FROM THE ORTHOPAEDIC CLINIC AND CENTRAL LABORATORY OF THE CENTRAL HOSPITAL IN LINKÖPING

AN OPERATED CASE OF ENCHONDROMA TIBIAE IN WHICH THE COURSE OF HEALING WAS FOLLOWED WITH SR^{85}

By

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Various types of isotopes have been used to an ever greater extent within the clinic and not least in diseases and injuries of the skeleton where above all calcium and strontium have been employed. In the present case we used Sr^{85}.

In February, 1958, a 66 year old farmer was admitted to the Orthopaedic Clinic for spontaneous fracture of the left tibiae (fig. 1). 1 year previously the diagnosis of a benign enchondroma in the left tibia had been already made in another hospital. Since the tumour had grown quite considerably during the last six months a certain tendency to malignancy was thought to exist. Owing to this and also owing to the risk of spontaneous fracture the patient had been advised thigh bone amputation which, however, he refused. With regard both to the patient's age and the wide spread of the tumour he was also advised by us to accept amputation. He still refused, however. The only acceptable alternative to amputation was evacuation of the tumour and the filling of the defect with bone transplant. A circumstance which provoked a sceptical attitude, however, towards this intervention was the relatively high age of the patient. Yet he had a very good general condition for his age and looked much younger than his age. Sedimentation rate was 9 mms. 1 hour on admittance and his pulse and temperature were unobjectionable. Hemoglobin value and the erythrocyte and leucocyt count could not be faulted, and serum-calcium, serum-phosphorus, and serum-phosphatase showed normal conditions. Protein fractions in serum showed also normal values and the internal organs were unexceptionable. As the patient, moreover, accepted the suggestion gratefully *the operation was performed on the 9.4.1958.* The tumour tissue

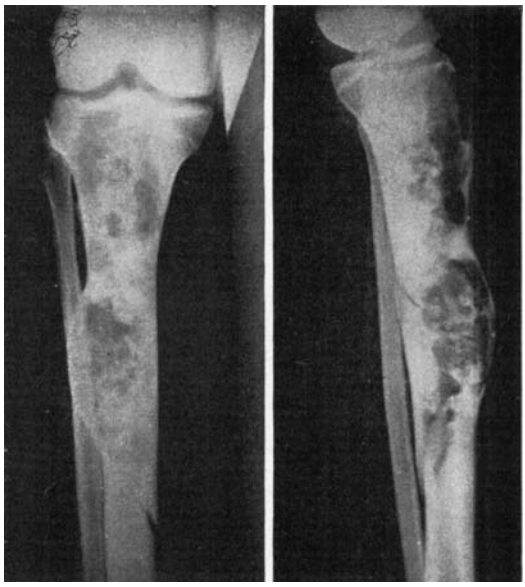

Fig. 1.
X-ray 2 months before operation 9. 4. 1958.

was chiselled and scraped out and the large defect was filled with bone-chips from the bone bank. Quite a large, subcutaneous oedema was found within the area of the tumour. The periosteum was considerably thickened. It could, however, be easily freed from the tibia. In some places perforations in the corticalis could be seen, through which the periosteum proliferated towards the medullary cavity. On the other hand no point could be seen where the tumour grew out into the soft tissue. At the places where the changes were largest, the corticalis was almost as thin as paper and after the tumour masses were removed there was not much left of the corticalis in parts. Proximally the tumour extended subchondrally towards the articular surface of the tibia. Distally it reached a point 13 cms. above the ankle joint. Apart from the spontaneous fracture for which the patient was first admitted to the clinic, a further fracture was sustained during the operation.

The tumour showed everywhere the picture typical of chondroma, i.e., a brittle, almost amorphously granular, easily crumbling mass of a blue-white colour. Typically it grew out into the bone in rounded cavities, large and small in size; everywhere, however, the tumour was well defined. The patho-anatomic diagnosis showed the typical picture

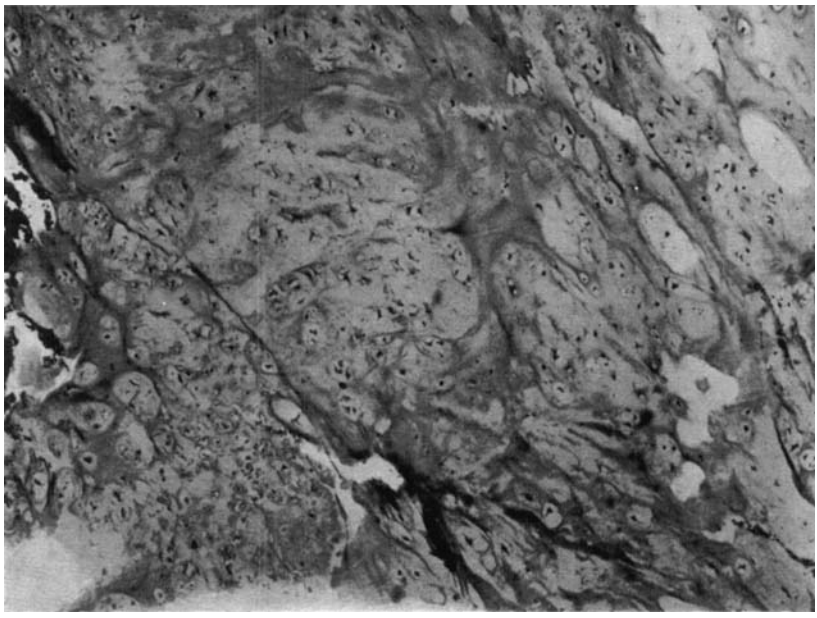

Fig. 2.
Microphotograph of the tumour (× 60).

of a chondroma (fig. 2). The aftercourse was on the whole uneventful. It was not until 4½ month after the operation that the bone was so stable that we ventured to begin movement therapy of knee and ankle joints and the patient was allowed to begin weightbearing 6 months after the operation.

When it was decided to carry out an evacuation of the tumour, we planned to follow the course of healing with isotopes and as stated above we chose Sr^{85}. From published research *(Bauer* and others) it is known that radio activity increases for years after a skeletal injury e.g., after a fracture. In the present case ,however, the situation was somewhat different since heterologous transplants had been used and we considered that this point was of some interest. With the Sr^{85} technique there should be some opportunity of following the processes of new bone formation and bone regeneration during the period of healing. In order to be able to follow the course of healing from all aspects and to be able to verify any possible recurrence, it should also be possible to carry out histological examinations in the bone tissue apart from the current radiological examinations. Therefore on *the 23.1.1959* (about 9 months after the 1st operation) an exploration of the proxi-

mal part of the operation area was made. It was then found that a few of the transplants implanted in the first operation were loose, but no macroscopic tissue reaction could be found around them. The great majority of the transplants had healed well but could be easily distinguished from the patient's own corticalis owing to the rough and uneven structure. Non-united bone chips were removed. Samples were taken from the parts where the bone-chips had united and also from parts of the original corticalis. All samples were sent for histological examination and for measurement of radio activity.

The loose, non-united transplants proved for the most part to consist of necrotic bone where the cell nuclei had disappeared, whereas the united transplants as expected consisted of vital bone. Accordingly the same degree of radioactivity was also obtained for the united transplants as for parts from the original tibia of the patient, while the non-united transplants did not show more activity than that given by background radiation, in spite of the fact that they lay in a radioctively very "contaminated" area.

On tomography on the 28.5.1959, that is, almost 14 months after the 1st operation (fig. 3) some areas of rarefaction had been found in the bone structure in the lower part of the tibia. On counting, moreover, an increased activity had been found within these areas, which indicated an active process, so that the recurrence diagnosis was considered to be established. *On the 8.6.1959 a fresh exploration was carried out therefore,* this time comprising the distal half of the tibia. No macroscopic signs of recurrence were found, however, at the site of the radiological changes and the histological examination showed vital bone without any suspicion of chondroma characteristics. As in the preceding operation samples were taken from the united transplants and from the original corticalis of the patient. The histological picture of the former showed vital bone and counting of the radioactivity showed the same range as for the tibia in other respects.

TABLE 1

Time for injection of Sr 85:		*Sr^{85} in μC:*
1958	1/4	28,5
	16/4	32,5
	8/9	23
1959	3/6	29
	29/12	28,5
1960	15/7	30
1962	16/1	30

Fig. 3.
X-ray 1 year after the operation.

Otherwise, it can only be added that the patient has worked since the winter of 1959 to full capacity as a farmer. He carries out very strenuous and demanding tasks and never uses any kind of support when he walks. He has a good mobility in both knee and ankle joints.

Table 1 gives the dates of the Sr^{85} injections and the amounts of radioactive Sr which were injected.

TABLE 2
Biological half-life.

Counting points:	*Days:*	
	May - August 1958	Oct. 1958 - Jan. 1959
1	39	53
2	39–40	53–55
3	28–29	36

In the tests with Sr^{85} the method described by *Bauer & Wendeberg* was applied. The counting sites on the diseased leg and healthy leg were marked and the counting was carried out under identical test

Fig. 4.
X-ray 16. 1. 1962, almost 4 years after the operation.

conditions on each occasion. The results appear in fig. 5. In this the counting values from the Sr^{85} injection in January, 1962, have also been included, i.e., almost 4 years after the first operation.

From the course of the curves the *biological* half-life was calculated both during the period May-August, 1958, and the period October, 1958, – January, 1959. The approximate values are to be found in Table 2.

The values of the biological half-life are an expression of the speed with which the radioactivity disappears from each counting point. They have no general significance but they do allow a comparison to be made between various periods of time for precisely that point at which they were counted. In this patient therefore the biological half-lives are throughout shorter during the first four months after the operation than during the period 6–9 months after the operation. This of course is a way of saying that bone tissue regeneration proceeds more quickly during the former period than during the latter. And this is also indeed what one should expect from a biological point of view.

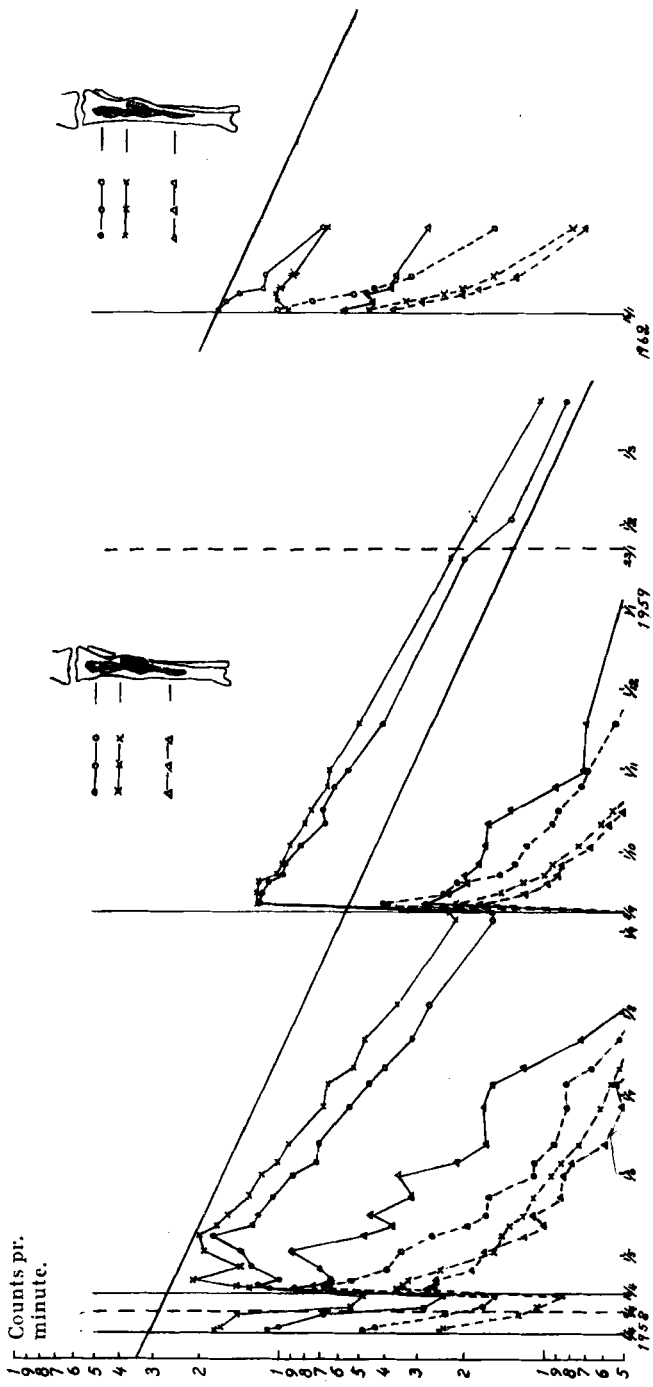

Fig. 5.

The curve shows the results of counting with Sr^{85}. The continuous curves show the straight lines show the physical half-life of Sr^{85}. The injection dates of Sr^{85} are straight lines show the physical half-life of Sr^{95}. The injection dates of Sr^{85} are to be seen in Table 1.

A test with Sr^{85} 3¾ years after the operation, when there is still considerably higher quantitiy of Sr^{85} present in the operated leg than in the healthy leg, shows that the increased speed of bone renewal still exists on the side treated even after this quite long period.

The previously discussed results in the text of radioactivity in united chips and in loose lying chips should be give the interpretation that the united chips have undergone regeneration and passed into bone specific to the body.

SUMMARY

A case of enchondroma tibia in a man aged 66. An operation was performed in which the tumour was scraped out and bone-chips from the bone bank were implanted. The course of the healing was followed by counting the radioactivity following injection of Sr^{85}. 4 years after the operation the diseased leg still shows increased activity. The biological half-life was greatest during the first four months.

RESUME

Cas d'enchondrome du tibia chez un homme âgé de 66 ans. Opération par grattage de la tumeur et insertion de fragments d'os prévelés sur les stocks du Centre. On a suivi le cours de la guérison par saturation radioactive après injection de Sr^{85}. Quatre ans après l'operation, on a constaté dans la jambe malade une activité accrue. C'est pendant les quatre premiers mois que la bipartition biologique a été la plus élevée.

ZUSAMMENFASSUNG

Ein Fall eines Enchondroms bei einem 66jährigen Mann. Operation mittels Auskratzung der Geschwulst und Einlegung von Knochenspähnchen von einer Knochenbank. Der Heilungsverlauf wurde mittels Messung der Radioactivitet nach Injection von Sr^{85} verfolgt. Noch 4 Jahre nach der Operation zeigt der erkrankte Knochen eine erhöhte Aktivitet. Die biologische Halbierungszeit war am grössten während der ersten vier Monate.

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