Alexander Watson Sanderson.

Six orthopaedic cases.

Sir Robert Jones Prize

in Orthopaedic Surgery.

July 1925.

Sect.

burgh.

Disease Paralysis of Quadraceps Extensor Femoris Muscle. (Right.)

Admitted 5 : II : 1925. Discharged 5 : III : 1925.

Treatment Transplantation of Biceps Femoris into Quadraceps Femoris (Right.)

CLINICAL CLERK.

~~Case Drawer~~

Remarks Orthopaedic Case No. I.

Th. Sect.

R. I. E.

Professor Sir HAROLD STILES.

Name Susannah Anderson.

Recommended by Dr. Findlay, Edinburgh.

Disease Paralysis of Quadraceps Extensor Femoris Muscle. (Right.)

Admitted 5 : II : 1925. Discharged 5 : III : 1925.

Treatment Transplantation of Biceps Femoris into Quadraceps Femoris (Right.)

Clinical Clerk.
~~Case Drawer~~

Remarks. Orthopaedic Case No. I.

THE ROYAL INFIRMARY OF EDINBURGH.

1.

Susannah Anderson,
24, Patrick Hall,
Edinburgh.

Single. Aet. 20 years.

Recommended by Dr. Findlay.
Admitted to Ward 8, R.I.E. :- 5 : 2 : 25.
Discharged - - - - - - - :- 5 : 3 : 25.

Complaint:- (a.) Weakness of muscles of right thigh.
(b.) Inability to extend the right knee fully.

Duration :- 19 years.

History:-

At the age of six months, this patient, while teething, took infantile paralysis. She went about this time to the Royal Hospital for Sick Children owing to paralytic symptoms in

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the right foot & leg but the Surgeon (Mr. Stiles) advised that no operation should be done at that time. Since early childhood she has had difficulty in walking and there has been deformity of the right lower extremity which becomes very easily tired. On 7th. May, 1924, she was admitted to ward 8, R.I.E. where her condition was investigated and it was found that she had a pes planus together with a prominent pes equinus & some degree of pes valgus all on the right foot. There was atrophy of muscles on the rt leg & thigh. On 16/5/24, she was operated on by Sir Harold Stiles who reduced the equinus condition by subcutaneous tenotomy of the tendo Achilles & corrected the pes planus by transplantation of the tendon of the peroneus longus into the base of the 1st metatarsal. The foot after operation being put up

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in plaster in a position of extreme inversion coupled with flexion of the foot to a right angle. On 31st/5/24, she was discharged with the stitches removed, the wounds soundly healed, & a light plaster casing applied. On 16/12/24, she reported when it was seen that the results of the previous operation were very satisfactory, but there was considerable weakness of the Quadriceps muscle on the right side and shortening of the hamstrings on the rt. side thus preventing full extension at the knee. In order to overcome the shortening of the hamstrings, suitable wedge plasters were applied, and for the weak quadriceps muscle, transplantation of tendon was advocated.

On 5th/2/25, patient was readmitted in order to have this tendon transplantation done

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4.

Previous Health:-

Anterior Poliomyelitis aet. 6 months.
Whooping Cough,
Measles
Diphtheria } in Childhood.

Following the anterior poliomyelitis there is a long history of difficulty in walking, leading up to the present complaint.

No other illness or accident.

Family History:-

Mother & father alive & well.
No similar complaint in the family.

Social History:-

Satisfactory.

Physical Examination:-

Patient is of a bright disposition & is mentally alert but tends to be nervous & apprehensive. She is pallid in complexion & rather small

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in stature. Apart from the right lower extremity, here development is quite satisfactory though her muscularity is poor. There is visible atrophy of muscle in the right lower extremity.

Local Examination:-

Right lower extremity:-

There is marked atrophy & weakness of the quadraceps muscle & also of the tibialis posterior, the flexor hallucis longus & of the flexor digitorum longus. The sartorius, the peronei, the extensor digitorum longus, the tibialis anterior, & the gastrocnemius are poorly developed. The biceps, the semimembranosis & the semitendinosis are acting powerfully. There is a slight degree of genu valgum & the knee is maintained in a permanent attitude of slight flexion. There is still some slight degree of pes planus deformity and the foot tends to eversion

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but this can easily be overcome passively. The knee cannot be extended fully either by active movement or by passive manipulation and on attempting to do so, the tendons of the hamstring muscles are felt to be very taut. Flexion at the knee is quite satisfactory, the biceps, semitendinosis, & semimembranosis all acting well but extension at the knee is most unsatisfactory, the quadriceps femoris being very weak indeed.

Circulatory System:-

The heart is not enlarged & the heart sounds are pure in all areas. There are no subjective circulatory phenomena.

Respiratory System:-

There is no cough, pain, breathlessness or haemoptysis. The breathing is thoraco abdominal in type, is easy, & is regular in rhythm. The chest is

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7.

Symmetrical, there is no abnormal fullness, and on auscultation the breath sounds are heard to be normal vesicular over both lungs. There are no morbid accompaniments.

Urinary System:-

There are no abnormal constituents in the urine.

Treatment

(a.) Preoperative:-

Four days before operation, the patient was admitted to Ward 8 for examination & preparation. During this time she was kept on a light nourishing diet. After dinner on the day before operation, castor oil was given & in the evening a soap & water enema was administered. On the evening before operation, the whole of the right lower extremity was thoroughly

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cleansed with methylated spirits & then treated with 2½% tincture of iodine before being covered by a sterile square.

Sodium bicarbonate gr. $\overline{xxx}$ t. i. d. was given on the day before operation & on the morning of operation. ¾ hour before operation, a hypodermic injection of atropine sulphate gr. 1/100 = $m\overline{v}$ was given.

(b.) Operation :—

9th. February, 1925. Prof. Sir Harold J. Stiles. ($CHCl_3$ & $\frac{C_2H_5}{C_2H_5}>O$)

The patient was placed on the operating table in the prone position, the right shoulder, right side of pelvis & right knee being supported & elevated by means of sandbags. The leg was rotated medially & held in a position with the knee flexed. An incision about 12" long was made over the

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line of the biceps femoris muscle, the incision commencing about 3" below the ischial tuberosity & passing downwards & laterally along the biceps tendon to its main insertion into the head of the fibula. The incision was deepened through subcutaneous fascia until the muscle itself was reached, the superficial vessels being secured. The lateral border of the muscle was defined near its distal part & the separation between it & the ilio tibial band recognised. The medial border of the muscle was then defined & mobilised from below upwards separating it from the semitendinosis as the interval between these two muscles was seen. Great care was taken to preserve the nerve supply intact to the long head from the lateral aspect of the sciatic nerve. The separation was carried out as high up as the lower border of the gluteus

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maximus. The origin of the short head of the biceps from the lateral lip of the linea aspera & from the lateral inter-muscular septum was then dissected off by snipping it away with Scissors, the nerve supply from the comm peroneal being carefully preserved & all bleeding points being secured & ligated. The fibular collateral ligament was now cut, as the tendon of insertion splits to encircle it, & the ultimate insertion dissected out, the periosteum over the head of the fibula being chiselled off as the whole insertion of the tendon was mobilised.

The patient was now turned over into the supine position & the leg extended at the knee. An vertical incision was then made in the middle line over the lower part of the thigh, extending upwards for 6" from

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the upper border of the patella. The incision was deepened through subcutaneous tissue and a tunnel made laterally towards the first dorsal incision so that the biceps tendon might be drawn, not underneath the deep fascia, but underneath the subcutaneous tissues. The biceps tendon was now securely stitched to the insertion of the quadriceps the periosteum carrying the insertion of the biceps being stitched to the periosteum over the upper border of the patella and a good grip being taken of the capsule, interrupted iodine tannic sutures being used throughout. The wound over the original line of the biceps muscle was then closed by interrupted stitches of silk worm gut and the anterior wound sutured in similar fashion, haemostasis having first been effected in each case. A gauze roller bandage

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was then applied & the limb set up in extension in a Thomas's Knee splint.

["Transplantation of biceps femoris into tendon of Quadraceps Extensor. (Right.)"]

(c.) Post operative:-

As she was coming out of the anaesthetic, a hypodermic injection of Heroin gr. 1/12 was given & repeated twice. A dose of castor oil was given on the evening of the day after operation.

A fortnight after the operation, the Thomas's knee splint was replaced by a long plaster casing after the manner of a Lorenz spica and extending from the waist to the heads of the metatarsals.

Six weeks after she was discharged, she returned to hospital to report, and the plaster spica was removed. The stitches

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were now also removed when it was seen that both wounds were soundly healed. She was advised to have massage and to carry out graduated active and passive movements. When last seen (30th : V : 1925) she was found to have good movement and power in the limb and was able to walk satisfactorily with the aid of a stick. The transplanted biceps is acting well in lieu of the Quadriceps extensor, and she will soon be able to resume her occupation.

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14.

Commentary.

Anterior Poliomyelitis is an acute infectious disease, due to the Heine-Medin organism, the main incidence of which falls upon the central nervous system and especially upon the spinal cord where it produces a specific perivascular infiltration around the anterior spinal arteries which supply the anterior horns. The spinal meninges also become hyperaemic and this gives rise to pain in the limbs during the first few weeks. Owing to the attack on the anterior horns, a large number of muscles are paralysed initially. The virus, however, has no specific action on nerve cells for these suffer irregularly and the process is really a general one,

but the great vascularity of the grey matter as compared with the white, and especially that of the ventral horns, determines the fact that this region is generally affected most.

Within a week or two, most of the paralysis usually clears up, and this clinical finding is due, presumably, to the fact that the cells governing these recovered muscles have merely been the subject of a temporary, functional disturbance. In other spinal segments, the ventral horn cells undergo a partial degeneration with chromatolysis & displacement of their nuclei and these areas are represented clinically by those muscles which undergo atrophy, but which recover either completely or in part. In some regions, the ventral cornual cells disappear rapidly, and these areas have their

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clinical counterpart in the residuum, generally asymmetrical, and often unilateral, of paralysed muscles which undergo rapid, complete, and permanent atrophy. The lower limb is more frequently affected than the upper. While the ideal in these cases of anterior poliomyelitis would be to prevent deformity and to preserve function, it is unfortunate that in many cases the orthopaedic surgeon is only called in at a stage when the treatment must be limited to correction of deformity and to restoration of function. The degree of deformity produced is aggravated by such factors as force of gravity, posture, functional use, and unopposed action of the muscles which remain active.

In this case under discussion, the quadriceps extensor muscle is paralysed

So that the patient is unable to extend the leg upon the thigh. Such a paralysis gives rise to a peculiar gait in which the leg is swung forward and then locked at the joint by direct contact of the bones and resistance of the hamstring muscles, the body being inclined forward and thigh supported by the hand. This method of progression is insecure, however, and the patient often takes recourse to some such appliance as a Judson brace or even a Thomas's caliper knee splint. Such measures are only palliative and the best chance of cure is offered by tendon transplantation — in which an endeavour is made to restore muscular balance by weakening the hamstring muscles which are tending to produce flexion deformity and by using these to replace or reinforce the paralysed extensor. In the technique of tendon

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transplantation, Jones lays stress on the following points:-

1. The selected muscle must be capable of strong voluntary contraction.
2. The new line of the muscle must be as direct as possible and it should pass along in fatty or subcutaneous tissue. Twisting and kinking should be avoided.
3. Implantation into bone or into the capsule of the joint is an aid to success
4. Adhesions between the muscle or tendon and the adjacent tissue should be avoided and the skin incisions should also be planned with this point in view.
5. Early strain on the transplant should be avoided
6. Operation before the age of five years is undesirable.

In this particular case under discussion, it seems likely that the transplantation of the biceps

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will be sufficient, but if not, then it would probably be advisable to reinforce the biceps by some other muscle, and the sartorius would probably be the best selection since it is normally in action in the attempt to extend the knee in walking, and by transplantation into the quadriceps extensor tendon would become even more effective in this action.

With regard to the after-treatment, while a certain amount of massage & passive movement may be useful, reeducation by active movement is the treatment par excellence. In the operative procedure of tendon transplantation, it is absolutely essential that the most perfect aseptic technique should be employed.

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20.

Susannah Anderson.

To show atrophy of the muscles of the right leg, and also pes planus & equinus. (right)

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21.

Susannah Anderson.

To show Pes planus & equinus as well as some degree of Pes valgus. (right.) The extensive atrophy of the quadraceps extensor femoris is well illustrated.

Th. Scot.

R. I. E.

Professor Sir HAROLD STILES.

Name Andrew Lawson.

Recommended by Dr. Wishart, Kirkcaldy.

Disease Shortening of Quadraceps Muscle. (Right.)

Admitted 28: I: 1925. Discharged 28: 2: 1925.

Treatment Lengthening of Quadraceps Extensor Tendon. (Right.)

Clinical Clerk.
~~Case Drawer~~ Alex W. Sanderson.

Remarks Orthopaedic Case No. 2.

THE ROYAL INFIRMARY OF EDINBURGH.

1.

Andrew Lawson,
Mount Farm,
Cupar,
Fife. Aet. 23 years.

Occupation :- "Motor Driver" (Chauffeur.)
Recommended by Dr. Wishart, Kirkcaldy.
Admitted to Ward 7, R.I.E. :- 28 : 1 : '25.
Discharged - - - - - - - - - :- 28 : 2 : '25.

Complaint :- (a) "Stiffness of right thigh"
(b) "Inability to flex right knee."
Duration :- 2 years.

History :-

In August 1922, Patient was driving a motor lorry when the flywheel broke & several of the fragments struck him on the right leg, the force being sufficient to throw him out of the

THE ROYAL INFIRMARY OF EDINBURGH.

car, the door of which he wrenched off en route. He was removed to Kirkcaldy Hospital where he was found to have sustained (α) a compound comminuted fracture of both bones of the right leg, (β) a fracture of the lower end of the right femur, (δ) a dislocation of the left wrist, as well as (δ) several minor skin lesions.

He was kept on a simple (Jones's) posterior splint for about 2 months during which time the leg injury had been septic. He was then put up in a Thomas's knee splint with weight extension. He remained in this position until 14th April, 1923, when he was transferred to Ward 7, R.I.E.

On admission on 14/4/23, it was found that the leg had been discharging, with periods of quiescence, for the previous month & that many sequestra had separated, but that the condition had now

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begun to settle down. The fracture of the right femur had united with overriding of the fragments at the site of the fracture, and for this deformity, Sir Harold Stiles on 9th May, 1923, performed an open operation with sawing of the bone ends & fixation in correct alignment. After this operation, he remained for 2 months in R.I.E., the limb being set up in a Thomas's knee splint fitted with a moveable knee flexion piece, extension being applied by weight & pulley through Pearson's resting calipers applied to the lower end of the femur.

On 16/7/23, he was discharged to Kincaldy hospital for convalescence. On 3/10/23 he was readmitted to ward 7, R.I.E. for 12 days in order that his progress might be studied. It was seen that there was satisfactory union of the femur & that union of the fracture of tibia & fibula

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had also taken place. He was fitted with a walking caliper splint with which he was walking easily before discharge on 15/5/23.

On 16/12/24, he reported again when it was observed that the union of the fracture of the femur & of both bones of the leg was satisfactory, but that he walked with a limp due partly to shortening to the extent of 1¾" on the affected side. To compensate for this shortening, he was advised to wear a low heel on the sound side & to have the sole of the boot on the affected side raised. His limp was also partly due to stiffness of the right knee joint, & to permit of a more complete flexion at the right knee joint, he was advised that it would be necessary to lengthen the quadriceps tendon. His name was accordingly placed on the waiting list &

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he was readmitted on 28/1/25.

After his discharge on 15/10/23, the patient walked about on his Thomas's walking caliper splint but found that there was stiffness in the region of the right knee & right ankle, the heel tending to be drawn up, and 8 weeks before admission on 28/1/25 he was operated on in Kirkcaldy Hospital by Mr. Jardine who lengthened the tendo achilles. The equinus condition was thereby improved.

Social History:-

He has a good home and satisfactory working conditions. He is a moderate smoker & a total abstainer.

Family History:-

There is no history of disease in the family.

Previous Health:-

He has previously enjoyed

very good general health. He has had diphtheria, influenza, & bronchitis.

Wassermann Reaction:-

Negative.

Physical Examination

The patient is healthy & robust. He is well developed & is of a bright disposition. He walks with a slight limp using a stick.

Right Leg:-

Inspection:-

numerous scars are present over the right lower limb. There are 2 operation scars — one in the lower part of the tendo Achilles & one along the lateral aspect of the thigh. Other scars are present over the front & sides of the leg in its middle third, over the medial aspect of the knee, & over the

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Lateral aspect of the patella. There is also a scar on the right side of the lower part of the sacrum.

Palpation:-

There is marked thickening of the bones in the region of the fractures in Femur, Tibia, & Fibula. There is sound union. There is no pain or tenderness at the site of the fractures. The knee joint cannot be flexed beyond an angle of 120° & at that point the quadriceps muscle is very taut.

There is some degree of equinus deformity still present in the foot and at the ankle there is slight restriction of movement especially in the direction of dorsiflexion. There is considerable creaking of all the joints on passive movement.

Left Leg:-

2 scars are present on the

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medial aspect of the knee. No other abnormality present.

Measurements:-

Right femur shows shortening of 3/4", measuring from anterior superior spine to adductor tubercle on each side.

Measuring from the adductor tubercle to the medial malleolus on each side, there is evidence of a further shortening of 3/4" on the right side.

Total shortening (rt. side) = 1½".

Left Wrist:-

There is backward projection of the lower end of the ulna but no restriction of movements.

Treatment:

(a) Preoperative.

Six days before operation

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the patient was admitted to Ward 7, for investigation & preparation. During this time he was kept on light nourishing diet. After dinner on the day before operation, Castor oil was administered & in the evening, a soap & water enema was given. On the evening before operation, the whole right lower extremity was shaved & thoroughly treated with methylated spirit & iodine (2½% tincture), after which the area was covered with a sterile square.

Sodium bicarbonate gr. xxx was given t.i.d. on the day before operation & on the morning of operation. 3/4 hour before operation, a hypodermic injection of atropine sulphate gr. 1/100 = mⁿ was given.

(6.) Operative :—

4th. February, 1925. Prof. Sir Harold Stiles. (CHCl₃ & Ether.)

The patient was placed on the

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operating table in the supine position, with the knee at the end of the table & the foot supported by a foot-rest. The movements of the knee were tested when it was found that forced flexion was only possible to an angle of about 140°.

The leg was then extended and a vertical incision was made, passing upwards from the middle of the patella to the junction of the middle & lower thirds of the femur in mid line of the anterior aspect. This incision was deepened through skin, subcutaneous tissue & deep fascia. The skin & fascia were undermined & the flaps retracted on both sides so as to expose the vasti, the attachment of the rectus femoris, the supra-patella pouch on each side of it, and the upper part of the capsule of the knee joint. All bleeding points were secured & ligated. A linear incision was then made on

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each side of the tendinous section of the quadraceps muscle, extending for about 2" from the attachment of the rectus femoris to the patella, leaving the normal strong attachment to the patella intact. These parallel incisions included also the tendinous section of the vastus intermedius. These incisions, dividing the tendinous portion of the vasti from the muscular fibres were, joined at the upper end by a short transverse incision & the isolated tendon dissected free from the underlying structures. The knee was then carefully flexed when it was found that the limitation was not wholly due to muscle contraction. On flexing the knee more strongly, an adhesion at the lateral part of the capsule gave way, & at the same time the lateral part of the capsule tore exposing the articular surface of the lateral condyle of the femur.

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The knee could now be flexed freely. With flexion to an angle of 80°, the tendon was secured in its new position by a mattress suture of strong iodine tannic catgut passing through the vasti on each side as well as through the tendon. The vastus lateralis was then sutured to the tendon & at the same time utilised to cover over the tear in the capsule. The vastus medialis was similarly united to the tendon, iodine tannic catgut being used in both instances. The vastus lateralis & vastus medialis were sutured together, with iodine tannic catgut, above the tendon in order to obliterate the space left by the slipping downwards of the tendon. All the bleeding points having been secured, the skin edges were approximated with interrupted silk worm gut sutures.

The knee was maintained in a

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position of flexion to an angle of 80° & the limb set up in plaster, from the waist to the ankle, the hip being in flexion.

[Lengthening of Quadriceps Extensor Tendon (Right)]

(c.) Post-operative :-

This patient was returned to bed lying on his left side, and the right lower extremity was slung up from a Balkan frame. On coming out of the anaesthetic, he was given a hypodermic injection of Heroin Gr. 1/12, and this was repeated twice. An aperient dose was given on the 2nd evening.

At the end of three weeks' time, the plaster casing was removed and replaced by a lighter plaster casing still extending from the waist to the ankle but with the knee in flexion and the

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hip in extension, so that the patient was now able to walk with the aid of crutches. He was discharged in this condition and returned a month later when the plaster casing was removed. The stitches were now removed and the wound was seen to be thoroughly and soundly healed. He was readmitted to the ward and massage was commenced on the limb. He was also instructed to carry out active & passive movements in order to obtain extension at the knee. Within a fortnight, he was able to obtain a range of movement at the knee from a right angle to almost complete extension (See clinical photographs.). There still remained some weakness of the quadraceps extensor muscle but this was disappearing rapidly as confidence was regained in the use of the limb.

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15.

Commentary.

"This case calls attention to the part which the quadriceps tendon may play in loss of mobility at the knee joint. Such loss of mobility at the knee joint may follow lesions of the femur such as simple or compound fractures, osteomyelitis, etc., or fractures of bones of the lower limb requiring long immobilisation. Such loss of mobility at the knee joint may be present, in spite of the fact that the lesion has been entirely extra capsular. In this case in a certain propotion of similar cases, the disability is due to contracture, or adhesions in the muscle substance. Although the three vasti muscles are to some extent independent of each other, yet their relationship in the lower third of the femur is a very close one and

their tendons are inseparable. The vastus intermedius which lies deepest, being on the anterior surface of the shaft of the femur, is easily tied down by adhesions, thereby rendering inert the function of the other three muscles forming the quadraceps.
Changes in the capsule are probably of very secondary importance even though they be present and the operation for correction of the disability should be an open dissection for lengthening of the quadraceps tendon as was done in this case. Stretching of the taut structures under an anaesthetic merely results in blind tearing of the tissue with consequent extravasation of blood which give rise to further adhesions so that the resultant condition is worse than the original. A satisfactory parallel in treatment may be drawn in the

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17

Operation of lengthening of the tendo Achilles for correction of equinus deformity at the ankle.

In the post operative treatment, there need be no fear of encasing the wound for several weeks in Plaster of Paris, provided that the operation has been carried out with proper aseptic technique Passive movements & massage are advocated within a few weeks of operation but this is surely one of the many suitable types of cases for active movement, short of causing pain.

A likely post operative finding is some degree of ecchymosis on the anterior aspect of the thigh, but no skin necrosis is likely to occur.

The return to power of the leg may take as long as one year, the last 15° of extension being slow to be recovered.

In this case, certain findings may be summarised:—

1. Contraction of the quadraceps, with or without adhesions, will produce a loss of mobility at the knee.
2. Contraction of and adhesion between the muscles themselves or between muscle & bone, will produce loss of flexion at the knee.
3. Capsular changes are of secondary importance and knee joint which cannot be flexed before release of the tendon can be easily flexed after the release.
4. It is not advisable to operate in the presence of an inflamed joint.
5. Time is probably an important factor and it is probably better to operate on a patient who has walked for several years with say 30 degrees of movement, than on a patient

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who has walked for several months only with say 30 degrees of flexion. In the former case, all the tissues are in good tone: they therefore lend themselves better to operation & they return to function much more rapidly.

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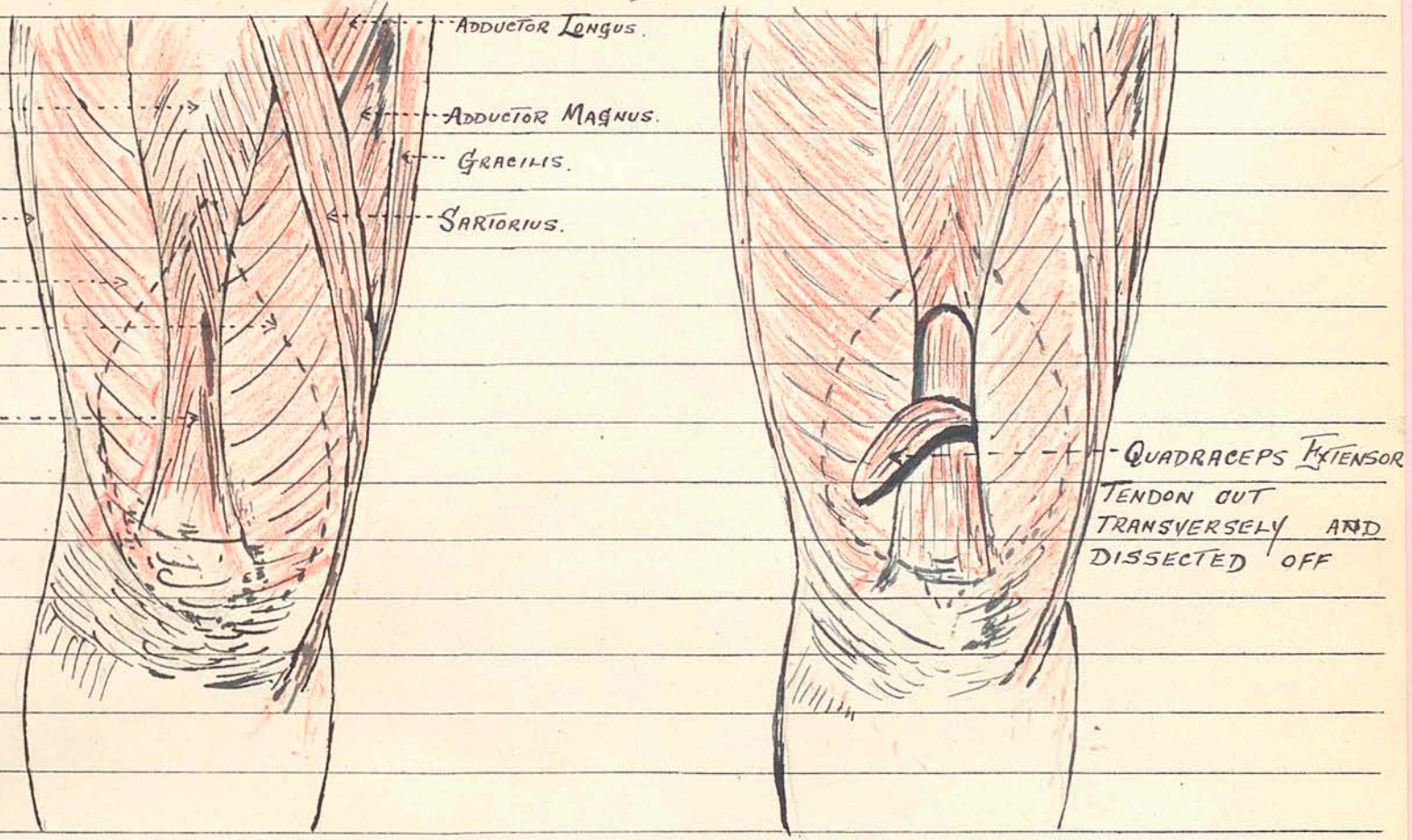
20.



Stage I. Stage II.

In Extension.

Schema of Operation Depicted in 4 Stages.

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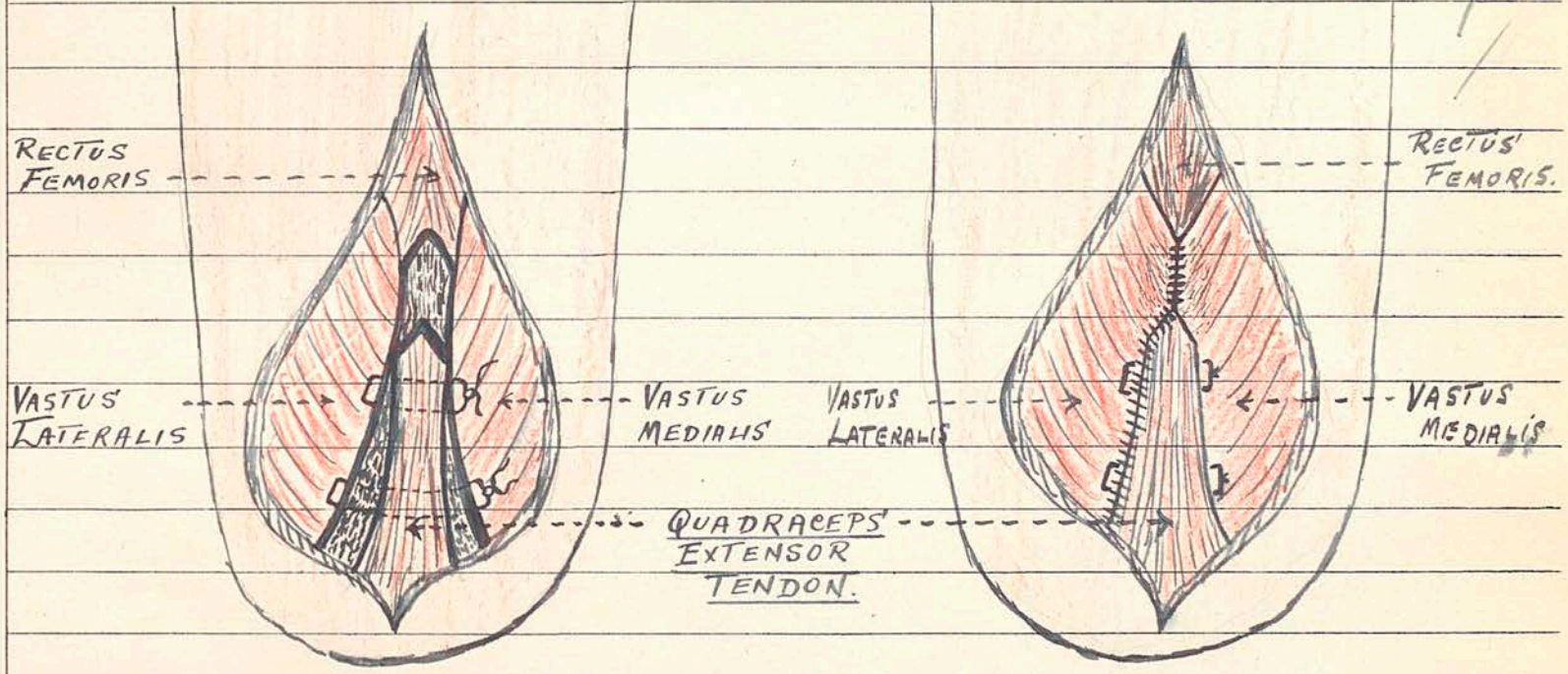
Pl.



Stage III.

Stage IV.

In Flexion.

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C.T.—2.

22. Andrew Lawson.

Showing original condition before operation.
Pes equinus present.
Knee flexion limited.
Scars of accident & of previous operation are seen.

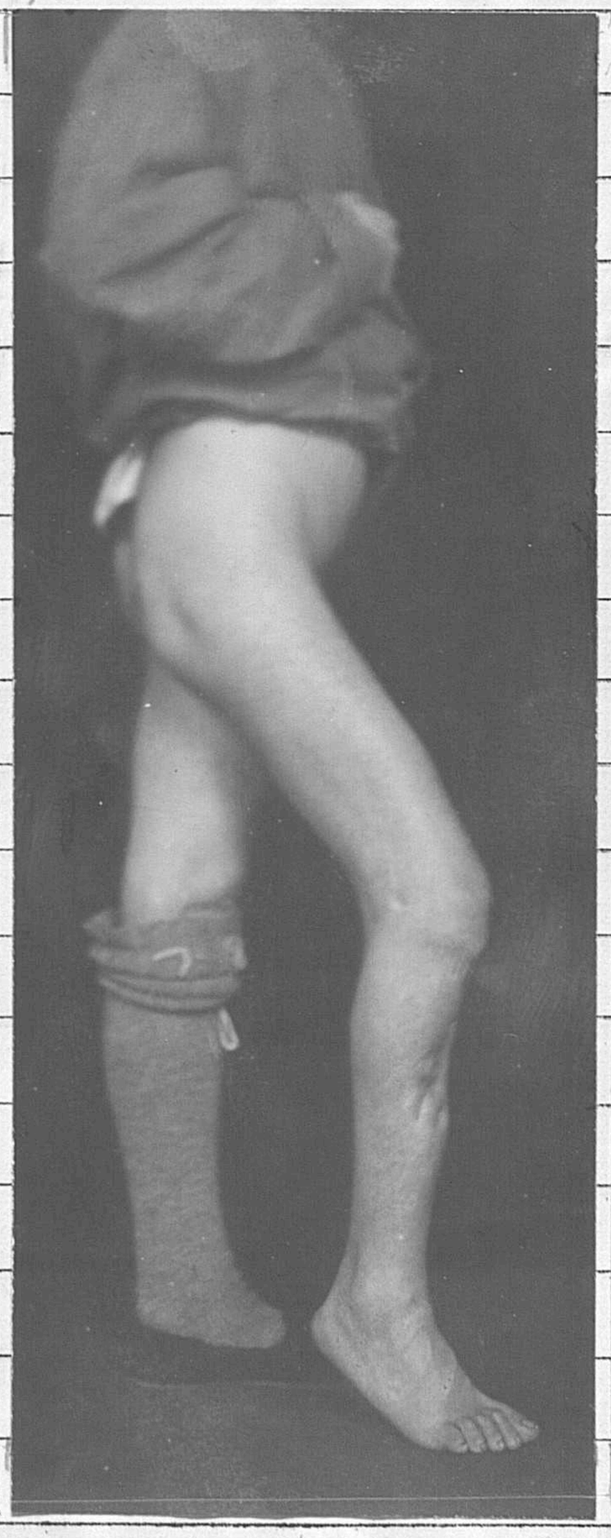
C.T.—2

THE ROYAL INFIRMARY OF EDINBURGH.

23.

Andrew Lawson.

Showing range of movement at the knee, two months after operation.



S.O.—50M.—C.—8.24

Th. Scot.

R. I. E.

Professor Sir HAROLD STILES.

Name Alexander Herriot

Recommended by Dr. Mc. Lean, Bucklaven.

Disease Pes Carus et Valgus.

Admitted 20 : I : 1925. Discharged 7 : II : 1925.

Treatment Subcutaneous Fasciotomy & Transplantation of Extensor Hallucis Tendon into Head of 1st Metatarsal.

CLINICAL CLERK.
~~Case Drawer~~ Alex. W. Sanderson.

Remarks Orthopaedic Case No. 3.

THE ROYAL INFIRMARY OF EDINBURGH.

7.

Alexander Herriot,
17, Victoria Road,
Buckhaven.

Single. Aet. 21 years.

Occupation :- Miner.
Recommended by Dr. M^c.Lean, Buckhaven.
Admitted to Ward 7, R.I.E. :- 20 : 1 : '25.
Discharged - - - - - - - :- 7 : 2 : '25

Complaint :- (a.) "Pain in the left foot" -
- in the region of the 1st meta-tarsal.
(b.) "Deformity of the left foot."

Duration :- 20 years.

History :-

During early infancy & before he began to walk, patient had an acute illness of comparatively short duration which left him paralysed in the left lower extremity. There is no history of paralysis elsewhere in

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the body. When about 1 year old, he was taken to The Royal Hospital for Sick Children, where five operations were performed on the left leg & foot. As patient began to walk, a special boot was provided fitted with a steel support for the inner aspect of the leg. Apparently, this apparatus was not entirely satisfactory, or at least, it did not meet with his approval, for it was soon discarded, a slipper being worn instead as this gave greater ease and comfort. For as long as he can remember, the foot has been in a "clawed" position & everted. Since he began to walk, there has been pain in the region of the head of the 1st. metatarsal bone of the left foot, and there has been a "callosity" here more or less continuously. Sometimes, the

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Pain radiates across the front of the ankle joint. During the past year, the pain & callosity at the head of the 1st. metatarsal bone have been very troublesome. The left lower extremity has always been particularly weak, especially below the knee, & movement at the ankle joint & of the foot have been restricted.

His general health has not been at all satisfactory & there is a history of chronic cough & chest trouble some six years ago.

Two months ~~of~~ before admission, he was seen by Sir Harold Stiles who advised operation, & his name was accordingly placed on the waiting list for admission to ward 7.

Family History:-

Nothing of interest relative to the present condition. There is

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no similar condition in any other member of the family — and there is no tuberculosis in the family.

Social History:-

Mucasis factory home surroundings Working conditions fairly satisfactory.

Habits:-

Teetotal

Cigarette smoker — moderate.

Physical Examination.

The patient looks fairly healthy but his muscularity is poor. There is obvious visible deformity in the left lower extremity. The patient walks with a limping movement, bearing the weight on the heel & on the head of the 1st metatarsal of the affected foot which is turned outwards.

Left Leg:-

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Left Leg:-

Inspection:-

There is a downward tilt of the pelvis to the left. On the left side there is a slight atrophy of the quadraceps muscle & of the hamstring muscles. The muscles of the leg, especially the gastrocnemius, show a marked degree of atrophy.

The foot is in a position of valgus & shows a considerable degree of cavus deformity. The toes are dorsi-flexed at the metatarsal phalangeal joints & plantar flexed at the interphalangeal joints.

Scars of previous operations are present. The first, about 6" in length, is along the line of the peroneus longus, its lower end being just behind the lateral malleolus. The second commences just in front of the base of the 5th

metatarsal & passes across the dorsum of the foot for about 3", ending just below the level of the ankle joint. The third commences opposite the base of the 1st metatarsal & passes upwards to a point about 2" above the level of ankle joint on its anterior aspect. The lower end of this scar is joined to a small 2" scar which passes backwards towards the region of the tuberosity of the navicular. A well marked callosity is present over the head of the 1st metatarsal bone.

Movements.

At the hip & knee joints, movements are rather weaker on the left side than on the right. At the ankle joint, plantar flexion is moderately strong but dorsiflexion is rather weak. The foot cannot be inverted & eversion is weak & limited in extent. At the

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metatarsal phalangeal joints, plantar flexion is totally absent. The extensor digitorum longus & the extensor hallucis longus are acting well.

The Right Leg is normal in appearance & in action. It shows no sign of paralysis.

There is no evidence of paralysis elsewhere.

Circulatory System:-

There are no subjective phenomena such as pain, palpitation, faintness, dyspnoea, or cough. The pulse is regular in rate, rhythm & force. The heart is not enlarged & the heart sounds are pure in all areas.

Respiratory System:-

There is no pain, cough, breathlessness or haemoptysis at present, though there is a history of chronic cough some six years ago. The breathing

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is thoraco abdominal in type & regular & easy in rhythm. There is no abnormal dullness on percussion & on auscultation, the breath sounds are normal vesicular in character over both lungs. There are no morbid accompaniments.

Urinary System:-

There are no abnormal constituents in the urine.

Treatment:-

a.) Preoperative:-

A few days before operation, this patient was admitted to ward 7 for investigation & preparation. During this time he was kept on light nourishing diet. After dinner on the day before operation, a dose of castor oil was administered & on the same

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evening an enema was given. On the evening before operation, the whole of the left lower extremity was shaved, thoroughly cleansed with methylated spirit, painted with 2½% tincture of iodine, & covered with a sterile square.

Sodium bicarbonate, gr. xxx t.i.d. was given on the day before operation & on the morning of operation. A hypodermic injection of atropine sulphate gr. 1/100 = m V. was given 3/4 hour before operation.

6.) Operative :-

21st January, 1925. Prof. Sir Harold J. Stiles. ($CHCl_3$ & Ether)

The patient was placed on the operating table ~~not~~ in the supine position, with the left leg supported by a sandbag. By means of a Jones tenotomy knife, the shortened bands of plantar aponeurosis were divided, the knife

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being introduced beneath the skin & the medial side of the central band of fascia & all contracture bands divided as they were made to appear by dorsal flexion of the foot. The tendon of the abductor hallucis was also divided. The foot could now be forcibly dorsiflexed.

An incision was next made in the line of the tendon of the extensor hallucis longus from a point just distal to where that tendon emerges from underneath the distal border of the lower band of the anterior annular ligament. and extending to the insertion of the tendon into the base of the terminal phalanx on the dorsum of the great toe. The incision was deepened through subcutaneous fascia and the tendon defined & freed for 3"-4" proximal to its insertion, the tendon then being divided transversely near its insertion. This mobilised tendon

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was wrapped in Gauze wrung out of warm Saline solution.

The pereosteum over the head of the 1st metatarsal bone was then incised & stripped off the bone with a pereosteum elevator. By means of a bone drill, a tunnel was now driven through the head of the metatarsal, the drill being entered on the lateral aspect of the bone and directed downwards & medially. This tunnel was threaded with a piece of silk worm gut which was attached to the free end of the extensor hallucis tendon and the tendon pulled through. The terminal portion of the tendon was then doubled back, so as to grasp the bone securely, and stitched side to side upon itself with interrupted sutures of fine linen thread. The great toe still remained somewhat dorsiflexed at the metatarsal phalangeal joint and therefore the

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most medial slip of the extensor hallucis brevis, which is inserted separately, as the extensor hallucis brevis, into the base of the terminal phalanx of the great toe, was divided. Haemostasis having been effected, the skin edges were opposed & united with interrupted sutures of silk worm gut. The leg, ankle, & foot was then put up in a plaster of Paris casing, the foot being dorsiflexed and the toes free.

[Subcutaneous fasciotomy and transplantation of the tendon of the extensor hallucis [left]]

(c.) Postoperative.

After operation, as he was coming out of the anaesthetic, this patient was given a hypodermic injection of Heroin gr. 1/12 and later of hyoscine gr. 1/100. A window was cut in the

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plaster casing and the stitches removed 17 days after operation. There was a small haematoma present in the dead space over the 1st metatarsal but there was no infection present. Tincture of iodine was applied to the wound and a sterile dressing. He was discharged and reported a month later when the plaster casing was removed and he was advised to carry out active & passive movements of the limb. The wound was soundly healed, and the deformity had been overcome by the operation.

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Commentary.

In this condition of "hollow foot" the arch of the foot is unnaturally high, the anterior part of the foot being approximated to the heel. This high arch implies some degree of contraction and loss of normal elasticity. The simple hollow foot may be an inherited peculiarity, or the depth of the arch may be exaggerated postnally as in the habitual use of high heels or as in professional dancers where the calf muscles are excessively developed. The hollow foot combined with some degree of equinus deformity as in this case under discussion, may be induced by the habitual disuse of dorsiflexion consequent upon the use of high heels, but is commonly due to a mild, transient anterior poliomyelitis of childhood as is evidenced by this case history. Shaffer considers that the simple

Pollow foot is never produced by the wearing of high-heeled shoes, and that the deformity due to malposition, habit, etc., is purely functional & not organic, so that the deformity disappears by simple manipulation and complete recovery occurs as use is made of the limb. He holds, however, that the true, so-called, "simple Pollow foot" occurs very commonly as a minor degree of contracture of the medial plantar fascia, giving rise to all the symptoms of Pollow foot in a minor degree. He knows of no definite etiological factor but remarks on the "frequent association with true rotatory lateral curvature of the spine." as a concomitant deformity.

"The Pollow foot in this case under discussion is undoubtedly due to the pre-existing anterior poliomyelitis and is present as a residual lesion from that disease. The chief symptoms are pain,

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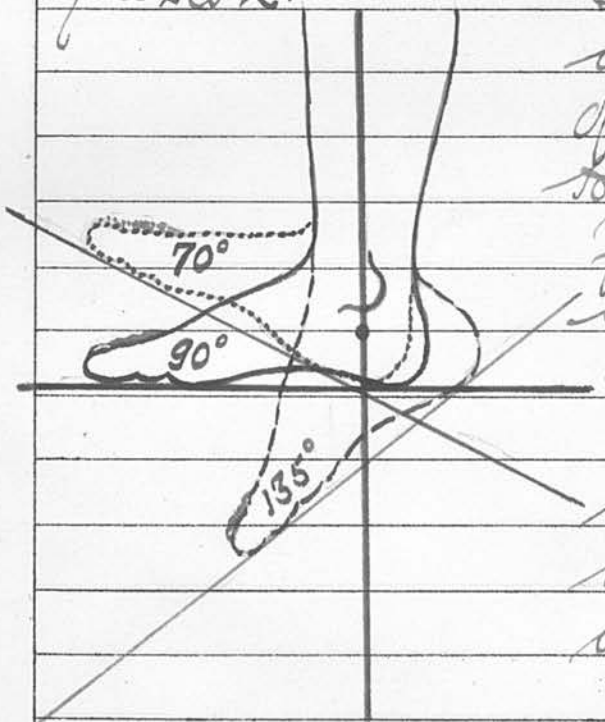
Disability, & Deformity. The pain is due to unnatural pressure and is usually in the region of the metatarsal arch, the great toe, or in the sole of the foot. Corns & inflamed bursae commonly appear at the points of pressure. The disability is due partly to fatigue & strain, partly to loss of the normal elasticity of the arch, and partly to loss of power of dorsi-flexion.



The accompanying sketch indicates the average degree of plantar- & dorsi- flexion to be expected in a normal foot. The integrity of locomotion depends to a large extent upon a proper degree of flexion & extension at the ankle joint, and in pes cavus this is largely absent — especially dorsi-flexion.

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The treatment is directed towards correction of deformity and improvement of function. In simple cases, it may be sufficient to correct faulty habits &c so on. In more resistant cases division of the contracted parts & forcible correction of the deformity are indicated. In addition it may be advisable to transplant the tendon of the long extensor of the great toe into the base of the 1st metatarsal by some modification of Ducroquet's method such as was used in this case, remembering that the tendon transplantation should be done after the fasciotomy. In extreme cases, Steindler's operation may be performed

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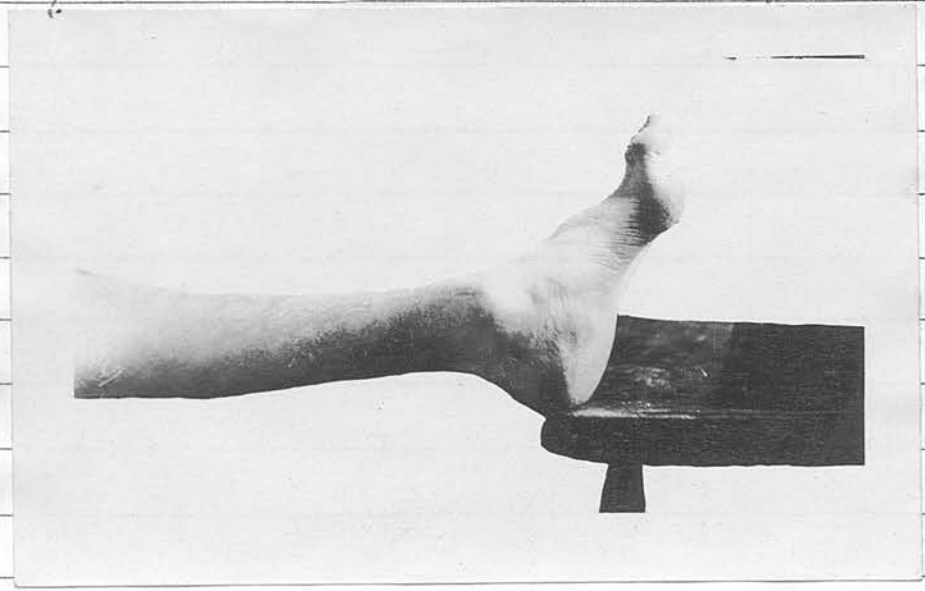
17. Alexander Herriot.

To show preoperative condition of pes cavus with callosity on the head of the 1st metatarsal bone. There is also Dorsi-flexion at the metatarsal-phalangeal joint & plantar flexion at the inter phalangeal joint.



C.T.--2.

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18. Alexander Herriot.

To show atrophy of muscles of left lower extremity, and condition of pes valgus & cavus. — preoperative.

Th. Sect

R. I. E.

Professor Sir HAROLD STILES.

Name William Scotland.

Recommended by Dr. Howieson, Bo'ness.

Disease Compression Fracture 3rd. & 4th. Lumbar Vertebrae.

Admitted 3: VI: 1925. Discharged 21: VII: 1925

Treatment Laminectomy.

Clinical Clerk.
~~Case Drawer~~ Alex. W. Sanderson

Remarks Orthopaedic Case No. 4.

C.T.—2

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1.

William Scotland
132, Castle Loan,
Bo'ness.

Single: Aet. 23 years.

Occupation :- Miner.

Recommended to R.I.E. by Dr Aitken, Bo'ness. and subsequently transferred from Ward 32 on the recommendation of Prof. Gulland.

Admitted to Ward 7, R.I.E. :- 3/3/'25.

Complaint :- (a) "Drop-foot (right)"
(b) "Difficulty in walking"

Duration :- 2 years.

History :-

While working in the mine on 15th. January, 1923, patient received an injury to the back by a fall of stone. He was carried home and attended by his doctor for 6 weeks after which time he was transferred to Ward 32, R.I.E., where he

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remained for a further period of 3 weeks. On investigation in Ward 32, it was considered that there had been a fracture of the 4th. lumbar vertebra, with haemorrhage in among the roots of the Cauda equina, but no actual injury to the spinal cord itself. The body of the 4th. lumbar vertebra had probably been smashed up as well as the laminae. Sir Harold Stiles saw him at this time and considered that he ought to be fitted with a plaster shell to be worn for several months, the idea being that this further time should be given to allow haemorrhage, etc. to be absorbed entirely. The amount of residual lesion could then be estimated. He was accordingly supplied with this plaster casing, as well as suitable posterior leg splints fitted with foot piece at right angles in order to keep his feet in proper position. It was

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considered by Prof. Gulland that, medically, nothing further could be done to improve the condition. He reported at ward 7. in June, 1923, wearing the plaster shell which was then removed. He returned home & lay in bed for a further period of 6 weeks during which time he was encouraged to carry out active movement. A spinal brace was next fitted and by means of crutches he was able to walk about. A few months later he was able to substitute sticks for the crutches. In December, 1923 he again reported at Ward 7 & was X-Rayed, after which he was recommended by Sir Harold Stiles as a patient for operation. His name was accordingly placed on the waiting list.

For the first 4 days after the accident there was complete retention of urine, requiring catheterisation twice per day and the urine contained a fair amount

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of blood for several weeks. After the 1st. 4 days there was incontinence of urine, the urine dribbling away steadily for 2-3 months. After that time, the bladder began to empty itself reflexly, and though the patient was able to say when the bladder was about to empty, he had no voluntary control over it. This condition lasted for about 6 months. During the past year there has been complete control of urine but there is still some irritability and often a strong desire to micturate. The frequency is about once every 2-3 hours, and once started, the flow of urine cannot be voluntarily interrupted.

For the 1st. 2 weeks after the accident there was severe pain in the region of the lumbar vertebrae where the local injury was sustained, the pain being very marked on the slightest movement, and distributed along the line

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of the vertebral column and into both shoulders. For the 1st. 10 weeks, there was complete anaesthesia of the abdomen & both lower extremities. Complete recovery took place gradually in the abdomen & in the right leg, but in the left leg, sensation has not completely returned. The first sensation to recover was the sense of touch, touch however being interpreted as pain. As time went on, sensation gradually became more normal.

There was complete paralysis of both limbs (lower) for 6 months after the accident. The first movement to be recovered was adduction of the left limb, and about the same time, flexion at the left knee became possible to a slight extent. Eventually all movements of the left lower extremity have been recovered. In the right lower extremity, recovery

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of motor function has not been complete and in particular, patient complains that he is unable to dorsiflex the right foot or toes and that he cannot invert the right foot. The condition has been practically stationary for the past 6 months, though the muscles have improved with exercise, more particularly those of the left limb. During this six months, patient has walked with a limp owing to the drop foot. Since the time of the accident, there has been slight gnawing pain in the right adductor region.

The bowels were unaffected. Constipation has been marked but relieved by constant use of aperients.

Previous Health:-

Patient has always been a healthy man with no illnesses of

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note and no previous accident.

Family History:-

Satisfactory.

Social History:-

Unsatisfactory home surroundings. He is teetotal and a light cigarette smoker.

Physical Examination.

The patient is of average intelligence but just inclined to be hypochondriac He is of satisfactory development & good muscularity. He is pale & anaemic & has pigmented scars around the left eye.

Gait:-

He walks with short steps which are regular in time & normal in length of stride. The right foot is turned outwards and he walks with a typical steppage gait, the toes scraping along the floor in spite of the fact that he tries to

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obviate this by high knee action. In this manner of progression he makes a rhythmic flop-like noise. The left foot functions satisfactorily & normally. The trunk & pelvis are not affected.

Back:-

On inspection, a projection is seen in the region of the middle lumbar vertebrae. Over this projection the skin is reddened. The posterior superior iliac spines are very prominent.

The upper segments of the vertebral column moves freely but there is diminished movement in the lumbar region. There is no tilting of the pelvis.

Right foot & leg:-

The following muscles are atrophied & paralysed:- Tibialis anterior.
Extensor digitorum longus
Extensor hallucis longus
Tibialis posterior

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He cannot dorsiflex the foot & he cannot invert it. He has no power of extension at the metatarsal-phalangeal joints or at the interphalangeal joints. He can plantar flex the toes. The peronei are acting well and the muscles of the calf are acting but show weakness especially the inner head of the gastrocnemius.

Left foot & leg:-

All the movements of flexion, extension, inversion, & eversion of the foot are satisfactory. The muscles are strongly acting. The flexors & extensors of the toes are satisfactory.

Thighs:-

There is marked hollowing on the right side just behind the sartorius below the anterior part of the crest of the ilium due to atrophy & weakness of the tensor fascia femoris. The anterior fibres of the glutens medius are paralysed &

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weaker on the right side than on the left. There is no weakness of the iliopsoas. The adductors are weaker on the right side than on the left. The Semimembranosis is paralysed & atrophied on the right side. The Quadriceps extensor on the right is atrophied & weak.

The muscles on the left side are all acting strongly & satisfactorily.

The abdominal muscles & the Sacro-spinalis muscle are acting well.

No reaction of degeneration was found in any muscle in the lower extremities, which alone were tested.

Sensory functions:—

Light touch, touch, pain, heat & cold, are normal all over the right lower limb and normal on the left side as far as the level of the knee joint. Along the posterior aspect of the leg, the sole of the foot and across the

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toes on the Dorsum, the sensation is practically normal but over the rest of the left leg and foot there is a mixture of impaired sensation & anaesthesia. The areas correspond closely as regards their sensitiveness to light touch, touch, pain, heat, & cold. See diagram.

Reflexes:-

Right side:- Knee jerk - present but weak & difficult to elicit even with reinforcement.

Ankle jerk. - doubtful positive.
Babinski - plantar flexion.
Cremasteric reflex - positive.

Left side:-

Knee jerk,
Ankle jerk,
Cremasteric reflex } - all negative.
Babinski - no definite response elicited.

All other reflexes normal on both sides

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Circulatory System:-

There is no precordial pain, palpitation, faintness, dyspnoea, or cough. The radial pulse is regular & satisfactory in rate, rhythm, & force. The heart is not enlarged & the heart sounds are pure in all areas.

Respiratory System:-

There is no thoracic pain, cough, or breathlessness. The breathing is regular & not restricted. There is no abnormal dullness a percussion, and a auscultation, the breath sounds are normal vesicular in type over both lungs. There are no morbis accompaniments

Urinary System:-

There is some irritability present and micturition frequency is about every 2-3 hours though at shorter intervals there is a strong desire to micturate. There is no true

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overflow or reflex incontinence, & from these points of view, the patient has control of the bladder, but once the act of micturition has been started, it cannot be voluntarily interrupted.

There are no abnormal constituents in the urine.

Wassermann Reaction:—

On a sample of blood taken under correct conditions from the median cubital vein, the Wassermann reaction was negative.

X-Ray Examination:—

The X-Ray negatives show a compression fracture of the 3rd. & 4th. lumbar vertebrae.

Provisional Diagnosis:— Pressure on roots of 4th. lumbar nerve (right) (a) in the spinal canal or (b) in the intervertebral foramen.

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JH.

Treatment.

(a) Preoperative:-

This patient was admitted to the Ward several days before the date of operation in order to ensure thorough investigation & preparation. During this interval she was kept on light nourishing diet. After dinner on the day before operation, she had a full dose of castor oil and on the same evening, a simple soap & water enema was given. On the day before operation & on the morning of operation, sodium bicarbonate gr. $\overline{xxx}$ t.i.d. was administered by the mouth. On the evening before operation, the site was shaved, cleansed with methylated spirit, treated with 2½% tincture of iodine & covered with a sterile square. ¾ hour before operation she was given a subcutaneous injection of atropine sulphate gr. 1/100 = m $\overline{v}$.

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15.

(6.) Operative :—

11th. March, 1925 Prof. Sir Harold J. Stiles. (Intratracheal Ether)

The patient was placed on the operating table in the prone position with the head pendant, the buttocks & abdomen being raised & supported on sandbags. An incision was made vertically in the mid line over the spinous processes and extending for about 6" from the 1st. to the 6th. lumbar spines. On either side of the spinous processes, the sacro spinalis muscle was stripped off by means of a pereosteum elevator, haemorrhage being controlled by swabs of gauze, wrung out of hot saline. After stripping the muscles they were strongly retracted by means of large flat retractors. When the spines & laminae were thus cleared & exposed, it was seen

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that there had been a compression fracture of the 3rd. lumbar vertebra, the laminae of which were compressed downwards & backwards, thus causing the spinous process of the 4th. lumbar vertebra to project unduly.

The spinous processes of the 4th., 2nd., & 3rd. lumbar vertebrae & the laminae of the 4th. & 3rd. were then removed by means of Horsley's heavy prism-pointed laminectomy forceps and the Italian "nutcracker" forceps. The dura was thus exposed. It was found that the laminae of the 4th were difficult to remove, as the bone was adherent to the dura by a process of ossification. Distal to this point, the dura was seen to be pulsating. The dura was then incised longitudinally in the mid-line, thus exposing the transparent arachnoid — which was incised in the upper part of the wound. There was

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an escape of cerebro spinal fluid which was mopped up. On the lower part of the wound, the nerve fibres were involved in the adherent ossified membrane and were dissected out as far as possible. It was found however that the posterior root of the 4th. lumbar nerve could not be freed and it was therefore resected. This allowed of removal of all the ossified dura. The anterior root of the 4th. lumbar nerve was defined & preserved. There was no further obvious pathological lesion present, and in particular it was seen that there was no constriction of or pressure on nerves at their foramina of exit. The edges of the Dura mater were then approximated by interrupted sutures of fine linen thread throughout the whole length of the incision; The sacro spinalis muscles were brought

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together by interrupted sutures of iodine tannic catgut. The edges of the lumbo-dorsal fascia were approximated in a similar manner, and the skin edges were carefully apposed & sutured with interrupted stitches of silk worm gut.

[Laminectomy for residual lesions following compression fracture of 3rd. & 4th. lumbar vertebrae.]

(c.) Post operative.

The patient was returned to bed in the prone position and about 2 litres of physiological saline solution was administered slowly into the loose cellular tissue of the breast & axilla. As he was coming out of the anaesthetic, a hypodermic injection of heroin gr 1/12 was given & this was repeated once. After

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operation it was found that he had developed retention of urine and incontinence of faeces. The latter condition cleared up within 2-3 weeks but the former continued for almost a month. The condition, no doubt, was to a great extent, traumatic, but the psychical element was not altogether absent. He was catheterised twice daily or as necessity demanded and the bladder was washed out once daily with 1 in 2000 $AgNO_3$ solution or with 4% boric acid solution. He also received urinary antiseptics by the mouth in the form of acid sodium phosphate and hexamine. Cystitis did not develop. Constant attention was also paid to the prevention of bed sores by careful cleansing with soap & water, rubbing with methylated spirit, & the use of a dusting powder.

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There were signs of recovery of the paralysed muscles at the time of his discharge, and there is every hope of cure. His sensory disturbance will be permanent over the area supplied by the resected posterior root of the 4th. lumbar nerve.

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21.

Commentary.

This is a case of compression fracture of the 3rd. & 4th. lumbar vertebrae. The patient, presenting himself for operation some two years after his accident, exhibits paralysis, flaccidity, & atrophy of certain muscles of the right lower limb. The dorsiflexors & invertors of the foot are essentially affected, but on further examination individual muscles such as the tensor fasciae, the gluteus medius, the quadratus femoris & quadratus extensor are also affected. There is no sign of spasticity. This state of affairs suggests a lower motor neuron lesion.

On the left lower limb, there is no trace of paralysis but there are sensory changes present.

When the history is investigated, it is seen that his present condition represents the residual lesion after a period of 2 years,

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and that further spontaneous recovery cannot be hoped for. Much of his earlier paralysis & anaesthesia was due to concussion, and he may be reckoned as having already passed through a period of spinal shock, with absent reflexes & paralysis of the bladder, followed by a period of recovery in which his reflexes have to a large extent returned and his bladder has passed from overflow incontinence to reflex incontinence & thence to full control.

The presence of these bladder symptoms as well as symptoms of irritability & urgency of micturition indicate that there was no permanent lesion in the lumbar enlargment of the cord.

In coming to a diagnosis, it will be seen 1) that there is evidence of a compression fracture between the 3rd & 4th lumbar vertebrae, (dislocation in this region is very rare), that the muscles permanently

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paralysed are supplied in every case by the 4th. lumbar motor root, and ③ that the area of anaesthesia corresponds to the posterior root of the 4th. lumbar on the opposite side. Since there is no reason to believe that the cord itself has been injured, the localisation of symptoms points to a lesion in the roots of the 4th. lumbar nerves. If the area of anaesthesia had been on the same side as the motor paralysis, then the probability is that the lesion would have been in the intervertebral foramen, but since it was on the opposite side and associated with no motor disturbance there, the probability was that the roots were involved inside the canal. This being so, a laminectomy was performed as described in the operation notes of the case, working in a systematic way towards the lesion both from above & from

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below. In opening into the canal, it is not advisable to take away the articular processes because you do not want to take away any more support than possible. It is quite sufficient to take away the spines & the laminae of the vertebrae. In this manner the spines & laminae of even four vertebrae may be removed without appreciably lessening the stability of the vertebral column.

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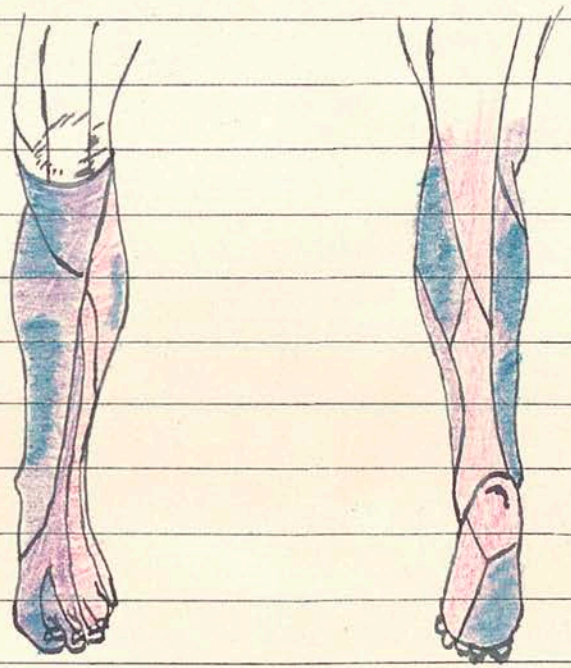
25.

Wm. Scotland.

Diagram of Sensory disturbance in the left leg.



The area of Anaesthesia is mainly incident over the area supplies by the 4th L., 3rd S., & 5th L. lumbar nerves.

= Partial Anaesthesia.

= Anaesthesia.

= Normal Sensation.

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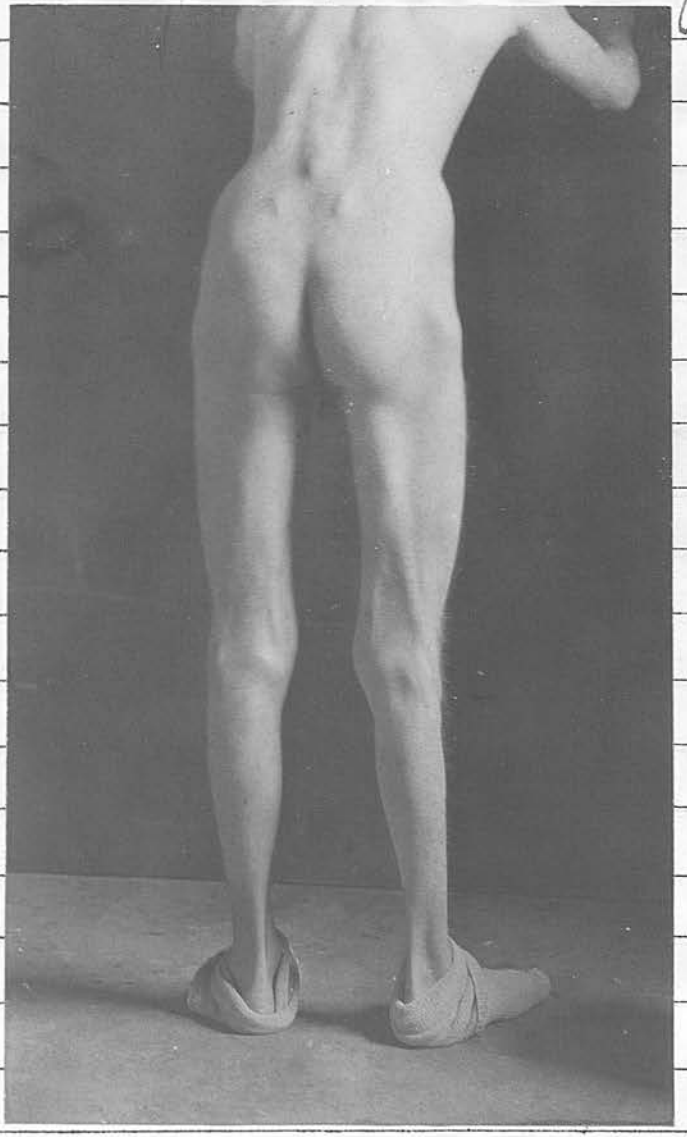
26. Wm. Scotland.

Preoperative:— To show lumbar spinal projection and atrophy of muscles of the right lower extremity. (See text)



Th. Sect

R. I. E.

Professor Sir HAROLD STILES.

Name Alexander Murdoch.

Recommended by Dr. Khambatta, East Wemyss.

Disease Genu Valgum (Right)

Admitted 20: I: 1925. Discharged 7: III: 1925.

Treatment Cuneiform Osteotomy for Genu Valgum (Right).

~~Case Drawer~~ Clinical Clerk. Alex. W. Sanderson.

Remarks Orthopaedic Case No. 5.

THE ROYAL INFIRMARY OF EDINBURGH.

1.

Alexander Murdoch,
Newbury Cottage,
East Wemyss.

Aet. 22 years.

Occupation :- Ploughman.

Recommended by Dr. K. Lambatta, East Wemyss.

Admitted to Ward 7. R.I.E. 20/1/25.

Complaint :- "Pain & deformity of the right knee."

Duration :- 5 years.

History :- 5 years ago, patient was working a horse when it kicked him on the lateral aspect of the right knee, the lateral condyle of the femur and the head of the fibula being thought to have been most affected. There was great pain & swelling in the region of the joint and he was unable to walk. He was admitted

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admitted to Wemyss Hospital where the knee was X-Rayed & put up in the flexed position. He does not know what diagnosis was made. The pain & swelling gradually subsided & within a few weeks he was able to walk again. He was detained in hospital for 11 weeks altogether, after which he repated weekly for massage. He did not resume work for 6 maths after the date of accident & by that time he realised that there was now a knock knee deformity on the affected side. Since then the degree of deformity has gradually increased & has been accompanied by weakness & pain on the medial aspect of the joint. In the past month this pain on the medial side of the knee has became aggravated & is now accompanied by weakness & pain which he refers to the medial aspect of the thigh. Especially

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in view of his occupation as a ploughman. He is anxious for operation because of disablement even more than because of the physical deformity per se.

Previous History:-

Measles & Scarlet fever, in childhood. Pleurisy a year ago. Otherwise he has always been a healthy man. There is no history of rickets.

Family History:-

Satisfactory. No history of similar complaint in the family. No history of rickets or of any deformity in the family.

Social History:-

Satisfactory home surroundings & working conditions. Plenty of fresh air & wholesome, nourishing food. He is teetotal and is a light cigarette smoker.

Physical Examination:-

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Physical Examination:-

The patient is of average intelligence. Apart from the local lesion, his development is satisfactory and his musculature is excellent. He is a robust, healthy-looking man.

Right Leg:-

Inspection:-

There is a well marked degree of genu valgum. Over the region of the medial condyle of the femur there is a definite prominence and the patella is displaced laterally. There is no visible sign of deformity below the knee, the whole of the deformity being in the region of the lower end of the femur. The valgus deformity disappears to a large extent on flexion of the knee. When the knee is flexed, a well-marked vertical ridge about 1½" in length is visible in the upper part of the lateral condyle of the femur but this

is lost to sight when the knee is extended. There is no noticeable atrophy of the muscles of the thigh or leg.

When the patient is erect with the knee forking and the feet parallel to one another, there is an interval of almost 9 cm. between the medial malleoli. A line from the anterior superior spine of the ilium to the great toe passes just lateral to the lateral condyle of the femur. A corresponding line on the left side passes through the median line of the patella.

Palpation:—

There is a bony hard ridge over the upper part of the lateral condyle of the femur. The medial condyle of the femur is irregular in outline & abnormally prominent. The intercondylar space can be palpated largely owing to the lateral displacement of the patella. There

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is no crepitus either audible or palpable. The joint is not swollen & there is no fluctuation in the joint: there is no floating of the patella. There is some tenderness especially over the the attachments of the medial (tibial) collateral ligament, but only on deep pressure. There is no restriction of movement and no pain on active or passive movement.

The outline of the tibia & fibula is normal.

Left Leg:-

There is no abnormality present.

There is no subjective or objective morbid phenomenon in any other part of the locomotory system. There is no sign of rickets.

Respiratory System:-

There is no cough, pain, or breathlessness. The respiratory movements

are mainly abdominal in type and are normal & free. There is no abnormal dullness on percussion, and on auscultation the breath sounds are heard to be normal vesicular in character over both lungs. There are no morbid accompaniments.

Circulatory System:-

There is no precordial pain, palpitation, faintness, dyspnoea, or cough. The pulse is regular & normal in rate, rhythm, & force. The heart is not enlarged and the heart sounds are pure & satisfactory in all areas.

Urinary System:-

There are no subjective phenomena and there are no abnormal constituents in the urine.

X-Ray:-

Shows irregular outline of the extra-articular part of the medial condyle of the femur. There is a suggestion of an

old fracture through the femoral condyles or of separation of the epiphyses. The tibia is normal in outline.

Provisional Diagnosis:- Genu Valgum (Right).

Treatment.

(a.) Preoperative:-

The patient was admitted to the ward a few days before the date of operation in order to allow of investigation & preparation. During this interval he was kept on a light nourishing diet. On the day before operation, he was given a full dose of castor oil after dinner & in the evening before operation an enema was given. On the day before operation & on the morning of operation, sodium bicarbonate gr. XXX t.i.d. was administered by the mouth. 3/4 hour before operation,

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a hypodermic injection of atropine sulphate gr. 1/100 = m $\overline{v}$ was given.

On the evening before operation, the whole of the right lower extremity was carefully shaved, cleansed with methylated spirits, painted with 2½% tincture of iodine and wrapped in a sterile square.

(6.) Operative:-

23rd. January, 1925. Prof. Sir Harold J. Stiles. (Chloroform & Ether)

The patient was placed on the operating table in the supine position, the lower part of the right thigh being rotated laterally and supported on sandbags. The knee was flexed. An incision was made about 3" in length, commencing just in front of the tendon of adductor magnus & passing forwards & downwards to a point about 1" in front of & just proximal to

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No.

the adductor tubercle on the medial condyle of the femur. The incision was deepened through superficial & deep fascia so as to expose the fibres of the vastus medialis muscle and these were incised in the line of the skin incision. Bleeding points were secured, these being mainly twigs from the superficial, saphenous, & musculo-articular branches of the arteria genu suprema, but the main branches were all avoided. The superior medial geniculate branch of the popliteal artery was below the area of operation & only anastomotic twigs of this were divided.

By means of an osteotome, a wedge of bone with its base on the medial aspect of the femur & its apex directed towards the intercondyloid notch was removed. The bone was very hard & was only removed with difficulty. The osseous wound was then covered

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with Gauze, and the Knee of the Surgeon acting opposite the wound as a fulcrum, the leg was forcibly abducted against resistance & thus the femur was fractured at the site of the osteotomy. The raw edges of the bone were now readjusted so as to undo the pre-existing valgus deformity. The edges of the rastus medialis were united with interrupted sutures of iodine tannic catgut and the skin edges accurately apposed & sutured with interrupted stitches of silk worm Gut.

A sterile Gauze pad was applied over the wound and a Gauze roller bandage was applied. The limb was then set up in extension in plaster of Paris casing extending from the foot to the waist.

[Cuneiform Osteotomy for Genu Valgum (Right.)]

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Commentary.

"In a normal limb, a line drawn from the centre of the head of the femur to a point midway between the malleoli passes through the centre of the knee-joint. If the line passes lateral to the centre of the knee-joint, the condition is one of genu valgum." (Thomson & Miles)

The condition appears to be more common in males than in females and while it is usually considered as a condition developing in childhood, there are many cases developed, or at least increased to an extent demanding treatment, during adolescence. The common predisposing cause is the erect posture combined with some abnormal direction of weight transmission. This may be induced in many ways, as for example by lessened stability of the supporting structures or by strain following

upon relaxation of muscles & the adoption of a persistent & exaggerated "attitude of rest." In some cases, the genu valgum may be compensatory to abnormal conditions elsewhere e.g. adduction of the hip, or it may follow upon trauma or disease around the joint.

What happens is that the lower third of the femur has the diaphysis lengthened on its medial aspect and shortened on its lateral aspect, so that the epiphysis, itself unaltered, is fitted on obliquely, & thus the medial condyle is rendered more prominent & the condition of genu valgum results. There has been some controversy as to whether the altered rate of growth in the medial & lateral parts of the epiphyseal cartilage is the primary cause or whether it is the consequence of altered structural changes in the joint. Wolff (1836—1902) postulated that "every change in the form

or function of a bone is followed by certain definite changes in the internal architecture of the bone, & equally definite secondary changes in the external conformation, in accordance with mathematical laws." He therefore believed that save where there is softening or actual disease of the bones, Knock Knee was always the result of faulty posture. Even Tubby absolves the muscles from any causation relation to Knock knee, and yet observers like Sir Arthur Keith maintain that the deformity is always due to definite muscular derangement which causes prolonged & unusual strain to fall on the tibial collateral ligament. This lengthens & a gap appears between the medial femoral condyle & the medial condyle of the tibia. The consequent change in pressure distribution affects the rate of growth along

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the epiphyseal line.

The gait of the patient is peculiarly awkward & shambling in bilateral cases, and the abduction & lateral rotation give a degree of pes valgus which is followed by pes planus. In some cases the condition of pes valgus is more apparent than real as may be evidenced by the varus attitude adopted occasionally after operation. The patient is always easily fatigued, & during the progressive stages, he experiences pain on the medial aspect of the knee where the ligaments are subjected to continuous strain. In unilateral cases, the gait may be of a limping & swaying character, with accompanying tilt of the pelvis & consequent scoliosis. In all cases, the deformity & the effects of the deformity on the gait & attitude are the important symptoms.

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The treatment is either (α) palliative & expectant, or (β) by mechanical correction, or by (γ) operation:-

(α.) The expectant treatment consists of general treatment such as Dietetic & medicinal measures, Heliotherapy, rest, Massage & manipulation, carefully graded exercises, and the use of supports.

(β.) In the mechanical correction, splints, braces, & plaster bandages may be used with advantage in the infantile type of genu valgum but are useless in the adolescent. Manual correction of the deformity, under an anaesthetic, is not without risk & correction so obtained is usually due to production of some other lesion(s) such as fracture of the lower end of the femur, separation of femoral or tibial epiphysis, fracture of the medial femoral condyle (≡ Ogston's operation), or rupture of the fibular collateral ligament.

(γ.) Where other methods have failed

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and disability remains, operation is indicated. After the 4th. year of age, improvement in the deformity cannot usually be expected from other than operative treatment. The operation is practically without risk in patients whose health is otherwise satisfactory, and is permissible for aesthetic reasons alone even apart from disability.

"The operation must be devised so as to overcome the three bony deformities commonly present (i) elongation of the internal femoral condyle, (ii) bending or medial elongation of the diaphysis of the femur, & (iii) Some bending of the upper end of the tibial diaphysis. "The operation commonly employed is an Osteotomy and practically all osteotomies for Genu valgum have been superseded by the MacEwan supracondyloid operation or some modification of it, performed in the manner described

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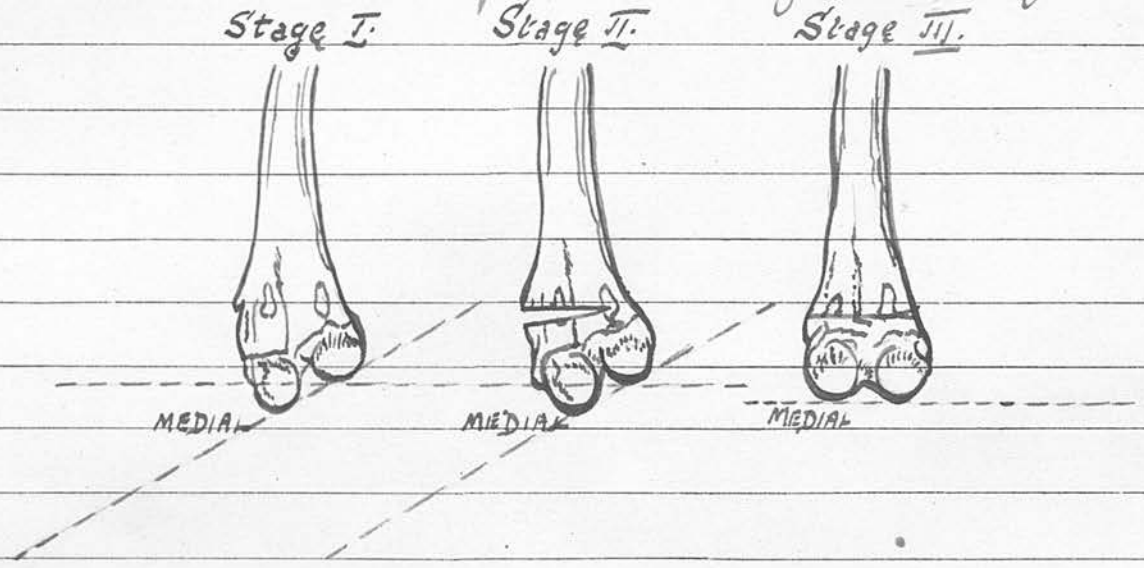
in this case under discussion. The evolution of Macewan's operation dates back to 1877, and the rationale of it is explained by the following Schema :—



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Alexander Murdock

Genu Valgum (Right.)

Anterior Aspect.

25R.—C.—2/25.

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Alexander Murdoch.

Genu Valgum (Right)

Posterior Aspect.

Th. Sect.

R. I. E.

Professor Sir HAROLD STILES.

Name Herbert Turner.

Recommended by Dr. Campbell, Rosyth.

Disease Loose Bodies and marked Osteo arthritic Change (Left Knee Joint.)

Admitted 25 : II : 1925. Discharged 4 : IV : 1925.

Treatment Removal of Loose Bodies & Infrapatellar Pad of Fat ; Cheilotomy :- Left Knee Joint.

~~Case Drawer~~ Clinical Clerk. Alex. W. Sanderson.

Remarks Orthopaedic Case No. 6.

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1.

Herbert Turner,
13, Cromwell Road,
Rosyth.

Occupation:- Shipyard Worker. Aet. 42 years.
Recommended by Dr. Campbell, Rosyth.
Admitted to Ward 8, R.I.E.:- 25/3/25.

Complaint:- "Swelling, stiffness, and intermittent locking of the left knee."

Duration:- 11 years?

History:-

Twenty one years ago, patient fell while playing football, and injured his left knee. At the time there was a fair amount of pain and swelling which lasted for several weeks but recovery apparently was complete

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and he had no further trouble with his knee for 10 years. Eleven years ago, his knee locked while he was kicking a football and the locking was accompanied by sickening pain. The knee joint soon began to swell & he was confined to bed for 6 weeks, during which time the swelling gradually subsided and mobility slowly returned. Recovery was not entirely satisfactory, however, and he was advised to undergo operation. This was carried out in St. Bartholomew's Hospital by Mr. Fairweather who informed the patient later that one semilunar cartilage was torn and locked between the articular surfaces. The torn cartilage was trimmed away. This operation seems to have been successful for the patient was able to serve throughout the war as an Infantryman, and experienced no trouble

with his knee and had no difficulty in walking during that period.

Five years ago, patient tripped and again the knee locked. Pain was not a marked feature but there was considerable local swelling and much restriction of movement which kept him indoors for about 3 weeks. Since that time there has been occasional locking, always unexpected, usually momentary, & always reducible by manipulation. There is not much pain at these times of locking but it is always followed by swelling of the joint. Occasionally, he has noticed a loose body appearing in the region of the supra patellar pouch and disappearing again near the lateral border of the patella. Five months ago, he had a locking of the knee with pain and swelling sufficient to make it necessary for him to remain in bed for 4 weeks.

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At that time he was sent by his Doctor to S.O.P.D. where X-Ray examination revealed 2 loose bodies and some old osteo-arthritic change in the knee joint.

In the intervals between locking, the knee joint has been stiff but not painful. This stiffness is aggravated by damp weather. For about 2 years he has had a limp owing to the condition of the knee. There is no history of any other joint having been similarly affected.

Previous Health:-

He has had no previous illnesses and his general condition has always been satisfactory. He was accepted by and served in the Army in a Fine Regiment.

Family History:-

He comes of a healthy family in which there is no similar complaint.

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Social History:-

Satisfactory home surroundings. He is teetotal and a very light smoker.

Physical Examination

This patient is of fresh complexion and looks healthy. He is of normal satisfactory development, and good muscularity. There is no evidence of previous disease or injury.

Left Lower Extremity:-

There is general atrophy of the muscles, especially of the quadriceps extensor and of the muscles of the calf. The bony points in the region of the knee are prominent, the condyles of the femur and the tibia being especially marked. On the lateral aspect of the limb there is a swelling just above the lateral condyle of the tibia in the region of the distal

attachment of the iliatibial tract.

On palpation, no definite point of tenderness can be elicited. The swelling seen on the lateral aspect of the joint is felt to be bony hard and to be movable from side to side but not up & down. It is about the size of a large bean. There is no loose body to be felt at the time of examination. The margins of the articular cartilage are palpably thickened. There is no fluid in the joint & no floating of the patella. Active & passive movements at the knee joint are quite free & painless but there is marked crepitus which is both palpable & audible.

There is no abnormality in any other part of the locomotory system.

Alimentary System:-

There are no subjective phenomena. The appetite & digestion are

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satisfactory. Artificial dentures are worn and the tongue is clean & moist.

Circulatory System:-

There is no pain, palpitation, faintness, dyspnoea, or cough. The pulse is regular in rate, rhythm, & force. The heart is not enlarged and the heart sounds are satisfactory & pure in all areas.

Respiratory System:-

There is no pain, cough, or breathlessness. The breathing is mainly abdominal in type & is free and regular. There is no abnormal dullness on percussion & on auscultation, the breath sounds are heard to be normal vesicular in character over both lungs. There are no morbid accompaniments.

Urinary System:-

There are no subjective phenomena and there are no abnormal

constituents in the urine.

Wassermann Reaction:-

"The Wassermann reaction on a sample of blood taken from the median cubital vein was negative.

Treatment.

(a.) Preoperative:-

"The patient was admitted to the Ward several days before the date of operation in order to admit of thorough investigation & preparation. During this time he was kept on a light nourishing diet. After dinner on the day before operation, castor oil was given & on the same evening he had a soap & water enema. On the day before operation and on the morning of operation, he was given sodium bicarbonate gr. xxx t.i.d. On the evening before operation, the whole of the

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left lower extremity was shaved, cleansed with methylated spirits, treated with 2½% tincture of iodine, & covered with a sterile square. ¾ hour before operation he received a hypodermic injection of atropine sulphate Gr. 1/100 = m $\overline{v}$.

(b.) Operative:-

HK. February, 1925. Prof. Sir Harold I. Stiles ($CHCl_3$ & $C_2H_5{}^{C_2H_5}_{C_2H_5}>O$)

The patient was placed in the supine position with the knee flexed & supported by a sandbag. An incision, after the manner of the median incision of Jones, was made in the middle line over the lower part of the quadraceps extensor muscle and passing down for about 6" to just beyond the tibial tuberosity. The incision was deepened through subcutaneous tissue and the superficial vessels were secured. In the upper part of the wound,

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the tendon of the quadraceps was exposed and the fibres divided longitudinally. The pereosteum over the patella was incised & separated in the line of the skin incision, and the patella sawn through longitudinally by means of a Hey's saw. In the lower part of the wound, the ligamentum patellae was split longitudinally in the middle line. The cut edges of the quadraceps tendon, the patella, and the ligamentum patellae were then strongly retracted by means of bone hooks, but there was difficulty in obtaining full retraction of the medial half of the patella. To overcome this, the medial half of the quadraceps tendon was dissected off higher up & subpereosteal separation effected in the case of both this tendon & the patellar ligament. The knee was then further flexed.

A loose body was removed from

the region of the supra-patellar pouch & a foreign, cartilaginous-looking, body from the space between the lateral condyles of the femur & the tibia. The infra-patellar & retro-patellar pad of fat was considerably hypertrophied & was dissected off along with the remains of the medial meniscus, care being taken not to injure the tibial collateral ligament. The edges of the articular cartilage showed characteristic osteoarthritic ~~of~~ lipping and the cartilage itself was fibrillated. It was of a yellowish colour and had lost its lustre. The synovial membrane was uniformly thickened but there were very few tags. By means of the chisel, the edges of the articular cartilage over the condyles of the femur was removed & the margins trimmed. In the postero-lateral aspect of the joint, another foreign body was palpated & brought

towards the surface of the wound. It was found to be contained in a compartment of synovial membrane and the whole compartment with the contained foreign body was excised & removed.

Haemostasis having been effected, the knee was then extended. The edges of the quadraceps tendon were approximated & sutured with interrupted stitches of stang iodine tannic catgut. The cut edges of the patella were united by sutures of iodine tannic catgut passed through the periosteum, and the edges of the ligamentum patellae were also united with iodine tannic catgut stitches. The skin edges were brought into accurate apposition and united with interrupted sutures of silk worm gut.

The limb was then set up in a padded Jones's posterior splint,

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a firm bandage with a large amount of cotton wool having first been applied to ensure firm elastic pressure.

[Removal of Loose Bodies, Cheilotomy, & removal of infrapatellar pad of fat, for chronic osteo-arthritis of the left Knee joint.]

(e.) Post operative :—

As he was coming out of the anaesthetic, this patient was given a hypodermic injection of heroin gr 1/12 and this was followed later by hyoscine hydrobromide gr. 1/100. On the 2nd night after operation he was given an aperient dose. He was discharged with the wound soundly healed 30 days after operation.

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Commentary.

The knee joint is the site of a great variety of pathological conditions which no doubt can be explained in large part by such predisposing factors as the intricate structure & the weight-bearing function of the joint.
Comparable with the mandibular joint in its multilocular character, it has, in addition a very extensive area of synovial membrane and an elaborate system of articular surfaces & of ligaments. Its function is essentially for stability, & in weight bearing & weight transmission it is subject to much incidental trauma & minor injury.

The affections of the knee joint may be classified in various ways but it is probably simplest to divide them first of all into ① congenital & ② acquired lesions

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(1) The congenital lesions would include such conditions as absent, rudimentary, displaced, & slipping patella, congenital displacements, contractions, etc..

(2) The acquired types may be subdivided into

α.) those which are bacterial in origin such as may be caused by the tubercle bacillus, the gonococcus, the meningococcus, the pneumococcus, the spirochaeta pallida, streptococcus & staphylococcus.

β.) traumatic conditions which may give rise to derangement of the joint as in torn semilunar cartilage, formation of loose bodies, hypertrophy & hyperplasia, & so on.

γ.) those which are neuropathic in origin as in Charcot's tabetic arthropathy, & congenital syphilitic lesions in the central nervous system.

δ.) constitutional disturbances following upon "gout," rheumatism, haemophilia, etc..

It must be understood that in many of these conditions, the symptoms & signs do not represent the disease but are rather

a manifestation of local reaction on the part of the patient against the disease.

The condition of loose bodies, common at the knee joint & even limited to one joint as in this case under discussion, was first given the name of "Osteochondritis Dessicans" by König in 1890. Injury is considered to be a prominent factor in the ~~et~~ etiology, and the disability is probably caused by breaking off of fragments of cartilage, or the occurrence of necrosis by interference with nutrition of the cartilage. Now, articular cartilage per se is a non vascular tissue and many observers have pointed out the advantage of this in securing a greater immunity to infection and inflammation consequent upon trauma or irritation. While the periphery of the articular cartilage is covered with a delicate extension of synovial membrane,

the central area is completely deficient of any membrane or epithelial layer & is directly exposed to the synovial fluid of the joint cavity. With regard to the nutrition of the articular cartilage, the concensus of opinion, based on experimental & histological evidence, is that this central area is supplied directly from the synovial fluid, that the periphery is supplied by the circulus articuli vasculosus as described by Hunter, and that the deeper strata are supplied by lymph exuded from the underlying cancellous bone.

Loose bodies in the joint are probably nourished by the synovial fluid and this view is confirmed by experimental evidence which goes to show that cartilaginous cells loose in the joint may retain their vitality & even proliferate. Bare cells, on the contrary become inactive & die. The importance of this latter observation has been

insisted on by Mr. Dowden with reference to non-union in intra-capsular fractures.

With regard to the osteo-arthritic changes present in this case under discussion, it is necessary to consider the pathology & etiology of the condition, so far as it is understood, before passing on to the principles underlying its surgical treatment. The pathological changes are of extraordinary diversity, for in the same joint at any one time, we may see the phenomena of inflammation, degeneration, repair, & new growth, going on side by side. To a great extent, however, the pathology may be simplified by dividing the articular cartilage into ① a central & ② a peripheral articular area, for these differ essentially from each other in the human subject. This difference is indicated early on in intra-uterine life for at the 4th. month, i.e. 2 months after the appearance of the joint cavities in the

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foetus, the pericardial layer begins to recede gradually from the central area which is left denuded but for a delicate superficial stratum, the cells of which are now considered to be the parent cells of the more fully developed cartilage cells in the deeper subjacent strata. Formerly this central superficial stratum was believed to be the effete product of growth of the deeper layers, the dead cells contributing to the synovial fluid of the joint, but this view has no justification & has been shown to be erroneous, for these superficial cells show no sign of degeneracy either by structure, staining reactions, development or comparative anatomy.

The peripheral articular area of the joint cartilage is covered by a delicate extension of synovial membrane and in this thin synovial layer ramify the

capillaries of Hunter's circulus arteriosus as has already been described. This question of nutrient supply is of fundamental importance in the study of osteoarthritis, for whereas the avascular central area of the articular cartilage will succumb & degenerate, the vascular peripheral area will respond by proliferation. The degree of repair after injury is likewise influenced apparently by the vascularity, for the central area, which is just above the threshold of existence, is practically incapable of repair, whereas the peripheral area of the articular cartilage is capable of repair by formation of new cartilage as well as by connective tissue formation.

In osteoarthritis of the knee joint, the articular surface of the patella & the trochlear surface of the femur are invariably the first to be affected, and

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the central area is always affected before the peripheral. This may be due in part to the fact that it sustains greater pressure but is largely due to its poorer nutrition. This first observable change is the well-known "fibrillation".

These central degenerative changes are now succeeded by the well known "lipping" of the articular margins, and this new-formed cartilage is largely produced by proliferation of the synovial perichondrium, and the view, postulated by Cornil & Ranvier, that the perichondrium acts as a delimiting membrane to prevent egress of proliferating cartilage cells into the interior of the joint cavity, has not been confirmed by more recent observers. The chondriophytic outgrowth is soon invaded by osteoblasts so that the cartilage is reduced to a mere layer on its surface and this also may eventually degenerate

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and disappear, the subjacent bone soon becoming eburnated. The cancellous spaces in the interior of this chondro-osteophyte are of extremely open & rarified texture and the contents are largely composed of adipose tissue, so that the buttresses seen on the under surface of these recurved osteophytes are probably designed architecturally to give strength & support to the new growth.

While these changes are occurring in the articular cartilage, it has been observed that the subarticular lamella of bone has begun to undergo sclerosis, and it is significant that this compensatory change in the bone begins before it is actually deprived of the protection which the articular cartilage normally provides. By the time that "lipping" has begun, there will be changes evident also in the synovial membrane

and these changes are mainly in the direction of thickening of the synovial membrane and increased vascularity. In some cases there is adipose tissue formation & there may even be cartilage formation in the synovial villi. In the late stages there may be arteriosclerotic changes with atrophy of the thickened synovial membrane.

The etiology of osteoarthritis is very difficult to summarise, principally because of the fact that "this is not a disease sui generis, but rather the series of physiological & pathological changes that occur in a joint when it is subjected to prolonged or oft-repeated injury either mechanical or toxic, but of a moderate degree of intensity." This osteoarthritic process may be related in some instances to disorders of ductless glands & in other

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cases to metabolic autointoxication, but in the majority of cases the exciting factor is either ① trauma, which may be local or transmitted, or ② toxic, due to bacterial toxins which may be formed locally or generated in some distant focus in the body. In all probability the route of infection in this second class is via the circulus articuli vasculosus.

The diagnosis of osteoarthritis is made from the case history & the clinical examination. The onset is usually slow & insidious and males are more liable to be affected than females. The age incidence varies, but the patient is usually at or beyond middle life. The traumatic variety is usually mono-articular whereas the toxic type tends to be polyarticular. There is no elevation of temperature & no marked

constitutional disturbance. Aching in the affected joint is the first symptom & this is usually associated with the cardinal symptoms of inflammation of a mild variety. Pain & swelling then become more prominent & there is now definite limitation of movement due to fluid in the joint & to muscular spasm. The fluid does not contain organisms but may be highly toxic. It contains an increased amount of albumen & the significance of this in the nutrition of loose bodies should not be lost sight of.

In some cases, the signs & symptoms indicate a more acute infection & point definitely to the inflammatory nature of the condition

Usually the morning stiffness continues for an indefinite period but the patient is not yet prevented from

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following his occupation. The synovial membrane does not thicken early but "lipping" may be felt at a variable period, the earliest degree of lipping not being apparent on X Ray examination since it is merely cartilaginous at this stage. Later, osteomata, chandromata, & loose bodies may be detected, & the thickened synovial fringes give rise to a peculiar characteristic "snowball crunching" type of crepitus on movement. In the very late stages, when the central area of the articular cartilage has been destroyed & the underlying bone exposed, constant gnawing pain with exacerbations on movement, is the prominent feature. Deformity & altered degree of movement are now usually present also.

The treatment should be directed towards eradication of any possible

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foci of infection and this would include such measures as may be necessary to prevent the formation & to assist the elimination of systemic toxins. Diseased articular surfaces should be relieved by suitable splintage so as to minimise intra-articular friction & pressure. This is particularly important with reference to the lower extremity. Local treatment may be instituted so as to stimulate the joint & to prevent ankylosis, while general treatment in the way of dietetic & medicinal therapy should be carried out.

If operative procedure is decided upon in these cases in the chronic stages, then the transpatellar route should be the method of choice to gain access to the joint, and it was utilised in this case.

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28. Herbert Turner

To show swelling on lateral aspect of knee joint.