

## TWO PATIENTS CURED OF BONE CANCER

## OSTEOGENIC SARCOMA AND EWING'S SARCOMA OF BONE

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'We must preserve  
Not only health and life  
But the joy of living'.

*Sir William Osler.*

Osteogenic sarcoma and Ewing's sarcoma are generally regarded as two deadly bone cancers with a 5-year survival rate no higher than 15%. We have had two patients, one suffering from an osteogenic sarcoma of the left femur and the other from an Ewing's sarcoma of the right humerus; both histologically proved. These two patients have survived more than 5 years since radiotherapy was commenced; telecobalt therapy was used in the former and deep X-ray therapy in the latter. Both are at present enjoying excellent health. During the past 5 years they have both got married and each has given birth to a bonny baby—a boy and a girl respectively.

We feel not only entitled to regard these two patients with primary bone cancers as theoretically cured but also to regard their individual stories as rather unique and worth recording.

The first 2,000 Curie Telecobalt Therapy Unit, south of the Sahara, was installed for therapeutic purposes at a cost of R50,000 in the new Department of Radiotherapy at the Pretoria General Hospital in the spring of 1959. Five years later, in July 1963, the old source was replaced by a 3,700 curie source.

## A PATIENT WITH AN OSTEOGENIC SARCOMA

Just a few months before the opening of our new Department of Radiotherapy, Miss B.V., 24 years of age, was aware one morning of a deep-seated, nagging pain in her left leg just above the knee joint. She could not recall bumping or injuring her leg. During the next few weeks she became accustomed to this nagging pain which seemed to vary in intensity during the day and night. When it was particularly severe she found that a couple of aspirins relieved the pain. About one month after first noticing the pain she developed a limp and discovered a lump above her knee joint. She consulted her doctor immediately, Dr. J. O. M. Wright, of Springs, who had serious misgivings about the underlying pathology of this lump. He referred her to Drs. Fram, Gould, Bostock and Silansky, radiologists at Springs, for an X-ray examination of the left femur and chest. On 29 September 1959 Dr. J. P. Bostock reported as follows:

*'Left femur.* At the junction of its lower and its middle thirds, there are large moth-eaten areas of bone destruction over a distance of about 3½ inches. There is marked periosteal reaction around the affected area. Spicule formation is seen in the periosteal reaction. The findings are very suggestive of an osteogenic sarcoma.' (Fig. 1.) There was no evidence of metastases in the lungs.

The patient was then referred to Mr. Felix Machanik, orthopaedic surgeon of Springs and Johannesburg. Mr. Machanik felt that the diagnosis had to be verified by histological examination.

On 3 October 1959 Mr. Machanik operated and removed a piece of diseased bone for histological examination. The

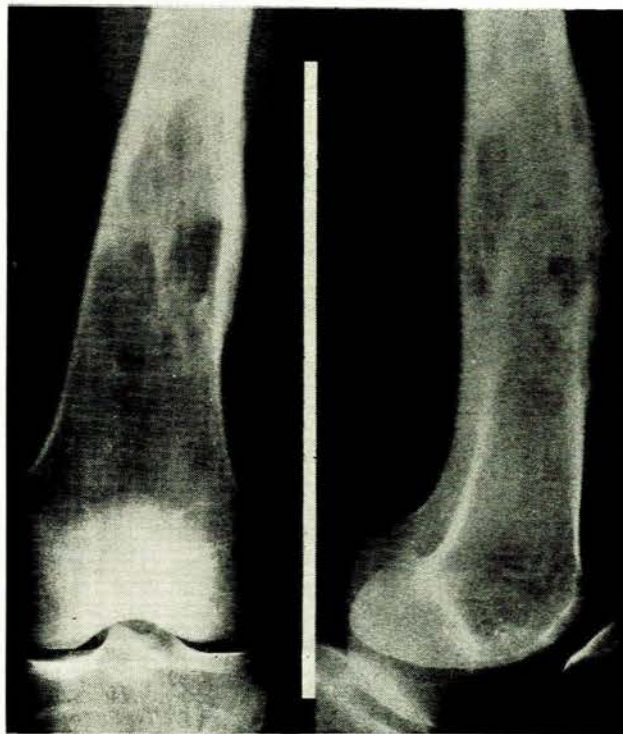


Fig. 1. X-ray examination of the left femur. Diagnosis—osteogenic sarcoma—29.9.59.

specimen was sent to the South African Institute for Medical Research, where Dr. H. I. Lurie, pathologist, reported as follows:

'Sections of this specimen from the lower femur show the presence of an osteogenic sarcoma.'

He let us have the slides from which Dr. I. W. Simson, pathologist at the Institute of Pathology, University of Pretoria, under Prof. J. Barnetson, had microphotographs made of the slides and corroborated the diagnosis of osteogenic sarcoma of the femur (Fig. 2).

After the diagnosis had been established beyond reasonable doubt, Mr. Machanik referred the patient to us for treatment with the new 2,000 curie telecobalt 'bomb' which had recently been installed.



On hearing that she had to have treatment with the 'cobalt bomb', that awe-inspiring apparatus that had figured so prominently in recent press reports and was hailed as the new marvel for curing cancer, she realized with a terrible shock that she was suffering from bone cancer and had probably only a few months to live. With much trepidation and many misgivings she wondered if she was going to be the first 'guinea-pig' to be tried out on

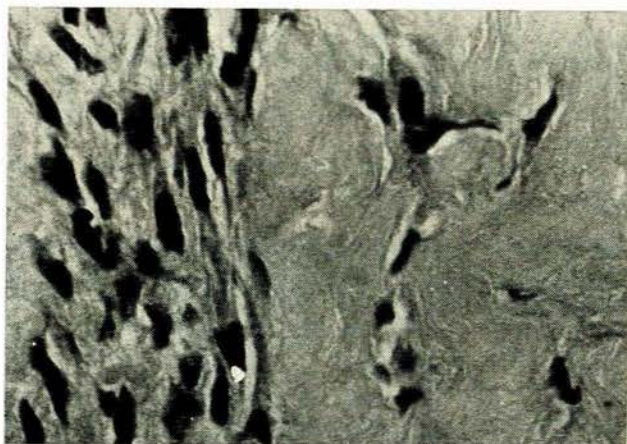


Fig. 2. Microphotographs of biopsy specimen ( $\times 1,000$ ). Osteogenic sarcoma.

the cobalt bomb. However, to be treated by this new medical marvel was reassuring but nevertheless an experience to be dreaded.

#### Telecobalt Therapy

On 16 October 1959 the patient was admitted to the Pretoria General Hospital for telecobalt therapy. An X-ray examination of her chest showed no evidence of lung metastases. Dr. C. S. Kingsley, haematologist, reported on the blood picture as follows: 'Haemoglobin 13.2 G/ml., 89%; leucocytes 6,500 per cu.mm.; polymorphs 75%; lymphocytes 21%; monocytes 4%; blood platelets normal. The first course of telecobalt therapy was then given. Telecobalt therapy was administered through 4 large  $17 \times 10$  cm. fields applied anteriorly, medially, posteriorly and laterally at a source skin distance of 65 cm. By treating all 4 fields every day, a homogeneous tumour-dose of 5,000 rads was obtained in 25 treatments. The treatment commenced on 16 October and was completed on 17 November 1959 (Fig. 3). During treatment and afterwards the patient was not allowed to bear weight on the left leg, and she was taught how to use crutches by the staff of the Department of Physiotherapy under Dr. H. D. Epstein, specialist in physical medicine.

The patient found treatment with the telecobalt 'bomb' rather an anticlimax, for while she lay under the 'bomb' and was being fired at by millions of invisible subatomic quanta of gamma-rays directed at the diseased bone, she neither felt nor heard anything. In fact she often wondered if the apparatus was working at all as she lay there for the 2-odd minutes that each treatment lasted. She felt, however, that the treatment was going to cure her, for she was told that during the treatment, silently, the gamma-rays were penetrating and killing the more radiosensitive cancer cells while leaving the more radioresistant normal cells and soft tissue cells alive to heal the lesion and eventually to cure the cancer. This she found most intriguing, for the only symptoms she experienced came shortly after each treatment session. A couple of hours after treatment she generally developed a slight headache, was a little giddy and sometimes, but not always, felt a little nauseous. She was not worried, for she was told to expect this. It was explained to

her that the body had to get rid of the products of destruction, and although these were eliminated and excreted along the normal channels, any excess caused nausea and even vomiting since this was an effort on the part of the body to get rid of the excess waste products in a hurry.

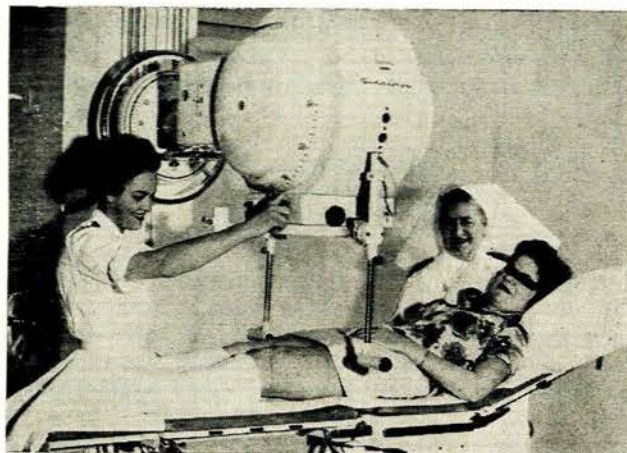


Fig. 3. 2,000 Curie Telecobalt 'bomb'. The patient being treated by Mrs. Raats, senior radiographer-in-charge, and sister Taylor.

As the patient took an intelligent interest in her treatment we explained to her that radiotherapy alone can cure cancer in a high percentage of cases; this is particularly true of cancer of the skin and cervix uteri. In combination with surgery it can produce a high percentage of cures in other malignancies, such as breast cancer and cancer of the corpus uteri. In deep-seated cancers, such as cancer of the brain, bronchus, alimentary tract, and in primary cancer of bone, such as osteogenic sarcoma, we do not get the same high percentage of cures. But in such cases the acquisition of the 'cobalt bomb' has given new hope. All this information she found encouraging but naturally not wholly satisfying, especially the information about primary bone cancer.

Throughout the treatment she bore a cheerful and courageous countenance because she felt sure she was going to be cured. At her side was her fiancé, who was always ready to encourage her in this great battle against cancer. But even more encouraging was the thought of wedding bells, for her marriage was planned to take place towards the end of January 1960, only a few months away, and she was not only determined to be well for the wedding but also determined to walk up the aisle in the church on her own two legs without the use of a wheel chair or even crutches—indeed quite a tall order (Fig. 4).

Fortunately she responded well to the first course of treatment with the telecobalt 'bomb'. There was complete relief of the nagging pain in the bone. She left the hospital on crutches and proceeded immediately with the wedding plans. On 30 January 1960 she walked up the aisle of the church on her own two legs to become Mrs. C.B.—a truly magnificent effort. But with all the excitement of the wedding and her new duties as housewife she threw away her crutches rather too eagerly. One day she twisted her knee rather sharply and must have torn a ligament. This meant that she had to spend a few weeks in bed. On leaving her bed she was advised to use crutches again for about a month. However, the leg remained painful. The nagging pains had returned (Fig. 5).

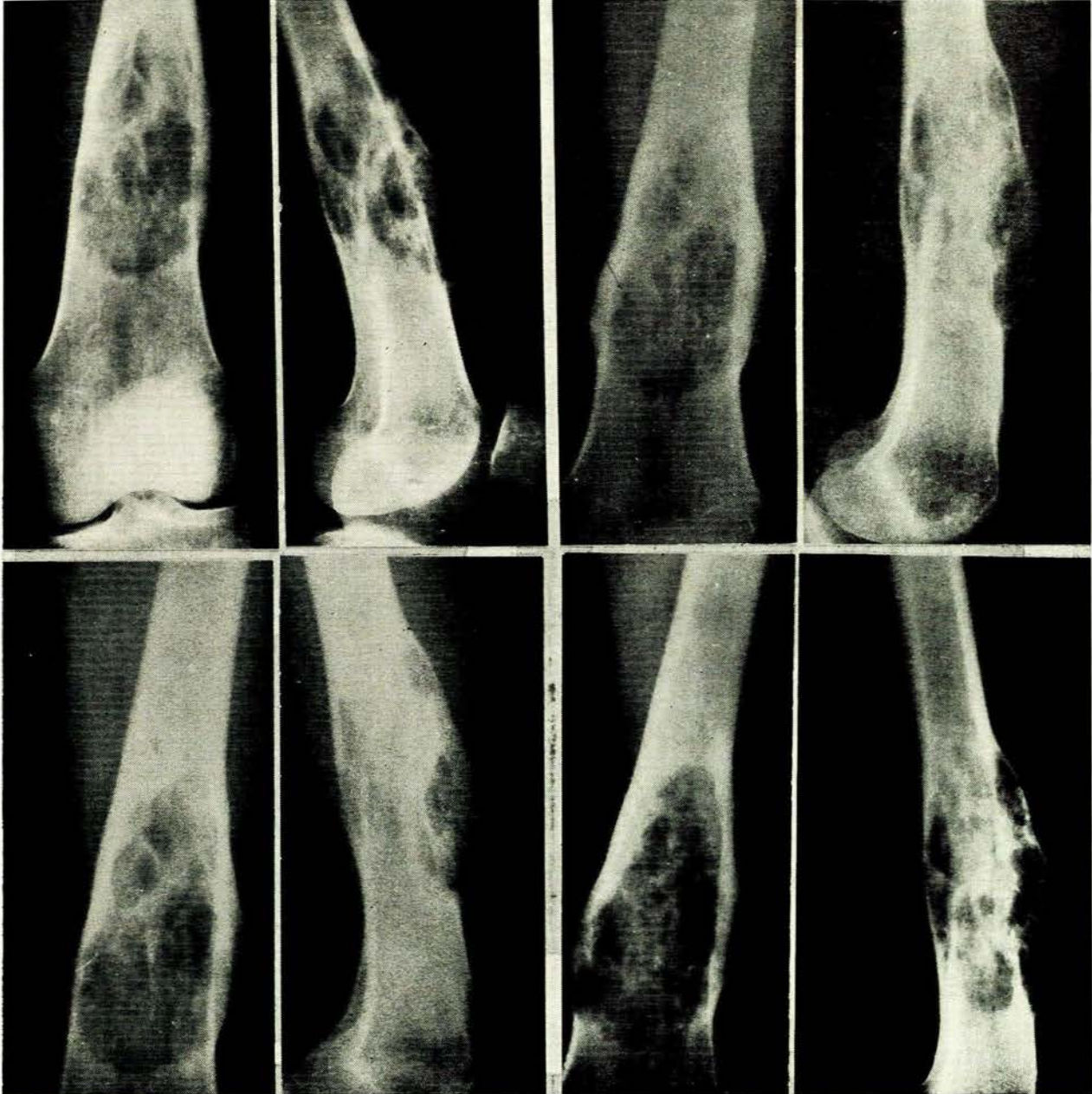
On 21 March 1960, some 2 months after the wedding, she was distressed to learn that X-rays of her left leg showed renewed activity. She was advised to undergo a second course of telecobalt therapy. It was however gratifying to know that the X-ray examination of her chest showed no evidence of lung metastases. On this occasion the telecobalt therapy was administered through one lateral field  $10 \times 10$  cm. at 60 cm.



source-skin-distance and centred over the most painful spot. A skin dose of 3,000 rads was administered in 10 days from 21 March to 1 April 1960. Once again the pain responded rapidly to telecobalt therapy. She soon left the hospital on crutches. Everything went well and the patient and her husband had great hopes that at last a cure had been obtained. Unfortunately this was not the case.

On 21 June 1960 she was readmitted to hospital with pains in her lower abdomen on the right side. A provisional diagnosis of a subacute appendicitis was made. She was put on anti-

biotics and fortunately the infection cleared up and the symptoms subsided. No operation was necessary. While she was in hospital her left leg was again painful; the same old nagging pains had returned. An X-ray examination of the left femur showed another suspicious area of activity—this time along the posterior aspect of the distal femur. We decided to give her a *third course* of telecobalt therapy. On this occasion the treatment was administered through a posterior field 10 × 7 cm. at 60 cm. source-skin-distance. A skin dose of 2,700 rads was administered in 9 days from 5 July to 16 July 1960.



*Fig. 4.* X-ray examination of left femur.

*Above:* Immediately after telecobalt therapy—24.11.59.

*Below:* Six weeks after telecobalt therapy—7.1.60.

*Fig. 5.* *Above:* Renewed activity—9.3.60.

*Second course* of telecobalt therapy—21.3.60 to 1.4.60. *Third course* 5.7.60 to 16.7.60.

*Below:* Renewed activity—8.9.60.

*Fourth course* of telecobalt therapy—1.11.60 to 25.11.60.



On discharge from hospital she had no pains in her leg and was feeling fit again (Fig. 5).

On 8 September 1960 she reported at the Department of Radiotherapy for follow-up examination. She said that she had felt fine since leaving hospital. No pains, no cough, no complaints to report. X-ray examination of the left femur showed no evidence of activity. The lungs were clear. She was asked to report back in 2 months' time. At last she felt a cure had been obtained.

Unfortunately on 1 November 1960, she had to be admitted to hospital because of severe pain in the left leg. This time the pains were more severe; much more than just a nagging pain. An X-ray examination of the left femur once again showed disquieting signs of malignant activity. Fortunately there was no evidence of metastases in the lungs. As there was no other form of treatment that could be given barring amputation, it was decided to give a *fourth course* of telecobalt therapy. Although she was nearing the limit of toleration of telecobalt therapy we decided to give a radical course similar

to the first course of telecobalt therapy. A tumour dose of 5,000 rads was obtained through 2 opposing fields 10 × 7 cm. at 60 cm. source-skin-distance, applied anteriorly and posteriorly. The treatment was given from 2 to 25 November 1960. During this course of treatment she had attended the hospital mostly as an outpatient on crutches. At the end of treatment she was asked to report back for follow-up examination on 11 January 1961. But on 13 December 1960 she was readmitted with severe pains in the leg. This time the pain was different and was caused by radiation reaction. The pain gradually responded to rest and analgesics. She was discharged for Christmas and New Year recess at her own request.

#### Complications and Surgical Treatment

Then the greatest misfortune that could have befallen her at this time happened. She slipped and fell on her left side sustaining a pathological fracture of the left femur through the weakened area of bone. Thus on 16 January 1961 she was admitted to hospital as an emergency suffering unbearable

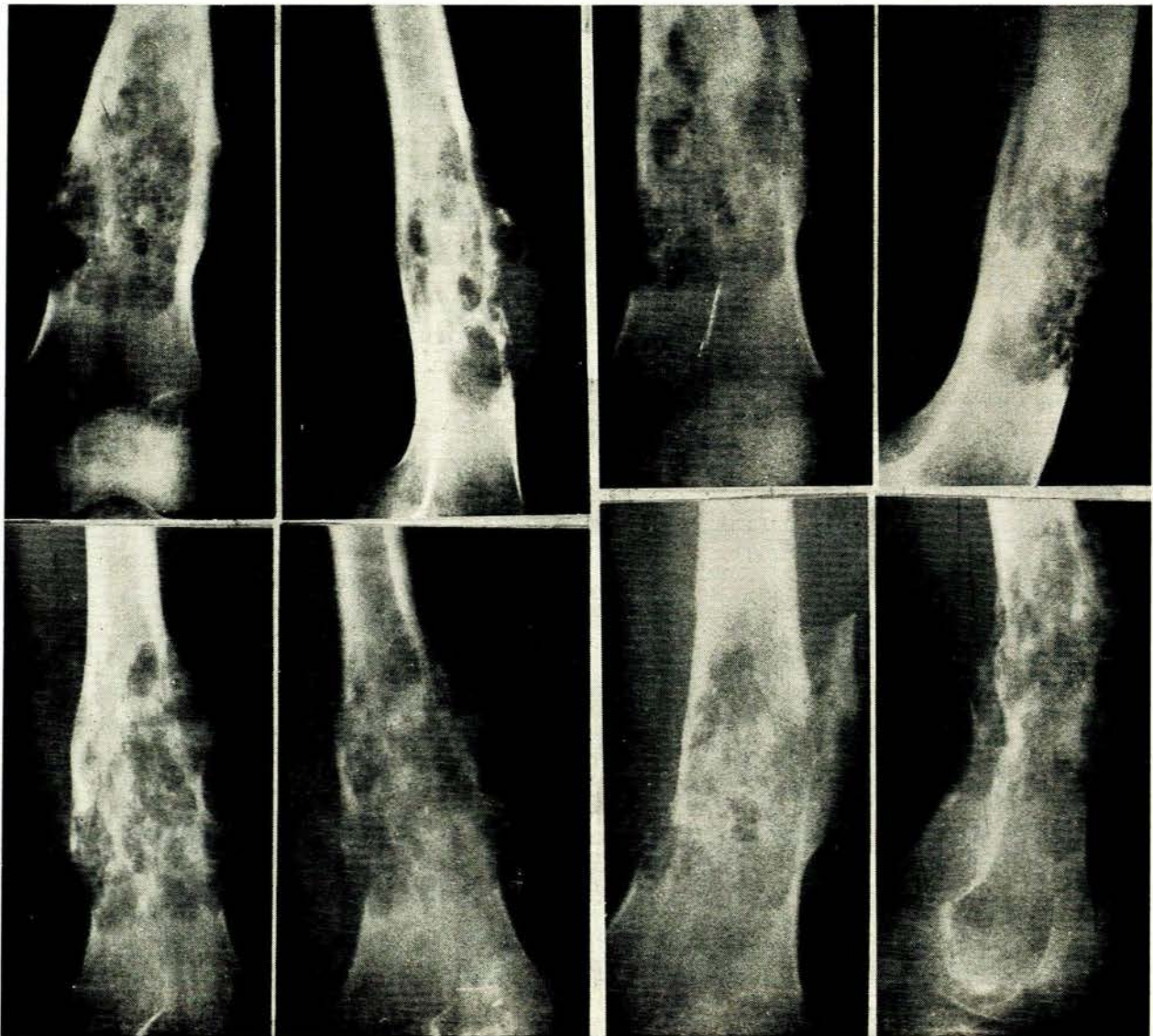


Fig. 6. Above: After fourth course of telecobalt therapy—25.11.60.

Below: Pathological fracture of left femur—16.1.61.

Fig. 7. Above: After 3½ months in plaster—26.4.61.

Some calcification, but no callous formation.

Below: After another 3½ months in splints—7.8.61.

No evidence of healing.



pain. All the telecobalt therapy that she had had during the past year had in all probability destroyed all the malignant cells, but at the same time had so devitalized the normal cells that they were unable to complete the healing process. Hence the fracture took place through the weakest point (Fig. 6).

Dr. Izak de Wet, orthopaedic surgeon of Pretoria, was immediately consulted. He advised immobilization in a plaster of paris spica. On 18 January 1961 under general anaesthetic Dr. de Wet put her in a plaster of paris spica. To make matters worse the patient was known to be allergic to analgesics such as morphine and pethidine and to antibiotics such as penicillin. Once in plaster the pain disappeared completely. The patient lay in this plaster of paris spica from 18 January to 26 April 1961—a period of 3½ months. This was a feat of endurance, especially during the hottest months of the year in Pretoria, that had to be witnessed to be appreciated. Her courage was tremendous and her faith in ultimate recovery and cure was a lesson to all concerned. Unfortunately this long period of immobilization did not produce the desired result. An X-ray examination (after the plaster of paris spica was removed) showed some calcification in the diseased area but no evidence of callous formation. A supportive back splint for the leg was made of plaster and this she wore for another 2 months, but there was practically no evidence of any healing. After 6 months Dr. de Wet was of the opinion that no further immobilization was going to heal the fracture. He advised amputation. With this opinion we had reluctantly to agree. We had hoped not only to cure the cancer with the telecobalt bomb but also to save the leg. This was not to be (Fig. 7).

We explained the position to the patient and pointed out that although we had done everything in our power to save the leg, we had to admit that we had failed. The best advice we could now give was amputation of the leg. Naturally this was a tremendous shock to her husband, especially in view of the fact that he had been magnificent throughout this long period of trial and tribulation. He could not get over the fact that after so much endurance on the part of his wife it had all been to no avail. He asked to be given time to think it over and to discuss it with his wife before we broke the news to her. In the meantime he also asked whether the opinion of another specialist could be obtained. This was a most reasonable request and we suggested that Professor Robert McWhirter, Director of the Department of Radiotherapy of the Edinburgh Royal Infirmary, Edinburgh, be approached by letter for an opinion, since he had seen and examined the patient while on a visit to South Africa in September 1960. All the X-rays were sent with the letter.

At the same time Prof. A. M. Lamont, psychiatrist of Pretoria, was asked to see the patient with a view to discussing the matter of amputation of the leg with her in the hope of minimizing any psychological trauma that may follow the thought of amputation after enduring so much to save the leg. Professor Lamont reported that the patient had a sound psychological approach to the problem—that she had resigned herself to her fate and that she had a philosophic outlook on the possibility of amputation. They discussed the implications of such an amputation on her future, and he was satisfied that she was well prepared for such an eventuality.

On 1 May 1961 we received a reply from Professor McWhirter. He wrote as follows:

'The practice we adopt here is to give treatment somewhat on the lines you gave on 16 October 1959. If, at the end of 6 months, no metastases are recognizable in the lungs, then the patient has an amputation. The purpose of delaying the amputation is, of course, to allow any metastatic cells which have reached the lungs to produce deposits of such a size that they can be recognized on the films. It would appear, too, from our experience that the treatment we give can control the primary tumour, and by arresting its growth in this way it is reasonable to expect that no new cells will be spread from the primary tumour. The whole purpose in treatment then is to select patients who are really suitable for amputation and to avoid the tragedy which so often happens after an amputation—namely about the time the patient is due to be fitted with an artificial limb metastatic deposits are found in the chest. Turning now to this particular patient, it would seem

to me that the treatment now is amputation without further delay. With the amount of treatment you have given I would think it is unlikely that the fracture will heal because very high dosage of radiation can inhibit the development of callus. I would be inclined to advise that you should proceed with a disarticulation now to avoid the risk of any metastases occurring and because the fracture is unlikely to heal.'

This information was conveyed to the patient and her husband and we stressed the fact that we fully agreed with Professor McWhirter's opinion.

As the patient had spent the last 6 months in hospital her husband was very keen to have her at home for 6 weeks before the final step was taken and the leg amputated. She was therefore sent home by ambulance and booked to come in on 16 July for amputation of the left leg. On 14 July her husband telephoned and asked whether the date of admission to hospital could be postponed to 6 August since his wife would be celebrating her 26th birthday on 29 July. We acceded to this request.

On 9 August 1961 Dr. de Wet amputated the left leg about 5 inches below the greater trochanter of the femur. As an X-ray examination of the femur had shown a healthy looking upper end Dr. de Wet decided to do an amputation rather than a disarticulation.

The amputated femur was sent to the Institute of Pathology for complete histological examination. At the same time biopsies were taken from various areas in and around the remaining stump, namely from the surrounding soft tissues, from the periosteum, cortex and bone marrow and from the skin. Dr. W. J. Pepler, pathologist at the Institute, reported a week later that he could find no evidence of any malignant cells in the amputated leg nor in the biopsies taken in and around the remaining stump. This was good news indeed especially after the decision to do an amputation rather than the more formidable operation of disarticulation of the hip joint (Fig. 8).

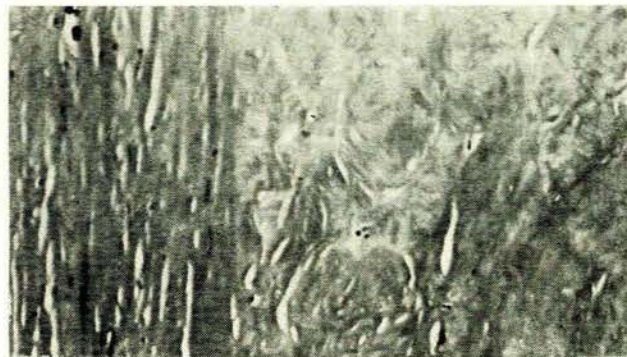


Fig. 8. Microphotograph of a representative specimen—showing fibrosis and no evidence of malignant cells.

#### Follow-up History

On 15 October 1961 the patient was discharged from hospital after an X-ray examination of the chest and stump of the left leg had shown no evidence of metastases or recurrence. It was now exactly 2 years since she had been admitted for the first time for telecobalt therapy. A small area of skin in the centre of the operation scar showed delayed healing. There remained a little discharging sinus. On 12 January 1962 she suddenly developed a severe pain in the stump and an X-ray examination of the stump showed no evidence of a recurrence or spread of the disease, but there was clear evidence of a localized periosteal reaction as a result of ascending infection from the discharging sinus. The low-grade infection cleared up very rapidly following antibiotics and plastic surgery



closing the discharging sinus. By the end of January 1962 she had gained a final victory over the primary bone cancer of osteogenic sarcoma. (Fig. 9).

Now new problems faced this family. At first there was the question of an artificial leg. On 19 March 1962 X-ray examinations of the chest and stump showed no evidence of metastases or a recurrence. Towards the end of May she expected to have the artificial leg fitted. On 23 June 1962 the patient was again seen in the clinic when she reported more exciting news. She was enjoying excellent

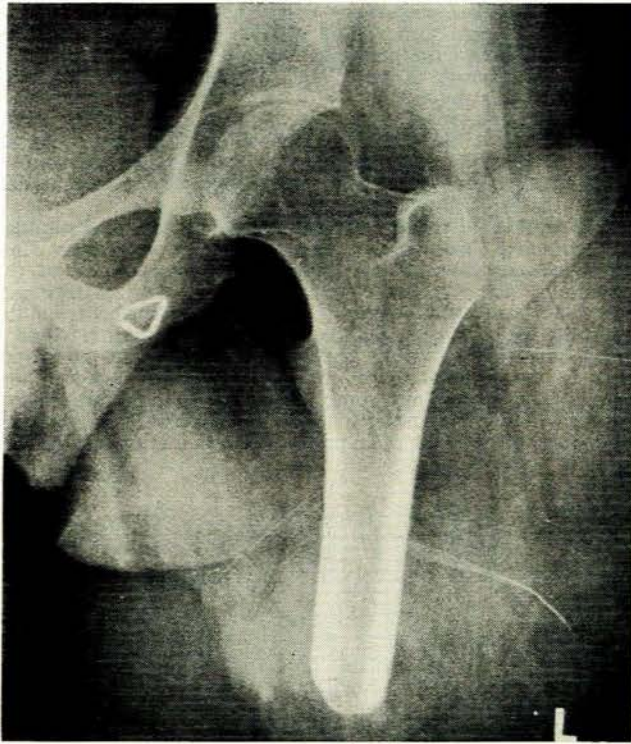


Fig. 9. Eighteen months after amputation—13.2.62.

health and wished to mention that the first day of her last normal period was on 4 April 1962 and that her doctor, Dr. J. Newman, of Boksburg, had diagnosed pregnancy. She was very excited about the news, but at the same time rather worried as to whether the considerable amount of telecobalt therapy which she had had was going to have a detrimental effect on her unborn infant. We assured her that she had nothing to fear from the point of view of the irradiation. The real problem was the pregnancy and its effect on malignancy. As we felt that in her case the malignancy was cured, we explained that there was no need to terminate the pregnancy, for we were convinced that her victory over cancer was complete and that she could go to full term and expect a normal, healthy baby.

On 20 October 1962 she was seen in the follow-up clinic wearing her artificial leg and looking the picture of health. She said that she expected her baby round about 14 January 1963. No further X-rays were taken at this stage because of the pregnancy. On 14 January 1963 her

husband telephoned to let us know that his wife had that morning given birth to a bonny 7 lb. baby boy, and that mother and baby were perfectly well. The baby boy was born at 3.0 a.m. and the confinement had lasted less than half an hour.

The patient was next seen in the clinic on 13 February 1963, with her husband and baby boy. She was beaming with delight and the proud father was all smiles. The baby was one month old and normal in all respects. The patient complained of pain in the back, and an X-ray examination of the pelvis showed slight subluxation of the sacro-iliac joints indicative of sacro-iliac strain probably caused by childbirth. The stump and chest showed no evidence of metastases. She had fed the baby for 3 weeks but had found this rather exhausting, and the baby has since flourished on artificial feeds. The baby is wonderfully healthy and is a great joy to his parents. The patient has attended our follow-up clinics regularly. She was last seen on 30 September 1964, now more than 5 years since all the trouble started. She is in excellent



Fig. 10. The patient and her husband with baby Peter. Peter is nearly 18 months old, and it is now more than 5 years since all the trouble started.



health and her baby is flourishing (Fig. 10). Faith and courage, with the aid of science, have won the day.

#### A PATIENT WITH AN EWING'S SARCOMA

In April 1954 a dainty little school girl, 12 years of age, had a right lower lobe lobectomy performed for bronchiectasis, from which she made an uneventful recovery. X-ray examination of the chest showed some residual fibrosis obliterating the right costo-phrenic angle of the chest.

In January 1956 at the beginning of the new school term, Miss J.H. was accidentally knocked off the school bus and severely injured her right shoulder and upper arm. She saw her doctor who told her that she had sprained the muscles of her shoulder but that there were no bones broken. He gave her some liniment with a pungent smell to rub on, and this relieved the pain.

Since that day, however, she had been conscious of a deep-seated, dull, nagging pain, like a toothache, which was better at times and then worse at other times. During the next 2 years she saw many doctors, but the real cause of the pain was not diagnosed. In January 1958 she could bear it no longer and she attended the surgical outpatient department of the Pretoria General Hospital. An X-ray examination of the right shoulder and humerus suggested the possibility of an osteomyelitis, but an Ewing's sarcoma could not be excluded. She was advised to be admitted to hospital for further investigations.

In hospital numerous investigations were carried out, but except for a raised erythrocyte sedimentation rate of 26 mm. after one hour (Westergren) all the investigations proved negative. A blood count showed a moderate leucocytosis of 11,000 per cu. mm. A provisional diagnosis of a chronic osteomyelitis was made and operation advised. At operation a piece of the humerus was excised for histological examination. The histological report was rather a shock, although not unexpected, namely, an Ewing's sarcoma of bone involving the humerus. Dr. I. W. Simson made fresh sections from the old specimen and gave the following confirmative report:

'Microscopic examination of the section from the biopsy from a tumour of the humerus shows infiltration of fairly small polyhedral cells with oval vesicular nuclei. Moderate nuclear pleomorphism and large numbers of mitotic figures are present. The cytoplasm of the tumour cells is not abun-

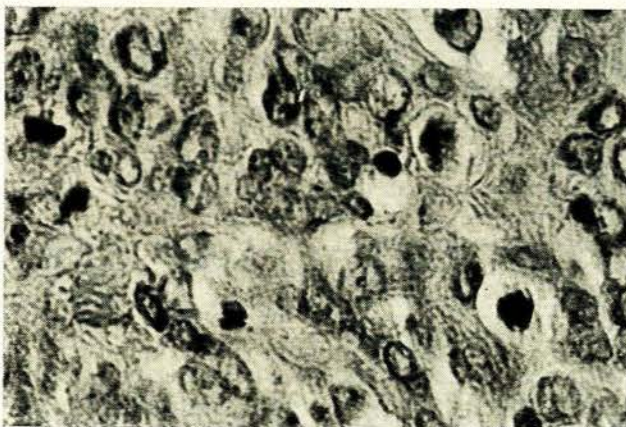


Fig. 11. Microphotographs of biopsy specimen ( $\times 2000$ ). Ewing's sarcoma of bone.

dant and many cells have a clear cytoplasm. Some of the cells contain small amounts of glycogen. A well-marked fibrous stroma is present, but peri-cellular reticulum is not a primary feature. *Diagnosis:* Ewing's sarcoma of the humerus.' Fig. 11 is a microphotograph of a representative section from the specimen.

The patient refused amputation and she was discharged.

Ten months later, on 17 December 1958, she reported back because the pain was once again unbearable. X-ray examination of the humerus showed that the Ewing's sarcoma had advanced and was now involving the whole of the shaft of the humerus, whereas previously it was localized to a small area in the middle of the shaft in the neighbourhood of the nutrient artery of the humerus. An X-ray examination of the chest showed no evidence of metastases. Once again amputation was advised and refused by the patient. On this occasion she was referred for radiotherapy and she was seen on the same day (Fig. 12, A).

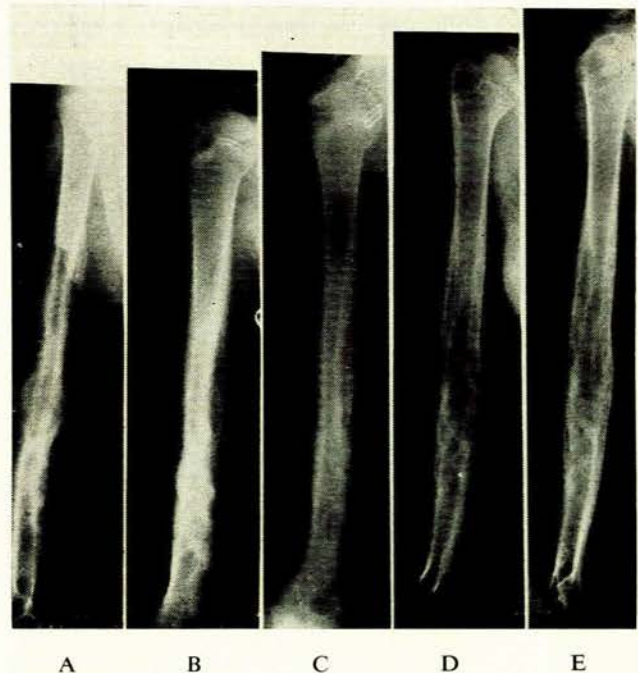


Fig. 12. X-ray stages of response to DXT of a primary sarcoma of bone—Ewing's sarcoma.

- A. Before deep X-ray therapy (DXT)—19.12.58.
- B. Before 2nd course of DXT—14.4.59 - 1.5.59.
- C. Before 3rd course of DXT—11.1.60 - 22.1.60.
- D. Before 4th course of DXT—20.6.60 - 12.7.60.
- E. Twelve months after the last course of DXT—12.7.61.

#### Deep X-ray Therapy

We decided to treat the patient with *deep X-ray therapy* over a long period of time—6 months to a year—giving repeated short courses amounting to a subradical dose every 3 months, rather than one radical dose in a one-course treatment as had been our custom up to that time. Deep X-ray therapy was prescribed using the following factors: 220 KV., 16 MA., 50 cm. focus-skin-distance, 1.0 mm. Cu and 1.0 mm. Al filtration and 2 opposing fields  $20 \times 10$  cm. A tumour dose of 2,000 rads in 20 treatments was obtained with a Siemen's Pendulum Orthovoltage Unit. The treatment was administered from 19 December 1958 to 19 January 1959 with some days off during the Christmas recess. There was imme-



diate relief from the pain. The improvement was so gratifying that it took much persuasion to get her to complete the course, in the New Year, consisting of another 10 treatments.

After the *first course* of deep X-ray therapy she was seen regularly in the outpatient clinic. On 20 March 1959 an X-ray examination of the arm showed considerable improvement, but she was again experiencing a dull nagging pain. We decided that it was time to give the second course of treatment (Fig. 12, B). It was decided to give the same course of treatment as on the first occasion, but to give a slightly higher dose of 2,250 rads in a shorter period of time, namely in 8 treatments in 2 weeks. The treatment was given from 14 April 1959 to 1 June 1959. Once again the pain disappeared after the first few treatments.

During the rest of the year she was seen in our follow-up clinic and X-rayed frequently. On 11 January 1960, 4 years after the lesion had first been diagnosed and one year after we had first commenced treatment, she once more complained of unbearable pain in the right humerus. X-ray examination showed suspicious activity (Fig. 12, C). On this occasion it was decided to use the same X-ray factors again, but once more to increase the dose. A tumour dose of 3,500 rads was given in 10 treatments. The treatment was given from 11 to 20 January 1960. Although the new telecobalt 'bomb' had

already been installed and in use for the past 3 months, we felt that we should continue with the deep X-ray therapy since the patient had previously responded so well to this form of treatment. Once again the pain was soon relieved by the treatment (Fig. 12, D).

During the next 6 months she was seen regularly in the follow-up clinic, and was doing very well. But on 18 June 1960 she complained again of a recurrence of the dull nagging pain that she had come to know so well. On this occasion it was not so severe as on previous occasions. She was now reaching the limit of toleration of radiotherapy that could be safely given. Nevertheless a *fourth course* of deep X-ray therapy was decided upon. A tumour dose of 2,000 rads was administered in 10 treatments through 2 opposing  $20 \times 10$  cm. fields. The treatment was given from 20 June to 12 July 1960. *Fortunately this proved to be the final course of deep X-ray therapy that cured the primary bone cancer of Ewing's sarcoma of bone* (Fig. 12, D and E).

#### Follow-up History

During the next year that the patient attended our follow-up clinics she felt perfectly well, except for the increasing limitation of the movements of the right elbow joint. This was due to fibrosis of the triceps and biceps muscles of the arm. Finally the joint became fixed in the right-angle position. The fibrosis was caused by all the deep X-ray therapy that was required to cure the cancer. The fixed elbow joint was the price she had to pay for a cure, but it was better than an amputation (Fig. 13).

On 3 May 1962 the patient informed us that she had got married in March 1962 and that she was now Mrs. N. She looked the picture of health and said that she had never felt better in her life. An X-ray examination of the chest and arm showed no evidence of metastases and no recurrent local activity in the humerus. During the next 2 years she was followed-up regularly. At no time was there any evidence of a recurrence of the disease or metastases in the lungs.

On 14 January 1964, now 6 years after the bone cancer was first diagnosed, she casually informed us that she was pregnant and that her doctor had told her she could expect her baby round about the end of August 1964. On 24 September 1964 she attended the clinic with her husband and a bonny little baby girl born on 29 August 1964, and now one month old. The mother was in excellent health. The little baby girl was normal in all respects. The father was as proud as could be. We all rejoiced in their happiness. X-ray investigations of the arm and chest showed no evidence of recurrence in the humerus or metastases in the lungs—now almost 7 years since the disease was first diagnosed, and 5 years after deep X-ray therapy was commenced.

#### CONCLUSION

In this article we have given a full account of the trials and tribulations endured and the final rejoicings of two young women who through faith, courage and endurance have enabled us to help them by means of modern methods of radiotherapy to master two deadly bone cancers.

We are much indebted to the two patients and their families for permission to publish their histories in such great detail and to use their photographs. Our thanks are due to Mr. Theo Marais, chief medical photographer, and Mrs. I. Wenk, photographer, for the excellent photographs. We also wish to thank the Institute of Pathology for the microphotographs.



Fig. 13. Mrs. N. with right arm fixed at 90-degree angle owing to fibrosis of muscles around the humerus after deep X-ray therapy (10.1.63).