malignancy an endowment of the tumour cell itself, or is it a potentiality of the cell, only to be manifested in a certain environment? May it not be that the isolated cell does not contain the whole elusive secret of malignancy? These questions arise whatever view we take of the aetiology of the adamantinoma of tibia.

ITS FURTHER EXAMINATION

There is one other possible view of these tumours which should perhaps be referred to. Should we look on these rare tumours as arising certainly from trauma, but as a peculiar response to trauma in persons congenitally predisposed to such reactions? One thinks of individual and racial peculiarities of response seen in traumatic keloids or in the occasional response to trauma by production of lipomata. This would not alter the general view of the origin of the tumours in aberrant repair, but would account for that aberrance by a congenital and general peculiarity of tissue reactivity instead of by an acquired and local one. It seems unnecessary to assume such a view, although it is, of course, very difficult to exclude such intangible factors in aetiology.

If our theory be correct it raises interesting points about the relation of trauma and tumour, and suggests that some other cases of epithelioma following trauma may be explained similarly. The following case of post-traumatic epithelioma gives interesting confirmation of the views put forward.

A European male, aged 59, presented himself at hospital with an ulcerated area the size of a threepenny piece on the left side of the neck over the upper end of the sterno-mastoid, about an inch below and behind the angle of the mandible. The area was excised and the tissue showed the histological structure of rodent ulcer. His story was that in January, 1932, five months previously, he had cut his neck while shaving, and the cut failed to heal. At the site there developed a scab which frequently broke off, and the ulcer gradually increased in size. Prior to the cut there was, he says, no

sore there. Further study of serial sections of the tumour showed that it was growing in an environment of persisting tissue absorption and irregular repair. Sections showed a small sequestration dermoid as one manifestation of aberrant repair, areas of giant-cell absorption, of hair follicles and hairs, and also tumour growth indistinguishable in parts from regenerative growth of hair follicles. Figs. 5 to 15 illustrate these points and make description unnecessary. It is demonstrable that this tumour arose on a basis of aberrant regeneration of hair follicles, and the study of this tumour goes to support the view of aetiology and pathogenesis put forward for the adamantinoma. The picture is exceedingly like the adamantinoma, and had this tumour been growing in the tibia we should have been strongly tempted to call it adamantinoma.

This raises the question of whether or not the diagnosis of adamantinoma of tibia is justified. The gross characteristics of adamantinoma of the jaw appear in our tumour but not in Fischer's. Perhaps the limitation of the tumour to the bone is a feature justifying the diagnosis. In any case both tumours are best considered of basal-cell carcinoma of traumatic origin, having their basis not in congenital cell rests, but in the passage of a constantly frustrated reparative hyperplasia into neoplasia, in a special environment of tissue reaction. This view of the aetiology and pathogenesis of the adamantinomata of tibia is further satisfying in that the neoplasia is brought into relationship with other types of pathological growth in inflammation and repair. The most promising feature of the cancer problem to-day is the growing tendency to bring the pathology of tumour growth back into relationship with the rest of general pathology, from which it was too long isolated as something peculiar and apart in a distorting mist of theories.

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DISPLACEMENT OF THE UPPER FEMORAL EPIPHYSIS

REPORT ON TWENTY-THREE CASES

BY

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LIVERPOOL

(With Special Plate)

This paper is based upon the study of twenty-three cases of displacement of the upper femoral epiphysis. Of these, thirteen were under observation long enough to make it possible to consider the results obtained by treatment, while ten were recent. No cases were recorded in which the history and radiographs did not definitely establish the diagnosis. An instance of the difficulty of diagnosis is that of W. R. (Figs. 1 and 2 on Plate), in which the history and the second radiograph appear to be typical of "slipped epiphysis," but which the earlier radiograph proves to have been a fracture of the neck of the femur—a rare injury in adolescence. In persons over the age of 25 it is often impossible to distinguish radiographically between old cases of "slipped epiphysis" and old cases of Perthes's disease. Such cases were excluded.

Both from the history and from the radiographic appearances it was possible to differentiate two types of displacement. First, the type due to a single gross trauma, in which the condition is probably one of fracture through the juxta-epiphyseal line, though it is held by some¹ that the separation takes place through the actual epiphyseal cartilage. In this type there is definite, complete loss of continuity between diaphysis and epiphysis. The second type is that in which the deformity develops gradually, and there appears to be a bending of the neck

of the femur, somewhat similar to that seen in the softened long bones of the rachitic child.

These two types, though giving rise to identical end-results if not treated, are different in aetiology and pathological anatomy, and manifestly cannot be treated in the same way. In this series a number of different methods of treatment were observed, and the final results recorded.

DIAGNOSIS

The history in the traumatic type is of a definite injury, following which the patient has pain and stiffness in the hip. In spite of the considerable displacement which is present, as evidenced by the radiographs, these patients are not completely disabled, but can limp along, and the injured limb is able to bear a little weight. In the gradual-slip type the patient usually gives a history of pain and increasing stiffness in the hip for a period of about twelve months; the condition is almost invariably diagnosed at first as "rheumatism."

The physical signs in the two types are similar, but are more pronounced in the traumatic variety. There is limitation of abduction and internal rotation, resulting in severe cases in adduction and external rotation deformity; there is often limitation of hyperextension, and sometimes flexion deformity. There is from one-half to one inch of real, and a varying amount of apparent, shortening. In one case there was marked abduction and external rotation, with fullness in Scarpa's triangle; this led to a provisional diagnosis of anterior dislocation of the hip being made until a radiograph showed the true nature of the injury.

ANATOMICAL CONSIDERATIONS

Up to the age of 4 years the head, neck, and trochanters of the femur are represented by a common cartilaginous mass, but later on, the neck, growing up from the dia-

physis, separates the head from the two trochanters. The age when union between the epiphysis of the head and the diaphysis takes place is given by different authorities at various ages between the fifteenth and twentieth years. Probably the eighteenth year would represent the average age of union. Up to this time the juxta-epiphyseal line is the weakest portion of the bone. Compensation is, however, provided for this by two factors: (1) the plane of the epiphyseal plate is almost horizontal and therefore perpendicular to the line of force of the body weight passing through it; and (2) the periosteum is strong and consists of two layers—a deep, which is attached to the junction of epiphysis and diaphysis, and a superficial, which blends with the joint capsule.² It is said that this periosteum is relatively weaker during the age period 12 to 16 years than at any other time, owing to the rapid growth of the femoral neck during this period.

Blood Supply

The upper femoral epiphysis, like any other epiphysis, together with the joint in which it takes part, obtains its blood supply from the *circulus articuli vasculosus*.³ The vessels in the *ligamentum teres* appear to be of very little functional value after the first few years of life.⁴ The arteries of the diaphysis are end-arteries, and no vessels penetrate the epiphyseal cartilage, which is avascular⁵ and obtains its nourishment from the surrounding tissue fluids. Injuries of this area, however, rarely lead to any demonstrable necrosis, and the free anastomosis, supported by the tough periosteum, ensures that the epiphysis itself shall receive an adequate supply of blood, even when a considerable degree of displacement has occurred.

AETIOLOGY

The following data are based upon twenty-three cases.

Age.—In all the cases in this series the first symptoms were noted between the ages of 13 and 16 years, excepting in one case (E. B.), in which the first symptom apparently occurred at the age of 18.

Sex.—Sixteen patients were male and seven female. Of the cases in which the condition could be ascribed to a definite trauma six were in males and three in females. If it be accepted that males are more exposed to trauma than females during this age period, then this evidence suggests that trauma is a causal factor.

Rapidity of Growth.—Several writers are of the opinion that this is a factor in the weakening of the juxta-epiphyseal line. In the present series information on this point could be obtained in fifteen cases. Five patients were said to be growing quickly at the time the condition developed, while ten were not. None of the children were of the "overgrown lanky" type. Many children normally grow rapidly during this period, and this factor has no significance in my series.

Infection.—This has been considered to play a part in the weakening of the juxta-epiphyseal line that precedes slipping.⁶ In no case in the series was there at any time a rise of temperature, nor did any patient show any signs whatsoever of suppuration in or around the joint.

Trauma.—Fourteen patients gave no history of trauma, and in these cases the radiograph was of the gradual-slip type. In three instances the condition followed immediately upon a severe trauma. In two cases (T. B. and C. J. N.) two definite traumata were reported; the first was fairly severe, while the second (occurring in each patient fourteen days after the first), although trifling, led to such marked symptoms that hospital treatment was sought almost immediately. In a third case (B. G. F.) the displacement followed a very slight trauma, the patient having no recollection of any previous injury. A fourth case (S. S.) dated from a fall from a bicycle fifteen months before admission to hospital. Two other

patients (J. C. and D. K.) gave histories of moderate injury, but were subjects of pituitary dystrophy. The radiographs of the last nine cases mentioned showed that they were all of the traumatic type.

THEORETICAL CONSIDERATIONS

(a) The definitely traumatic cases present no difficulty. They are fractures through the juxta-epiphyseal line, the weakest part of the femoral neck in adolescence, and are aetiologically comparable with fractures of the neck in adults. Some authorities regard all cases as being ordinary fractures, but the definite differentiation of the two types appears to be against this view.

(b) In the gradual-slip cases the generally accepted view is that slight trauma leads to interference with the blood supply of the neck of the femur in the region of the epiphysis, either causing a local anaemia or, according to the views of Leriche and Policard, a local hyperaemia, which leads to rarefaction at the juxta-epiphyseal region. I have not been able to demonstrate any such changes in my series. It is then assumed that this rarefied area is unable to support the weight of the body, and gradually gives way under it. On this theory the two cases of "delayed slip" can be explained as fractures occurring through an area rarefied as a result of the alteration of the local blood supply caused by a previous trauma. But if it be admitted that trauma is the cause of this condition, it is obvious that other factors must play a part in the aetiology. Every adolescent sustains injuries to the hip, yet few develop "slipped epiphysis."

Evidence of bone softening was sought. In two patients it was found. One (R. R. P.) had renal rickets, and showed separation of other epiphyses. The patient has since died. In the second (E. B.) there was a generalized softening of bone, as evidenced by other deformities which appeared later—such as scoliosis. Two cases showed rickety deformities, but in each the condition had been inactive for several years.

The relation between the strength of the bone and the weight it has to bear is manifestly of importance. With the exception of the two instances just mentioned there was in no case in the series any evidence, either radiological or otherwise, of any weakness in the bone. It has been stated that in these patients widening¹ and fluffiness⁷ of the epiphyseal line can be detected radiographically. I could detect no such change in my series. In two cases only (J. C. and D. K.) was there any abnormal load upon the bone. Both patients suffered from pituitary dystrophy, and it is significant that in both the deformity was bilateral. On the other hand, Ferguson and Howarth,⁸ in a review of fifty-five cases, found that 65 per cent. of the patients were over-weight, and that half of them had endocrine imbalance.

PATHOLOGICAL ANATOMY

I had no opportunity of studying any actual bony specimens which could be proved to have been obtained from cases of this condition, and was therefore driven back upon radiographs for information regarding the pathological anatomy.

The neck of the femur is displaced upward and rotated outward relatively to the head, which is rotated backward. In the traumatic type this displacement occurs instantaneously, and there is complete dissolution of continuity of the bone, though there are strong reasons for believing that a part at least of the periosteum remains intact. In the gradual-slip type the same displacement takes place, but occurs gradually, and at no time is there complete dissolution of continuity of the bone. The weakened neck bends gradually under the strain of the body weight, which, once the displacement has commenced, no longer acts in a line perpendicular to the plane of the epiphyseal

TABLE OF END-RESULTS

Case	Age at Onset in Years	Sex	Type	Treatment	Time under Observation	Result		
						Functional	Clinical	X-Ray
J. W.	14	M.	Traumatic	Gentle manipulation. Retention 3 months. Protection 6 months	3½ years	Perfect	Perfect	Perfect
T. B.	13	F.	"	Forcible Manipulation. Retention 2 months. Protection to date	9 months	—	Moderate	—
B. G. F.	15	M.	"	Forcible manipulation. Retention 2 months. Protection 5 months	1½ years	Bad. Fibrous ankylosis	—	Good anatomical reposition
J. C.	13	M.	"	Forcible manipulation. Retention 4 months. Protection (right) 3 months	1 year	Right poor	Fair	Bad
F. H.	13	M.	Gradual-slip	T.T. osteotomy. Retention 3 months. Protection 9 months	2½ years	Left poor	Bad	Bad
G. R.	15	M.	"	See under	4½ years	Good	Fair	Moderate
H. S.	14	M.	"	Extension 5 weeks. Protection to date	1 year	Bad	Bad	Bad
T. W.	16	M.	"	T.T. osteotomy. Retention 3 months. Protection 6 months	2½ years	Promising	Promising	Good
E. L.	14	F.	"	Protection 18 months	4 years	Moderate	Moderate	Poor
M. H.	15	F.	"	T.T. osteotomy. Retention 2 months. Protection 1 month	1 year	Perfect	Good	Fair
L. D.	16	M.	"	T.T. osteotomy. Retention 2 months	1½ years	Good	—	—
V. C. G.	15	M.	"	Open reduction. Retention 10 weeks. Protection 3 months	1½ years	Good	Moderate	Anatomically good, but very marked arthritis
R. J.	15	M.	"	T.T. osteotomy. Retention 10 weeks	2 years	Fair	Poor	Moderate

The treatment of G. R. was as follows: T.T. osteotomy, ten months, after which weight-bearing was allowed. Fresh displacement then occurred at the epiphyseal line, and a second osteotomy was done, followed by three months' retention and eighteen months' protection from weight-bearing. The hip was still painful and there was definite arthritis; a Lorenz bifurcation osteotomy was then done.

N.B.—In the above table, "retention" means retention in a plaster spica, and "protection" means protection from weight-bearing—in all cases by means of a walking caliper.

plate, but exerts a shearing effect. The radiographic appearance of the neck has been described as though it had partially "melted." In the early stages the upper corner of the stump of the neck projects opposite the upper border of the acetabulum. In the later stages this projecting stump disappears, and the upper border of the neck becomes smooth and rounded. Microscopically, changes similar to those found in rickets have been described. The condition, however, is one of irregular proliferation of cartilage cells similar to, but less pronounced than, that seen in rickets, and is merely the normal response of epiphyseal cartilage to trauma. It has been experimentally produced in rabbits.⁸

TREATMENT

The ultimate object of treatment is to obtain a functionally perfect hip-joint. Two factors are largely responsible for impairment of function in these cases: limitation of movement and arthritis. Shortening occurs, but is slight, and can be disregarded from the point of view of function. Limitation of movement of the joint is compatible with a considerable degree of usefulness for a time, but in these cases it appears inevitable for a painful arthritis to develop later. Our aim in treatment, therefore, is to obtain a hip-joint with a full range of movement without damaging the articular cartilage in so doing. This last point is important, because there are cases in the series in which anatomical reposition has been obtained, but in which a resulting severe arthritis can only be ascribed to damage to the articular cartilage caused by the forcible manipulation necessary to obtain complete reduction at one sitting.

The methods of treatment in the traumatic type and the gradual-slip type must be considered separately.

Traumatic Type

These are simple fractures, and theoretically it would appear that a simple manipulation would be adequate. In practice, however, it is found that considerable force is required to effect at one sitting complete anatomical reposition, and such a degree of force leads to severe damage to the articular cartilage, with resultant residual stiffness of the joint (cases B. G. F. and T. B.). Of the six definitely traumatic cases (excluding the two with

pituitary disorder and one which could not be traced) three were recent, two were treated by forcible manipulation with one rather moderate result and one very bad one, and one patient (J. W., Figs. 3 and 4 on Plate) was treated by gentle manipulation, retention in plaster in full abduction for three months, and protection from weight-bearing for a further six months. Perfect anatomical reposition was not obtained by the manipulation, but the end-result was in every way excellent: in the radiograph (Fig. 4) taken three and a half years after the injury it is impossible to detect any abnormality. One of the cases of pituitary dystrophy (J. C.) was treated by forcible manipulation on both sides, with very unsatisfactory results. Jahss⁹ in 1931 reported three cases in which good results were obtained by manipulative treatment, but it is worthy of notice that his cases were in young children (aged between 8 and 12 years), and were each of the traumatic type.

Gradual-slip Type

Here the problem is different. In some cases the juxta-epiphyseal line has consolidated in a position of coxa vara; in others it is still weak. Arthritis may be present in varying degree. Nine of these cases have been under observation long enough to enable one to draw some conclusions. In five transtrochanteric osteotomy was done. In view of the varying conditions present in these patients it is not possible to draw any deductions from the results obtained, but it is significant that the best result of the five (F. H.) was in the case in which protection from weight-bearing was the longest continued. In one (G. R.) the evils of too short a period of protection from weight-bearing are demonstrated in a series of radiographs, in which fresh displacement can be seen after the patient began to walk again without support. One case was treated by open operation, and although after eighteen months the function is good, radiographs show that in spite of good anatomical reposition there is a considerable degree of arthritis, and the prognosis as to function is correspondingly bad. There would appear also to be some danger of causing necrosis of the head by open operation.¹⁰

One patient was treated by extension on a Jones abduction frame. Fair reposition was obtained, and the function is promising. I can find only one case which

was traced in this manner described in the literature,¹¹ and the result is reported to be excellent.

One case was treated purely by protection from weight-bearing for eighteen months. There was an excellent clinical and functional result (the best of this type), in spite of a definite coxa vara as shown by the radiograph.

CONCLUSIONS

1. That two types of "slipped epiphysis" can be distinguished, differing in aetiology, pathological anatomy, and treatment.

2. That trauma is an aetiological factor, but that in the "gradual-slip" type some other factor must be present.

3. That evidence of softening of bone, widening of the epiphyseal line, and increased load upon the bone was sought for and, while found in a few cases, was not present in the majority.

4. That some other factor, not yet demonstrated, must be present.

5. That the pathological anatomy of the condition preceding the actual slip is obscure.

6. That gentleness of manipulation and prolonged protection from weight-bearing are essential features in the treatment.

7. That prolonged extension on a frame appears to be the most suitable form of "manipulation" in the gradual-slip type.

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A CASE OF MALIGNANT THYMOMA

BY

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(With Special Plate)

The following case is of interest both from the clinical and from the pathological aspects.

The patient, a boy aged 2½ years, was admitted to the Victoria Infirmary, Glasgow, on February 4th, 1932, and died on the following day.

HISTORY

Five weeks before admission the child became rather listless, went off his food, and developed an irritating cough, which troubled him at night. Three weeks later it was noticed that he seemed to have a difficulty in breathing, and that he was crowing at night. He was seen by the local doctor, who sent him to Kilmarnock Fever Hospital with a provisional diagnosis of laryngeal diphtheria. Dr. Nesbitt, medical officer of health for Kilmarnock, took charge of the case in the Fever Hospital, and after appropriate treatment for diphtheria had been given

with no evident results, the question of a lung lesion was raised—either a pneumonic condition or one due to a foreign body in the left bronchus. At the time of admission to the infirmary no bronchoscopic examination had been carried out.

CLINICAL REPORT (DR. BELL)

The patient is a well-nourished, well-developed child. The face, mucous membranes, and finger-nails are cyanosed; there is well-marked circumoral pallor. Both external jugular veins are greatly distended, as are the veins in the backs of the hands and arms. The suprasternal fossa is full, presenting the appearance of a goitre. It feels firm. There is bulging of the left side of the chest, lack of expansion, and absence of visible cardiac impulse. Percussion gives absolute dullness: breath sounds over the right lung are harsh and puerile, and abundant rales are present. Over the left lung the breath sounds are tubular, having a nasal quality. The pulse is rapid, thready, and regular in rhythm. There is no area of cardiac dullness. The heart sounds, audible only well to the left in the anterior axillary line, appear to be pure. The mouth is dry, and sordes is present on the tongue and lips. The teeth are healthy. The abdomen is somewhat distended, and moves with respiration. The liver edge is palpable about 1½ fingerbreadths below the costal margin.

The renal system appears to be normal; the pupils are equal and react to light; the reflexes are normal. A chest radiograph shows an entire dulling of the left side of chest, with no indication of lung tissue. The dullness extends over to the right side, and encroaches upon the right lung.

The left side of the chest was explored, and about 10 oz. of milky fluid was removed, which showed on examination the presence of lymphocytes, but no evidence of organisms or the presence of fat. After exploration the child was very restless, cyanosed, and breathless; stridor was present, and his general condition became very grave. Oxygen was administered and injections of atropine and morphine, but without relief. The stridor became worse, and immediate tracheotomy was performed, but without beneficial result.

POST-MORTEM EXAMINATION

Necropsy, performed by Dr. Anderson on February 6th, revealed the following findings.

On opening the chest there was found a tumour mass measuring about 6 inches in length, 4 to 4½ inches in breadth, and 1½ inches in depth. It was situated in front of the pericardium, and spread outwards towards both pleural sacs. It was definitely a superior and anterior mediastinal growth occurring at the site of the thymus gland. It presented a globular appearance, was pale in colour, and of firm but not dense consistence. There was no evidence of the presence of haemorrhages. The right pleural cavity was normal. The hilum of the right lung showed the presence of several enlarged glands. The bronchus and pulmonary artery were normal. On section the right lung was congested, but otherwise normal. The left pleural cavity contained some turbid but non-purulent fluid. Adhesions to the upper lobe were present. The hilum of the lung presented several enlarged glands; the bronchus and pulmonary artery were normal. The upper lobe of the lung showed the presence of adhesions, and was in a state of collapse. The lower lobe was congested, and showed several small areas of localized collapse. On the surface of the lung were a few petechial haemorrhages.

The heart and pericardium were covered over by the tumour mass; chambers, valves, and muscular consistence were normal.

Apart from the main mass, areas of tumour growth were present in the pleuro-pericardial region, and some of the posterior mediastinal glands were involved. There was also a spread along the lymphatics in the intercostal spaces; on the left side the spread reached the anterior axillary border, while on the right side nodules were present in the intercostal spaces close to the vertebral column. The spleen was slightly enlarged and on section showed an increase of lymphoid tissue, with the Malpighian bodies unduly prominent. The liver was slightly enlarged, and on section showed a cloudy appearance. The pancreas was normal, but a few enlarged glands were present at the head. The suprarenals, stomach, and intestines

V. J. MORCOM TAYLOR: DISPLACEMENT OF THE UPPER FEMORAL EPIPHYSIS

FIG. 1.—W. R.: Radiograph taken on January 6th, 1925.

FIG. 2.—W. R.: Radiograph taken on November 16th, 1929.

FIG. 3.—J. W.: Radiograph taken on September 19th, 1927.

FIG. 4.—J. W.: Radiograph taken on March 5th, 1931.

MARGARET LESLIE AND WILLIAM S. BELL: MALIGNANT THYMOMA

FIG. 1.—Tumour growth overlying and surrounding pericardium opened up to show its relationship to heart.

FIG. 2.—Medial section of one kidney showing pale and swollen character of cortex due to infiltration with tumour cells.

FIG. 3.—Radiograph of chest.

FIG. 4.—Photomicrograph of tumour growth overlying pericardium, showing the character of cells.