949. C. V. Mosby & Co.
Urist, M. R. and *McLean, F. C.:* Am. J. Surg. 80: 685–695, 1950.