

Conclusions

Under the conditions of this trial heparin did not exert an analgesic effect in myocardial infarction greater than that of a placebo, nor did it affect the pulse rate or diastolic blood pressure. There was no significant alteration in the electrocardiographic tracings of six patients who received heparin.

Summary

A double-blind trial was performed to determine the effect of intravenous heparin on myocardial pain, pulse rate, diastolic blood pressure, and the electrocardiographic tracing.

No significant differences were found from the placebo effects of intravenous saline.

I am indebted to Drs. F. A. Richards, R. A. Moir, J. D. Craig, and M. Sadiq for encouragement, criticism, and permission to study patients under their care. The chief pharmacist, Mr. H. Duckett, kindly prepared the drugs and held the code. My thanks are also due to the resident medical staff for their assistance and to Miss D. Rose for secretarial work.

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Calcium Infusion Test in Osteomalacia: an Appraisal

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Brit. med. J., 1967, 3, 281-282

Nordin and Fraser (1956), as well as many other authors, have reported that patients with osteomalacia retain more of an infused dose of calcium than normal persons. A high retention of infused calcium by itself has been taken as diagnostic of osteomalacia (Harvald *et al.*, 1962; Deller *et al.*, 1963; Thompson *et al.*, 1966). Nordin and Fraser suggested that the calcium retained in osteomalacia was taken up by the uncalcified bone matrix—that is, osteoid tissue. If this was so then the amount of calcium retained should be related to the amount of osteoid.

We report here the relation between calcium retention and the amount of osteoid in trabecular bone in 15 patients.

Patients

Eleven patients had had a partial gastrectomy, but only four had typical osteomalacia with bone pains and a large increase in serum alkaline phosphatase which responded to vitamin D (Morgan *et al.*, 1965). The other seven were investigated because at that time we thought that a small increase in serum alkaline phosphatase, which they were shown to have, meant that they had a symptomless osteomalacia. Four further patients had typical osteomalacia which was not the result of gastric surgery. Three of these had proved gluten-induced enteropathy; the fourth is still being investigated.

Methods

The protocol for the infusion of calcium was that given by Nordin and Fraser (1956) except that calcium gluconate was infused in a 5% solution of dextrose and not in saline. Calcium in the urine was estimated by flame photometry (MacIntyre, 1961).

The proportion of the dose excreted was calculated from the difference between the calcium excreted in the urine in the 12 hours from the beginning of the infusion and the calcium excreted during the corresponding period on the previous day. The results were expressed as the percentage of the infused calcium retained in the body in the 12 hours.

The bone biopsy specimens were obtained from the iliac crest under local anaesthesia (Williams and Nicholson, 1963). The specimens were fixed in barbitone-buffered formalin (Ball, 1957) and sections cut without decalcification by Russell's (1956) technique. The area of osteoid in the section was expressed as a percentage of the total area of bone in the section. These measurements were made by Dr. C. G. Woods and will be reported by him elsewhere.

Results and Discussion

Fig. 1 shows that while all eight patients with typical osteomalacia retained most of the infused calcium so did four of the seven patients without an excess of osteoid in the bone. There was no relation between the amount of calcium retained and the area of osteoid.

Thus an excessive retention of calcium does not depend on an excess of osteoid. A similar conclusion could be drawn from the data of Thompson *et al.* (1966) and of Deller *et al.* (1963). The results in these two series have been plotted in Fig. 2, which includes our results for comparison. The histological criteria for the diagnosis of osteomalacia have been those of the respective authors.

The high retention of calcium in patients without osteoid is not limited to patients who have had a gastrectomy. Lindahl (1959) reported that a third of 70 patients with senile osteoporosis retained excessive amounts of infused calcium, though none of them had histological evidence of osteomalacia. Atkinson *et al.* (1956) reported an increased calcium retention in 7 out of 14 patients with chronic jaundice. Three of these seven had no osteoid on bone biopsy.

Apart from osteomalacia, high retention of calcium has been reported in other disorders of bone where osteoid is found. Thompson *et al.* reported, and we have confirmed, that in Paget's disease of bone there is an increased calcium retention after calcium infusion. Nordin and Fraser (1956) showed this in hypoparathyroidism, and also in a number of other diseases such as diabetes, rheumatoid arthritis, and renal failure.

The interpretation of calcium infusion tests may be questioned because normal persons retain as much as 73% of an infused dose, yet the retention of a further 10% is regarded as highly abnormal. The fate of the retained calcium is not

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known even in normal people. The extra calcium may be accommodated by the growth of immature crystals in bone; or the calcium may be deposited in the soft tissues of the body and not the bone. It would be interesting to know the effect of age on the retention of calcium; it is reasonable to postulate that the calcified soft tissues found in elderly persons have an

amount of osteoid. These findings, together with the reports of high retentions of infused calcium in bone disorders other than osteomalacia, make it impossible to interpret an "abnormal" calcium infusion test. It is suggested that the only possible value of this test is that a normal result may exclude osteomalacia.

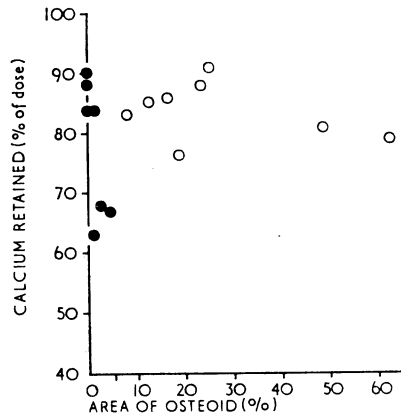


FIG. 1

FIG. 1.—Relation between retention of infused calcium and amount of osteoid (by area) in the bone biopsy specimen in eight patients with osteomalacia (open circles) and seven patients with a partial gastrectomy but without osteomalacia (closed circles). FIG. 2.—Retention of infused calcium in patients after gastrectomy. The open circles represent patients with osteomalacia and the closed circles patients who did not have osteomalacia. The histological definition of osteomalacia was that given by the respective authors.

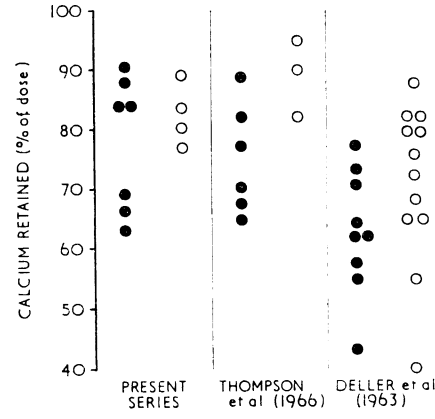


FIG. 2

increased affinity for calcium (Bürger, 1960) and, in addition, many of them have some impairment of renal function. But we do not think such an investigation is justified, and we report these results in the hope of sparing many patients an unnecessary infusion of calcium.

We feel that it is impossible to interpret an "abnormal" calcium infusion test and that the only possible value of the test is that a normal result may exclude osteomalacia.

Summary

A high retention of infused calcium has been regarded as evidence of osteomalacia. This extra retention has been attributed to the excess of uncalcified bone (osteoid). In 15 patients the calcium retention and the amount of osteoid were compared. Although eight patients with osteomalacia did have a high retention of infused calcium, so did four out of seven patients with a gastrectomy but without osteomalacia. There was no relation between the amount of calcium retained and the

We thank Miss Judith Metcalfe for technical help and the sisters and nursing staff of the Leeds General Infirmary for their willing co-operation.

The study owes much to the guidance of our chief, Professor Paul Fourman. The work was supported in part by a grant from the Medical Research Council to Professor Fourman.

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