of a month he was out of bed and walking about. The anaesthesia was slower in clearing up, but improvement also occurred with regard to this, and has continued slowly up to the present. The slowest improvement of all was that of control of the bladder and rectum. Catheterization was still necessary, and he developed a mild attack of cystitis, which was, however, quickly overcome by the usual remedies. About the end of the third week he experienced slight feeling when the catheter was passed, and appreciated the passage of flatus. It was not till April 24th that he managed to pass urine spontaneously, this being helped by the pressure of his hands on the lower abdomen. This he did every hour, and so managed to keep the bladder empty, but if he went longer than an hour involuntary dribbling occurred.

Pathology of Tumour.

The pathology of this tumour is very interesting, and is unique according to the literature on the subject to which we have had access.

Dr. Hugh Barber, pathologist to the hospital, who cut a section of the growth, reported that it was a fibrochondroma. Professor Dudgeon also cut and examined several sections for us, and he says:

"This is a very interesting specimen. It is largely a chondroma with areas of necrosis, and at the periphery some calcification. There is a fibrous covering in places, and the fibrous tissue runs

bladder will empty itself. He is just conscious of the flow of urine. There is practically no dribbling between these times, so that he has been able to discard the absorbent bag which he formerly had to wear. He has educated his lower bowel to act once in the twenty-four hours at a certain time, but he is almost insensitive to the passage of the motion. The sphincter has regained most of its tone.

The prognosis in this case is good. Since the growth is non-malignant there is no likelihood of recurrence, which, of course, is not the case with the sarcomata. In Warrington's¹ case, for instance, part of a sarcoma of the cauda equina was removed, with improvement of symptoms, but after three months recurrence took place, and the patient died. The same, though to a lesser degree, may happen to the endotheliomata.

Finally, although there has been pressure on the cauda

FIG. 3.

FIG. 4.

Microphotographs of a section of the tumour (Fig. 3, low power; Fig. 4, high power), showing large number of cartilage cells, with some calcification at the periphery, and strands of fibrous tissue which run into the tumour.

into the cartilaginous tumour. The fibrous tissue shows extensive old haemorrhage with tissue reaction, and marked phagocytosis of the blood pigment by the tissue cells. This would suggest that the tumour had become twisted. There are no other elements present. The cartilage cells are of the large type, such as we see in articular cartilage."

Having regard to the fact that at the operation we found that the tumour was attached only by such a narrow tail, we think Professor Dudgeon's surmise as to the twist is correct.

The nature of this tumour must be very rare. Steinhe,⁴ in his analysis of the pathology of 330 tumours of the spinal cord, reports 26 cases of fibroma, 6 of chondroma, 2 of chondrosarcoma, but none of fibrochondroma. The commonest tumours are sarcoma (112 cases) and endothelioma (28 cases). The 3 cases of caudal tumours of which Percy Sargent⁶ has given an account all proved to be sarcomatous.

The after-history of this case has been one of great though slow improvement. At the present time (February, 1925) his right leg is almost as strong as his left. He can walk several miles each day without undue fatigue, and is doing light work. He complains of no pain. The area of hypaesthesia is less, but it has been stationary for the last two or three months. The part involved now is over a small portion of the right buttock and perineum. Sensation in the urethra and anal canal is still impaired, especially in the latter. He can retain his urine for about three hours, then with an effort, helped by suprapubic pressure, the

equina for some considerable time in our case, we hope that we have interfered before degeneration has occurred, and that restoration of function may be complete.

REFERENCES.

- ¹ Warrington: *Lancet*, 1905, ii, p. 749. ² Spiller: *Amer. Journ. Med. Sci.*, 1908, vol. i, p. 365. ³ Morgan and Roberts: *Med. Journ. of Australia*, 1920, ii, p. 533. ⁴ Steinhe: *Journ. of Nerv. and Ment. Dis.*, June, 1918, p. 418. ⁵ *Collected Papers of the Mayo Clinic*, 1923, Ailson and Ott, p. 1052. ⁶ Sargent: *BRITISH MEDICAL JOURNAL*, 1920, i, p. 37.

IRRADIATION OF MILK AND THE HEALING OF RICKETS.

BY

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THE two processes of growth and bone calcification in young animals are intimately connected, as has been repeatedly stressed by E. Mellanby.¹ An adequate supply of fat-soluble vitamin in the food is essential if the animals are to grow normally and to have their bones normally calcified. But it has been shown recently that if a minimum amount of fat-soluble vitamin is present in the animals' food or tissues, exposure of the animals to ultra-violet rays will, up to a certain point, make good the deficiency of vitamin, thus promoting both good growth and good bone calcifica-

tion in animals fed on diets which would otherwise be inadequate for these purposes.

Observations on the effect of ultra-violet rays on children were published by Huldshinsky² in 1919. He was concerned with the calcification effect, and showed that active rickets could be healed by exposure of the children to the rays of a mercury vapour lamp. In 1922 Hume,³ mainly concerned with the growth-stimulating effect of the rays, showed that young rats fed on a diet deficient in fat-soluble vitamin would grow if they were exposed to ultra-violet light. This same observation was made independently by Goldblatt and Soames⁴ and published also in 1922. In 1923 Hume and Smith⁵ found that good growth in young rats could be obtained, in spite of deprivation of fat-soluble vitamin in the food, if they were kept in glass jars which were periodically exposed to ultra-violet rays. They found subsequently⁶ that this good growth, and with it good bone calcification, occurred only when sawdust was present in the jars while they were being irradiated, the "activated" sawdust having apparently a similar growth-promoting and bone-calcifying effect to that of fat-soluble vitamin. In the meantime Steenbock and Black⁷ had shown that if a rat's food ration, deficient in fat-soluble vitamin, were exposed to ultra-violet rays it became "activated" and produced as good growth and calcification of bone as if the animal itself had been irradiated.

In the light of these experiments it seemed important to determine whether any similar effects could be demon-

Breakfast: Bread 2 oz., margarine 1 oz., milk 6 oz., orange juice 1/2 oz.
Lunch: Milk 4 oz.
Dinner: Meat 2 oz., potatoes 3 oz., milk pudding 2 oz., orange juice 1/2 oz.
Tea: Bread 1 1/2 oz., margarine 1/2 oz., milk 4 oz., marmite 1 drachm.
Supper: Bread 1 oz., margarine 1 drachm, milk 6 oz.

FIG. 1.—Radiograms of wrist of a girl, aged 1 year and 9 months, taken (a) on admission, (b) after one month's dieting, the milk not being irradiated. Active rickets with poor calcification of the ends of the bones is revealed in both radiograms, only a slight improvement having taken place during the month. The child had only very slight deformity of the limbs, and was remarkably fit and lively during the whole period.

The three children thus received each one pint of milk in the twenty-four hours, and this was virtually the only source of antirachitic vitamin in their diet. As the test was carried out during the winter months the amount of vitamin was presumably not great. The milk destined for two of the children was exposed to the rays of a mercury vapour lamp of the Hanot type before it was given to them, while the third child received untreated milk. The irradiation was carried out twice a day by exposing the milk in a wide shallow dish for twenty minutes at a distance of 3 feet from the lamp. At the end of four weeks the children's wrists were again x-rayed. It will be seen from the illustrations that in the case of the child that received untreated milk there was during the month only a very slight increase in the amount of calcification at the lower ends of the radius and ulna, while in the case of the

two children that had received milk that had been exposed to ultra-violet rays dense calcification had taken place, much in excess of what one would expect to have occurred in this short time as the result of giving this particular diet.

This quite definite and remarkable "activating" effect of ultra-violet rays on foodstuffs is obviously well worth

FIG. 2.—Radiograms of a girl, aged 1 year and 5 months, taken (c) on admission, (d) after one month of the same diet as in the first case, except that the milk was irradiated. Dense calcification is seen to have occurred during the month's treatment.

strated in the case of children. Accordingly the following test was made of the efficacy of radiating children's food as regards the promotion of bone calcification. Three young children with active rickets, as determined by radiographic examination of their wrists, were admitted to hospital. They were given the following diet, which was not in itself calculated to promote particularly rapid calcification of their bones.

FIG. 3.—Radiograms of a girl, aged 2 1/2 years, taken (e) on admission, (f) after one month's dieting, irradiated milk being given. In this case also great increase in calcification occurred during the month.

following up, and opens up new possibilities in the treatment of infantile disorders.

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REFERENCES.

- ¹ *Lancet*, 1919, i, 407; Med. Res. Council, Special Report Series No. 6.
- ² *Deut. med. Woch.*, 1919, 45, 712. ³ *Lancet*, 1922, ii, 1318. ⁴ *Ibid.*, 1922, ii, 1321. ⁵ *Biochem. Journ.*, 1923, 17, 364. ⁶ *Ibid.*, 1924, 18, 133. ⁷ *Journ. Biol. Chem.*, 1924, 61, 405.