REPORT AND COMMENTARY ON
SIX ORTHOPAEDIC CASES.

<table>
<thead>
<tr>
<th>NO.</th>
<th>INDEX OF CASES</th>
<th>PAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.</td>
<td>Case of Hemiplegic Spastic Paralysis.</td>
<td>1-8</td>
</tr>
<tr>
<td>II.</td>
<td>Case of Chronic Osteomyelitis of the Tibia.</td>
<td>9-16</td>
</tr>
<tr>
<td>III.</td>
<td>Case of Osteoarthritis of the Hip Joint.</td>
<td>17-24</td>
</tr>
<tr>
<td>IV.</td>
<td>Case of Rupture of the Medial Meniscus of the Knee Joint.</td>
<td>25-32</td>
</tr>
<tr>
<td>V.</td>
<td>Case of Congenital Dislocation of the Hip Joint.</td>
<td>32-41</td>
</tr>
<tr>
<td>VI.</td>
<td>Case of Adolescent Kyphosis.</td>
<td>42-49</td>
</tr>
</tbody>
</table>

Final Commentary and Summary of all the cases: 50-52.

INDEX OF X-RAY PHOTOGRAPHS.

| 1.  | X-ray showing the Arthrodesis of the wrist.        | 4.     |
| 2.  | X-ray showing the Condition of Chronic Osteomyelitis. | 12.    |
| 3.  | X-ray showing the Condition of Chronic Osteoarthritis. | 19.    |
| 4.  | X-ray showing the Cup Arthroplasty of the Hip.     | 20.    |
| 5.  | X-ray showing the Shantz's Osteotomy, using the Vitallium plate, of the Hip. | 35.    |
| 6.  | X-ray showing the Kyphosis of the Vertebrae in the Mid-Thoracic Region. | 4.5    |

XXXXXX
CASE NO. 1.

Case of Hemiplegic SPASTIC PARALYSIS
MISS A. MCLEISH, Aged 23 years.
144 Gorgie Road, Edinburgh.

OCCUPATION - Shop assistant (requiring much standing).

DOCTOR - Dr. McDonald, Edinburgh.

ADMISSION - 1.4.46.

COMPLAINT - Pain in right foot and ankle with some limitation of movement, for last 18 months.

HISTORY:

PAST - Right arm and leg have been spastic and semi-paralysed since the age of 18 months. The condition being diagnosed as caused by a "hemiplegia, due to a rupture of a blood vessel". As a child she walked on the toes of her right foot and was unable to put her ankle in normal position near the ground; giving this patient a characteristic inco-ordinated gait. At the age of 7 years she was operated on by Mr. Middleton, for this condition - a Stoffel's operation on the Medial Popliteal nerve.

PRESENT - Was not troubled with her right leg until 18 months ago, when she began to have numbness, "cramp" and pain, without a feeling of "pins and needles" in her toes of the right foot, with some stiffness of her right ankle. The pain became more severe and became localised to her big toe and ankle, causing the patient to walk more and more on her toes, to prevent this pain.

Now on walking, she suffers with pain, stiffness and "cramp" in her right foot, which does not disappear on resting.

The patient notices some swelling of her right leg after a day's work.

FAMILY - No history of similar condition in rest of family. No history of difficult labour when this patient was born.

EXAMINATION:

Healthy young woman, with some apparent mental deficiency. Very nervous and completely dependent upon her mother, who accompanied her, during examinations. Patient has no difficulty in speaking correctly.

RIGHT ARM:

Muscles are obviously atrophied and wasted, with shortening of the right arm, on comparison with the normal left arm. There is marked spasm of the ADDUCTOR and FLEXOR groups of muscles of the upper arm and forearm, giving a very characteristic appearance of flexion at elbow and wrist joints, pronation of forearm, thumb adducted across palm of hand with fingers flexed to slight amount at all phalangeal joints.

Active movements are weak and limited, (especially in hand).

Passive movements show the marked spasticity by increased resistance to attempts at extension of joints, and after pressure is released, the parts return to their semi-flexed positions.
Diagram to illustrate method of lengthening of the tendon Achilles.
RIGHT LEG: Some atrophy of calf muscles is seen. 
Hip joint is in normal position, with no abnormal flexion, adduction, medial rotation seen. 
Knee joint is slightly flexed. 
Foot is plantar flexed, with some inversion. Marked elevation of longitudinal arch of foot is well seen with slight tendency towards hammer-toe - most noticeable in the big toe. 
Active and passive movements of ankle joints are very limited and the toes cannot be moved actively. 
N.B. Reflexes are slightly exaggerated. 

DIAGNOSIS: This is a case of SPASTIC PARALYSIS or cerebral paralysis of children. 
It is a hemiplegia, involving the right arm and right leg. 
Reasons for diagnosis: 
1) The spastic paralysis being present from 16 months. 
2) The mental state of the patient. 
3) Spasticity of the calf muscles, which was lessened by the Stoffels operation at the age of 7 years. 
4) Characteristic walking gait with characteristic equino varus position of foot (foot is inverted, plantar flexed, and adducted to some degree). 
5) Characteristic spastic deformity of right arm. 

DIFFERENTIAL DIAGNOSIS: 
ANTERIOR POLIOMYELITIS: In the acute stage of this virus infection of young children, there is always a history of an acute infection e.g. pyrexia, pain - maybe a meningitis with headache, hyperaesthesia, irritability etc. 
This is followed by a phase of paralysis, involving loss of power of a wide group or muscle - some of which is only transitory, but the residual effect is seen in a flaccid paralysis + atrophy of groups of muscles. 
CEREBRAL TUMOUR: Can give rise to an upper motor neuron lesion + paralysis of groups of muscles, but usually indicates its locality by signs of brain irritation - eye signs: vomiting; headache etc. 
HYDROCEPHALUS: Can cause spastic paralysis of groups of muscle, with exaggeration of the deep reflexes but it is easily distinguished at birth by the huge head with separation of the cranial bones. These children usually die very early. 

TREATMENT OF LEG CONDITION: 
The patient was admitted on 1.4.46, and after the normal routine physical examination of the various systems, was operated on the following day: 
Anaesthetic Pre Med. 1/omopon. 1/100 Hyoscine. Surgeon Mr. Mercer. 

LENGTHENING OF TENDO-ACHILLES. 
Description of Operation: 
A 6" vertical skin incision was made along the medial margin of the Tendo-Achilles, down to its insertion into the calcaneous bone. Skin was retracted and synovial sheath of tendon exposed and incised. 
The tendon was then divided into Anterior and Posterior halves by a long lateral incision, vertically downwards. At the lower end, the anterior half of the tendon was detached and at the upper end the posterior half of the tendon was detached by transverse incisions. 
The Ankle joint was then manipulated backwards, to detach the other ankle joint ligaments and was then dorsi-flexed to a right angle. 

The/
PHOTOGRAPHS NO 1. Are postero-anterior and lateral X-ray views of the right wrist joint and hand, showing the removal of the proximal row of carpal bones and the position of the vitallium screw, running from the base of the 3rd metacarpal bone to the radius.
The two flaps of the Tendo-Achilles were co-apted at this new level and stitched together with linen thread.

Synovial sheath and skin were then stitched separately.

Plaster of Paris was then applied from the level of the heads of the metatarsal bones to below the knee with reinforcement of the longitudinal and transverse arches of the foot. A foot slab was then applied, extending 4" beyond the toes.

8.4.46 - Patient had a "walking-iron" applied to plaster and was discharged home.

22.5.46 - P.O.P. was removed and patient wore a special heavy shoe.

**TREATMENT OF ARM CONDITION.**

Patient re-admitted 30.6.46.

Operated on 9.7.46.

Anaesthetic Pre Med. 3/4 Omnopon. 1/150 Hyoscine. Surgeon Mr. Mercer.


**I. TÜFFEL'S OPERATION ON MEDIAN & ULNAR NERVES.**

A 6" skin incision was made down the anterior aspect of the right forearm along the midline.

By strong retraction of the Flexor Carpi Radialis, Palmaris Longus, Flexor Digitorum Sublimis, the ulnar and median nerves were exposed. N.B. the median nerve had to be dissected away from the back of the sublimus muscle.

Muscular branches arising from the median nerves, which were divided, were those going to:—

- Flexor Carpi Radialis; Palmaris Longus; and Flexor Digitorum Sublimis.

Similarly muscular branches of the ulnar nerve which were divided:

- Flexor Carpi Ulnaris; branch to medial half of Flexor Profundus mus.

All the muscular branches exposed were divided leaving the main trunks.

The skin wound was then stitched.

**Progress Notes:** The wound was very painful for a few days.

Physiotherapy started on the 7th day.

Stitches out on the 9th and 10th days.

**II. ARTHRODESIS OF RIGHT WRIST JOINT.**

Date:— 19.7.46.

Anaesthetic Pre Med. 3/4 Omnopon. 1/150 Hyoscine. Surgeon Mr. Mercer.


About a 4" vertical skin incision was made down over the lateral aspect of the dorsum of the wrist.

After reflection of skin, the Extensor Carpi tendons, the Extensor Digitorum, Extensor Digitorum Minimi, Extensor Indicis tendons were dissected off the bone and retracted to expose the carpal bones. The proximal row of carpal bones i.e. Scaphoid, lunate and triquetrum were removed and the proximal articular surfaces of the distal row of carpal bones - trapezium, trapezoid, capitate, and hamate,— were scraped, exposing good bare bone. Similarly the articular cartilage over the distal end of the radius was scrapped off. Good apposition could now be obtained between the radius and carpal bones.

Using an electric drill, a hole was made through the proximal end of the second metacarpal bone, capitate and distal end of the radius.

A vitallium screw was then inserted, holding the radius in position to the carpal and 3rd metacarpal bones.

The muscular tendons were then returned to place and skin incision closed.

P.O.P. was then applied to arm, with elbow joint almost fully extended and fingers straight, from above the level of the elbow joint down to the metacarpal-phalangeal joint line. Wrist joint was slightly dorsi flexed.
Progress Notes:

For several days following the operation, the patient had severe pain around the wound on the right wrist, and required omnopon: morphine: choralt nepenthe.

X-rayed 23.7.46 - showed good position.

39. 7.46 Under pentothal anaesthesia, P.O.P. removed and stitches were taken out. Fresh P.O.P. was re-applied. Re-X-rayed. Still pained with wound. Physiotherapy for fingers in plaster cast.

8. 8.46 Discharged home with P.O.P. on arm.

29. 7.46 Under pentothal anaesthesia, P.O.P. removed and stitches were taken out. Fresh P.O.P. was reapplied. Re-x-rayed. Still pained with wound. Physiotherapy for fingers in plaster cast.

8. 8.46 Discharged home with P.O.P. on arm.

2. 9.46 Plaster causing pain to patient, so was changed.

10. 10.46 Re-X-rayed. Condition very satisfactory.

12. 2.47 Satisfactory.

19. 2.47 Satisfactory.

16. 4.47 Satisfactory.

COMMENTS:
DEFINITION OF THIS CONDITION:

There is seen in this condition, a hypertonic state of groups of muscles, with an exaggerated spasm of the muscles concerned due to some lesion in the upper motor neurone tract. This causes a loss of the normal inhibition, with upset in the balance of excitatory and inhibitory impulses which controls normal voluntary movements. The reflexes of the limbs concerned are also found to be exaggerated.

Development of deformities is seen, because the lesion occurs early in childhood, with prevention of normal muscle structure growth and it is said, normal bone growth.

In this case, the condition was noticed from the early age of 18 months, and the final result being a partial hemiplegia i.e. the upper and lower extremities of the right side being affected.

AETIOLOGY OF THIS DISEASE:

The destructive lesion is found in the cerebral cortex — particularly in the motor area. Factors causing this destructive lesion has been classified according to the time of occurrence, during the development of the foetus and baby:

1. BEFORE BIRTH:
   a) Agenesis of nerve cells and so failure of formation of adequate motor pathways.
   b) Haemorrhage, due to Vitamin K lack in maternal blood stream.
   c) Syphilitic infection from maternal blood stream.
   d) Injury to pregnant uterus.

2. DURING BIRTH: said to be the commonest time.
   a) Prolonged and difficult labour with excessive moulding of foetal head.
   b) Trauma by unskilled use of axis traction forceps.
   c) In precipitate labour, with sudden moulding and release of foetal head - subarachnoid haemorrhage commonly occurs.

Damage to cerebral cortex and corpus striatum is frequently found.

3. AFTER BIRTH: the most common factors in this group are inflammatory conditions and their results:
   a) Infection disease (in U.S.A. 20% of cases are found following these diseases).
   b) Polio-encephalitis which occurs in epidemics.
   c) Cerebral Thrombosis or Embolism.

The lesion in these cases is more localised than that found in other causative factors.
This case probably falls into this group, because no history can be obtained of injury to pregnant uterus, difficult of precipitate labour etc., and also signs and symptoms would have been noticed before the age of 18 months.

In the history of this young woman, it is seen that when she was first treated for her condition, it was thought to be due to a "rupture of a blood vessel resulting in a hemiplegia". There could have been a rupture of a congenital aneurysm in the circle of Willis.

**PATHOLOGY of haemorrhage, which could have caused this lesion and condition.**

Congenital aneurysms occur most commonly in the vessels making up the circle of Willis i.e. Middle Cerebral, Anterior Cerebral, and arteries, at the bifurcation of one of these vessels. Reason for the artery rupturing at the point of bifurcation is not definitely known but two theories have been put forward as the likely cause:-

1) at the bifurcation of the vessel, there is seen to be absence of the normal muscle tissue of the media component of the vessel wall, and it definitely is a congenital defect.

2) a weakness at this point is caused by atheromatous change in the wall of the vessel.

The actual destruction of the brain tissue is caused by the haemorrhage into the brain substance, with clot formation, disintegration of tissue. The clot softens, liquefies and a cyst is formed by a glial sheath of astrocytes which collect around the clot.

Microscopically there is seen neurone destruction, nerve cell degeneration and degeneration of the motor pathways, particularly the lateral columns and Pyramidal tracts.

If haemorrhage is accepted as the most likely cause of the condition which is seen in this patient, its actual localisation is difficult to define accurately.

Lesions in the cortical region are seen most likely as a monoplegia, while further down the upper motor tract i.e. the Lateral Column, the lesion is also usually an ipsilateral monoplegia.

The lesion could probably have been in the Internal capsule, resulting in a contralateral hemiplegia involving the limbs of the opposite side.

The haemorrhage probably occurred in the region illustrated by the diagram, with involvement of the lower limb, trunk, and upper limb fibres.

This results in a flaccid paralysis which is followed by spastic paralysis - the time of recovery to this stage depending upon the severity of the lesion in the brain - the trunk is rarely effected because its movements are bilaterally represented in the cortex and hence they escape the paralysis. Complete recovery is rare.

Another interesting feature in this case is the slight mental retardation or deficiency which is quite a common feature in this disease. The modern explanation of this is that it is not due to any lesion in the brain tissue, but is due to:-

lack of normal sensory stimuli from the child's environment, because the parents are inclined to keep them in bed and hence stop any further possible development, both mentally and physically.
Possible means of treating Spastic Paralysis:

**NON-OPERATIVE TREATMENT:**

1. **MUSCLE RE-EDUCATION** - This method of treating spastic paralysis is of much value if the patient is seen early enough in its trouble, the child is of sufficient intelligence and the spasticity is not too severe. The patient is taught to use, and hence strengthen, the weaker muscle group by simple exercises and rhythmic movements. In the lower limb cases a P.O.P. can be applied with legs in the position of abduction for 8 - 12 weeks, and then braces or splints can be fitted to prevent the typical deformity of flexion at the knee and adduction at the hip joint. The apparatus is only removed in order to carry out the exercises and movement during the day. Unfortunately in this case, the condition was too well established with appearance of marked deformities before she came forward for treatment.

II. **MASSAGE** is of no value, apart from improving the tone of muscles after operation. In this case, passive and active movements were begun 2 months after operation when P.O.P. was taken off. But active movements of the fingers were carried out when P.O.P. was on her forearm and hand. This helped the patient greatly.

It is quite clear that the treatment of choice is non-operative, because operative treatment only corrects the established deformities or else prevents the formation of further deformities, and hence it is better to prevent the formation of deformities by non-operative treatment. But non-operative treatment of muscle re-education etc. must be commenced as soon as the child is capable of understanding what is required from it in the sense of co-operation.

Mental deficiency, as seen in quite a proportion of these cases, limits the chance of this type of treatment and hence in U.S.A. there are established special schools for this class of child. In these schools special attention is paid in preventing mental deficiency and physical deformities, with great success.

**OPERATIVE TREATMENT:** is divided into three main groups:

I) Operations on the muscles.
II) Operations on the nervous system.
III) Operations on the joints.

N.B. That operative treatment is contra-indicated if the mental defect is pronounced and also if the patient is suffering with Athetosis besides the spastic diplegia.

(The athetosis is due to the lesion being at the level of the Basal Ganglia and is seen clinically as a squirming movements of parts of the body affected).

1) **Operations on Muscles:** - In this case, a lengthening of the Tendo-Achilles was performed to relieve the Pes Equinus deformity, with some success. In other cases with marked flexion deformity of the knee, it is necessary to lengthen the tendon of semitendinosus and gracilis, using the Z-shaped cut. Similarly division of the adductor tendons (tenotomy) in severe adduction deformity at the hip, and also division of the tendon of Gluteus medius with persistent internal rotation of the hip joint, are sometimes necessary.

II) **Operations of the nervous system:** - **STREIFEL'S OPERATION** on the different nerves. This consists in dividing the motor fibres, supplying the spastic groups of muscles, with weakening of the spasm of contraction and hence paralysis.
Hence giving their opponents a chance to restore the balance of power between the opposing groups of muscle.

This patient had a Stöffel's operation performed on her in 1930 with, it is said, improvement of the condition of the leg.

This patient also had another Stöffel's operation performed on her right arm, with cutting of the ulnar and median nerves + branches, 9.7.46, with a good result.

Other operations of little value and rarely performed:-

1. HUNTER & ROYLE's operation of dividing the grey rami communicantes of the sympathetic nervous system.
2. FURSTERS operation of Posterior Rhizotomy, consisting in dividing the posterior spinal roots.
3. PUTAMEN'S - section of the Extra-pyramidal tract.

III) Operation on the joints:-
In this case, in order to stabilise and improve the function of the right wrist joint, an arthrodesis, using a metal screw, was performed. The wrist is now in the position of slight dorsi-flexion.

SUMMARY & PROGNOSIS:-
This young woman of 23 years, only came forward for treatment when her spastic lesion was well established, about one year ago. Although her condition was well recognised as shown by the fact that she had a Stöffel's operation for spastic paralysis 16 years ago, it was only when she began to have actual severe pain and difficulty in walking - of 13 months' standing - that she again came forward for treatment.

Now, 13 months after her operations, we find that:-

1. she has no pain on walking and nearly walks on the flat of her right foot, with much diminution in the elevation of her longitudinal arch. Her gait is more natural and there is definite improved function of her right leg, although her spastic characteristics are still noticeable.

2. she has no movement of her right wrist, which was arthrodesed to a position of slight dorsi-flexion (about 15°). There is almost complete movement of all her fingers and her grasping power is quite strong. But the thumb still remains adducted across the palm of her hand. On being examined for progress, she makes an effort and her right arm hangs naturally by the side without flexion at the elbow joint, and her fingers extended, but when she thinks that she is unobserved, there is a marked return of the old characteristic position of the arm with flexion at elbow joint, fingers slightly flexed etc. Functionally there has been improvement in her arm condition, but little in the appearance.

As regards future occupation or work which she could now perform satisfactorily, there is definitely more opportunity for her, but unfortunately her impaired mentality limits her to a certain standard of work, no matter how much her physical status has been improved by her treatment.

At her age of 23 years, no matter how skilful the treatment has been, there are always some residual deformity and impairment of function, because of the firm establishment of the condition, and the prevention of normal development of the part affected. Hence, as it should be in the majority of disorders affecting people, treatment should be begun as early as possible, and in this case, if treatment had been started in early childhood, conservative, with minor operative means, would have sufficed in correcting this deformity. This could have been carried out in a special school, where attention could also have been given to the mental development as well as the physical development of this young woman.
Case No. 2:

Case of CHRONIC OSTEOMYELITIS of the right Tibia.
HARRY MCCANDLISH, Aged 17 years.
37 Craigentinny Road, Edinburgh.

OCCUPATION - Apprentice-salesman and window dresser.

DATE OF ADMISSIONS - 7.10.45. 2.9.46.
DATE OF DISCHARGES - 1.11.45. 2.3.47.

COMPLAINT ON ADMISSION: 4.10.45.
1. Severe pain above right ankle for 5 days.
2. Feeling of weakness, nausea with shivering attacks.

PRESENT HISTORY: This boy first experienced a slight pain above his right ankle, and after receiving a kick on the right "shin", the pain became very much worse and was not relieved by poultices nor salicylate drugs. The pain increased in severity until it was about intolerable for the patient, and was now situated on the medial aspect of the lower third of the right leg. It was severe and throbbing in character with occasional exacerbations and it did not radiate in any direction. There was no suggestion of a "flitting" nature of the pain.
Patient had no cough, sore throat, nor pain in the chest, nor any other symptoms. (No trouble with water etc.). No history of boils, carbuncles etc.

FAMILY HISTORY: Nothing of any significance relating to this case was obtained from the patient.

EXAMINATION: This boy on examination was well nourished looking, but appeared very toxic with a flushed and perspiring face.
Temperature 101.4°F. Pulse 102/min.

Tongue was furred and dry.

AFFECTED JOINT - On inspection of the right ankle region there was seen a small, but almost healed laceration over the medial aspect of the right ankle joint. Lower end of right tibia and joint was distinctly swollen and suggested the presence of an effusion. The overlying skin was not red, but on palpation there was a local rise in temperature.
On palpation, there was marked tenderness overlying the lower end of the tibia, which continued downwards over the medial aspect of the ankle joint. Movements of the ankle joint were limited, because of the pain.
Nothing abnormal was detected on examining the other joints in this boy's lower limb.
When the upper end of the right tibia was tapped it caused pain in the lower aspect of the leg.

CARDIOVASCULAR SYSTEM:
- Pulse - 102/min. Regular in rhythm and force.
- Apex beat - very diffuse.
Heart sounds very loud, but were closed.

RESPIRATORY SYSTEM:
- Respiratory rate 28/min.
- No other abnormality detected.

ABDOMINAL EXAMINATION:
- No renal tenderness nor swelling detected.
- No abnormalities seen.
7.10.45.

**DIFFERENTIAL DIAGNOSIS:** This condition was distinguished from:-

1. **Acute Pyogenic Arthritis:**
   This condition also gives rise to features of a generalised acute infection, but on examination of the joint proper, the tenderness is usually limited to the joint capsule with a more marked limitation of movement, and the joint effusion usually occurs just after the beginning of the onset of the acute arthritis.

2. **Acute Rheumatism:**
   In this condition, there is pain and tenderness over more than one joint with the pain being very characteristically "flitting" in type and usually relieved by salicylates. The onset of this disease is more gradual with the general features of a slow toxemia, rather than an acute infection. Effusion or swelling of the joint also occurs in acute rheumatism, with a red, glazed skin and a local rise in temperature.

3. **Cellulitis:**
   Involves the cellular structures, and therefore the absence of localised swelling or tenderness overlying a bone is diagnostic. Pain is less intense with the features of an acute infection, being much less severe.

4. **Erysipelas:**
   There is a bright scarlet red colouration of the skin with raised margins of the infected area. Pain and the general features of infection are much less severe.

**TREATMENT:**

4.10.45. The patient was put to bed with his right leg elevated and immobilised between sandbags.

He was started on a full course of penicillin of 100,000 units daily intra-muscularly and a full course of sulphonamide, of 30 Gms. total.

Next day the boy's right leg was encased in a skin-tight plaster and because of his great pain was given full doses of sedatives:-

Morphone 1/6 - 1 gr. Pethedine 50 mm. etc.

The pain continued to be very severe and therefore drainage of the subperiosteal abscess was decided on.

7.10.45. **DRAINAGE OF SUBPERIOSTEAL ABSCESS.** Surgeon-Mr. Simpson:

Anæsthesia Pre-Med. 1/4 Omocon. 1/75 Atropine.

During op. Oxygen: Ether.

A small vertical incision (about 10 cms. long) was made over the lower end of the right tibia. On incising through the periosseum a large subperiosteal abscess was found.

Underneath this, there was discovered by drilling, a small cavity, whose outlying bone was chiseled away to expose the cavity, which was cleaned out and packed with gauze. The skin incision was partially closed and after dressing the leg was encased in a tight plaster.
PHOTOGRAPH No 2. Is an antero-posterior X-ray view of the lower aspect of the right tibia and fibula, showing the characteristic pathological changes of chronic osteomyelitis. These changes are seen as areas of general decalcification, actual bone destruction, formation of involucrum and also sequestrum formation which is seen as well defined areas of dense and necrotic bone, in the lower third of the right tibia. This X-ray was taken before the radical excision operation of diseased bone had taken place.
This made the patient more comfortable, but he still required hypnotics.

The temperature settled down two days after the operation and the pain began to diminish in severity. The pain disappeared 12 days after his operation and the boy's condition was very much improved with normal temperature and pulse.

33.10.45. The vaseline gauze pack was removed and the wound looked clean. Was X-rayed: Report

The Right Leg: There is a defect on the antero-medial aspect of the lower aspect of the right tibia, which suggests operative procedure. At this level there is new sub-periosteal bone formation and a soft tissue swelling, below which the tibia shows irregular osteoporosis. Has the appearance of acute osteomyelitis.

This boy's condition improved with almost complete and satisfactory healing of the wound and he was discharged for convalescence to Astley-Ainslie Institution on 1.11.45.

By 16.1.46 this patient's general condition had improved greatly with a B.S.R. 37 mm/hour, but he was still having a slight discharge through his partly healed wound.

This discharge from a small sinus continued for 3 months and the patient was re-X-rayed.

Report stated that - in the lower aspect of the right tibia there was evidence of osteomyelitis with sequestrum formation.

On the accompanying positive photograph of the X-ray there can be seen osteoporosis, with new bone formation, parallel to degenerated cortex, which is not complete, and also evidence of necrotic bone sequestration.

This patient was examined periodically but the discharge persisted and hence he was re-admitted on 2.9.46.

EXAMINATION ON ADMITTANCE 2.9.46.

The boy was in good health (Temperature 97.4°F. Pulse rate 86/min.) but a small discharging sinus was seen from an oval scar over the junction of the middle and lower thirds of his right tibia.

A course of penicillin 50,000 units 4 hourly was begun and the sequestrum formation was confirmed by another X-ray (9.9.46). A radical resection of the infected bone was decided upon.

10.9.46. Operation. Surgeon Mr. Porter.

Radical Treatment of Chronic Osteomyelitis.


A tourniquet was applied to the thigh of the right leg and complete excision of all the old scarred skin with the sinuses was carried out, over the distal aspect of the right tibia. The tibia was exposed and all affected bone was removed, leaving only a very thin shell of bone on the medial part of the tibia (about 4" thick). This newly formed cavity was then grafted with Thiersch grafts and after a compression dressing had been applied, the leg was put up in plaster.

Pus from the osteomyelitic cavity was examined bacteriologically and it contained Staphylococci Pyogenes (aureus) on culture.

This boy's temperature rose to 99°F for the remainder of the day of operation and the following day, but then settled down to normal.

On X-ray it was reported that there was extensive excision of diseased bone, leaving a thin shell of bone on the medial aspect.
ETIOLOGY:

Osteomyelitis can arise or result from two main origins or routes:

HEMATOGENOUS infection (blood borne) - is usually found in children and adolescents i.e. those with growing bones, and very rarely in adults, in which the condition is very much less acute. The commonest infecting organism is the Staphylococcus Aureus (80%) but other organisms do give rise to osteomyelitis e.g. Staphylococcus Albus; Streptococci Pyogenes; Pneumococci (especially in infants and young children) etc. Staphylococcus Aureus often enters through the skin and invades the blood stream. Site of infection may be a "boil" or throat or teeth infections.

Trauma is not likely to predispose to this condition because trauma in this age group of youth is very common without osteomyelitis ever/

HEMATOGENOUS origin is seen in children and is due to infection of blood borne organisms, for example, Staphylococcus Aureus, Streptococci Pyogenes, and Pneumococci. The infection often enters through the skin and invades the blood stream. Site of infection may be a "boil" or throat or tooth infections.

DEFINITION OF OSTEOMYELITIS: Means that there is an inflammation of the soft parts of the bone i.e. the medullary cavity contents, the haversian canals and the periosteum. The calcified portion of the bone is only affected secondarily to the alteration of the bloody supply to the area. When there is an increase in the blood supply (hyperemia), this is followed by decalcification and osteoporosis. This is well seen in acute osteomyelitis; if there is a decrease in the circulation this is followed by osteosclerosis; and if there is a complete loss of the blood supply, this is followed by bone necrosis, giving rise to sequestrum formation, as seen in chronic osteomyelitis. (Leriche and Policard's explanation of bone pathology and physiology.)
ever following it. But it is of importance for localisation of the infection, once the septicaemic stage has occurred.

Probably this boy McCandish belongs to this group, because of his age and also because of the causative organism being Staphylococcus Aureus.

2. NON-HEMATOMGENOUS in which there is:-

I) infection from without e.g. compound fracture, gunshot wounds etc.

II) infection by extension from a focus e.g. an infected tooth giving rise to osteomyelitis of the mandible etc.

It is found that boys are more likely to develop osteomyelitis than girls (ratio 4:1) and that the incidence of osteomyelitis is declining.

PATHOLOGY:

In hematogenous osteomyelitis, the infection usually begins in the metaphysis of a long bone, because it is said that although this region has a very rich blood supply, the blood vessels (branches of the nutrient artery) end in sharp "hair-pin" bends, in which the bacteria are easily arrested. Another theory (Hobbs) states that it is due to lack of active phagocytes in the region of the metaphysis.

Abscess formation occurs and then the pus spreads:

1) along the medullary cavity

outwards to the cortex, where it collects under the periosteum and runs down underneath, to enter the medullary cavity at a lower level, through the Volkmann's canals. This lifting off of the periosteum diminishes the blood supply from the periosteal vessels, and with thrombosis in the blood vessels due to pressure by the inflammatory swelling, there is complete cessation of blood flow to particular areas of bone which results in bone necrosis, and sequestrum formation or "separation of the dead bone from the living bone".

Once the infection begins to settle down, the osteoblastic layer of the periostium which has survived the infection becomes active and the osteoblast cells form new bone which is laid down parallel to the old, diseased bone on the surface and this is called the INVLUCRUM or new covering. This involucrum is perforated at irregular intervals by passages of CLOACA, through which the pus of the marrow passes. This process can become CHRONIC in which small cavities become surrounded by dense and sclerosed bone, because of the diminution of the blood supply to the area. These areas being called BRODIE'S ASSESSSES. Sequestration is also evident with small, sclerosed pieces of bone lying free in the new bone, owing to the action of the osteoclasts or bone phagocytes.

Relation of Symptoms to the underlying Pathology:

1. Intense throbbing pain - this is due to the marked increase of tension in the Haversian canals and within the cancellous spaces, because of the swelling of the inflammatory process.

2. Joint swelling and effusion - is uncommonly due to an acute arthritis of the joint by infective spread through the epiphysis (along the epiphyseal vessels), because on examination by aspiration the effusion is usually found to be sterile and serous. It is probably of reflex origin and is called a "SYMPATHETIC EFFUSION".

3. The features of a septicaemia - pyrexia, malaise, etc. is due to the passage of infected material or organisms from the medullary sinusoids into the veins. (N.B. that pyaemia used to be quite frequent, because septic thrombi also used to pass into the venous system and lodge in other bones, lungs, pleurae and pericardium, setting up conditions like broncho-pneumonia, pleurisy, pericarditis, etc.)
DISCUSSION ON THE TREATMENT OF OSTEOMYELITIS.

The management of osteomyelitis consists of treating the various pathological stages through which this disease progresses:

1. Stage of Septicaemia; in which there is pyrexia, tachycardia, delirium etc., without any signs or symptoms of localisation of the infection, although rarely the primary focus may be seen as a boil. The treatment of this stage is by chemotherapeutic drugs, which must be started immediately on diagnosis of the condition. This should control the septicaemia, clear up the primary focus and may prevent metastases, depending upon such factors as the organism, chemotherapeutically sensitive, adequate doses of the drugs are used, the treatment is started at once and is prolonged.

The two main chemotherapeutic drugs used are:-
a) Penicillin in doses of 100,000 units per day, either intramuscularly or by a continuous drip. This should be continued for at least 10 - 14 days.
b) Sulphathiazole - particularly in cases where the infecting organism is the Staphylococci. This can be given orally as 2 Gms. followed in 4 hours by another 2 Gms., and then followed every 4 hours by 1 Gm. can be given intravenously, using special intravenous preparation dissolved up in 10 ccs. of distilled water. Sulphathiazole must be accompanied by large quantities of fluids and alkalines. (These doses are for adolescents and adults.)

2. Stage of Metaphyseal Localisation; is indicated by tenderness and pain over the end of a long bone with joint effusion sometimes, and with a local rise in temperature of the overlying skin. The septicaemia continues and may become worse with delirium and coma. This is the stage in which the boy McCandlish was admitted. The treatment consists of:
   I) continuing chemotherapy
   II) and immobilisation of the affected part, by means of sand bags, plaster casts.
   III) sedation for the pain.

Spread of infection must be prevented by absolute immobilisation with lymph stasis, muscle and bone stillness etc. by means of plaster casts, splints etc.

3. Stage of Subperiosteal Abscess formation; is indicated by the appearance of a tender and fluctuant swelling over the affected region. Treatment is directed towards relieving the tension by evacuation of the abscess, using:-
   I) Starr's method of metaphyseal drilling. The periosteum is incised and the abscess evacuated. A series of oblique drill holes is made downwards towards the epiphysis, in the affected area, and drainage occurs through these holes.
   II) Gutter operation, which consists of relieving the subperiosteal abscess and then chiseling out a gutter of bone overlying the affected metaphyseal lesion. The cavity is packed with vaseline gauze and the limb immobilised by means of plaster etc. This was carried out in this patient's case, 3 days after admission. Modifications of this operation are used, and they consist of adding bacteriophage solutions (Albee's); chemical solutions of picric acid and CaCO3 (Stewart's) etc. to the cavity from which all affected bone has been removed before dressing it with vaseline gauze etc.

These patients should have a carefully organised convalescence with a correct diet (high protein content, high vitamin intake etc.) and blood transfusion is, often, very beneficial. Immobilisation usually lasts for at least 6 weeks.

4. Stage of Chronic Osteomyelitis with sequestrum formation.

Separation of dead bone is seen on periodic X-ray examination, and usually can be felt by probing. Sequestrectomy is carried out as early as possible after the original operation, but only once the sequestrum is lying free, which usually takes about 3 - 4 months.
If sequestrum formation re-occurs with persistent discharge through a small sinus, radical treatment with obliteration and sacuerisation of cavity is necessary and should not be postponed for too long a time before this operation is decided upon. This was carried out on Harry McCandlish, with the removal of all affected bone, a small margin of healthy bone and sacuerisation of the edges of the cavity. In this operation, because the whole of the diseased and scarred skin had been excised, the cavity surface was skin grafted using Thiersch grafts taken from the thigh. The Thiersch grafts are then gently packed down by vaseline gauze, cotton wool and careful bandaging.

The leg is very carefully immobilised because of the danger of a pathological fracture through the weakened site of bone. Instead of using skin grafts for filling up the cavity, a pedicled flap of muscle, with a broad base plus a good blood supply, is turned down into the cavity. The sartorius muscle is commonly used for obliterating cavities in the tibia.

Once healing has taken place, it is possible to restrengthen the bone at its point of weakness by means of a bone graft and this it is hoped will be performed on this patient in the near future.

If the chronic condition of osteomyelitis does not respond to the above treatment, and the sinuses persist for years, amputation of the affected limb should seriously be considered. Amputation is always followed by a marked improvement in the general health and happiness of the patient.

PROGNOSIS AND SUMMARY OF THIS CASE.

This case illustrates well, how persistent, and damaging both to the general health and economically, this condition of osteomyelitis proves to be.

Although intensive treatment was started (4.10.45) 4 days after the recognised onset of this disease, in the form of chemotherapy using maximum doses of both penicillin and sulphathiazole (Staphylococcus Aureus is sensitive to both), operative drainage and absolute immobilisation, a persistent discharge resulted with sequestrum formation. This discharge continued for 11 months until a radical resection of the diseased and necrotic bone was carried out, along with another course of penicillin, lasting 29 days. Thiersch skin grafts were applied to the cavity and had not taken, the others were replaced by fresh Thiersch grafts and the wound dressed periodically for several months. But the wound did not heal completely and a further small resection of diseased bone was carried out, after 6 months. Since then the wound has healed and is now quite dry (17.3.47) after 17 months intensive treatment. During this period this patient had spent about 4 months at convalescence, with marked improvement in his general health.

With the various courses of penicillin and sulphathiazole a bacteriostatic level must have been built up and maintained for varying periods of time (14 - 29 days etc.) but even so infective food must have persisted, without being affected at all by the chemotherapeutic agents. Chemotherapy definitely has a most striking beneficial effect in septicaemias etc., but once localisation occurs in the bone, its effect is less striking and the results by using it are not so easy to foretell. Chemotherapy has very definitely reduced the fatality of this disease - especially the ACUTE ULTIMATING type of osteomyelitis, but the chronicity of this disease is not reduced, in most cases, to any great extent by the use of these drugs.

In this case, if the wound continues to remain healed without discharge, there will have to be another operation performed, consisting of introduction of a bone graft to reinforce the very weakened tibia. With this operation and if the disease has really been eradicated, the prognosis for this boy is excellent, because the treatment has prevented any secondary lesions occurring and further treatment can strengthen the local lesion. But if infection is still present locally in the distal aspect of the right tibia, the prognosis is less pleasing because there is left a mere shell of the bone at this level and any further damage or removal of this area will result in a pathological fracture and hence this would have to be treated by amputation and the wearing of an artificial limb.
Case No. 3.

Case of OSTEARTHITIS of the right Hip-Joint.
MRS. JESSIE GRANT, Aged 69 years.
Cherry Grove,
Grantown-on-Spey.

OCCUPATION - Housewife, but also runs a boarding-house for summer visitors with much heavy domestic work.

DATE OF ADMISSION - 5.12.46.

COMPLAINT - 1. Movements of hip joints cause severe pain.
2. Stiffness and actual limitation of movements of both hip joints.

HISTORY: This woman had a bicycle accident 7 years ago, which caused an ache across the small of the back and in the right hip joint, for a few days. Since then for the last 6 years, this ache has occasionally reappeared and was of a more severe character. But, for the last year, this patient has been unable to walk or cycle without causing some pain in her hip joints - particularly in the right hip. She found that to begin with cycling caused much less pain but now both forms of exercise cause severe pain in her hips, down the legs, and also in the left ankle region. Recently, whenever the patient turned over in bed, this pain was sharp and severe enough to wake her up.

Mrs. Grant also complains that she experiences great difficulty in climbing stairs etc. because of "stiffness" in her joints, besides the actual pain.

PREVIOUS - About one year ago, this patient was X-rayed for "stomach trouble", but it was found negative. The stomach trouble consisted of pain, flatulence and loss of appetite.

Six months ago had a "sympathectomy" in Perth Infirmary, on the right side, for coldness and cyanosis of her skin on the toes of her right leg. Has had no trouble with this since then. Before her accident 7 years ago she never had any trouble, like pain, limping etc., relating to her hips, of which she can remember.

FAMILY - Nothing of any interest relating to this case.

EXAMINATION: Healthy, well-built woman who is not obese. Is of average intelligence, but appears over anxious and very worried about her condition.

RIGHT LOWER LIMB -
No shortening and no muscular wasting at mid-thigh or mid-calf levels.
Nelaton's line passes just below the tip of the Great Trochanter.

Hip Joint: Limitation of flexion, and on forcibly flexing the left leg against the abdomen there is some flexion of the right leg, when the lumbar vertebrae is flat against the examiner's hand. (Thomas' hip flexion test).
Marked limitation of extension.
Marked limitation of abduction, but some adductor present. External and Internal rotation limited.
All movements accompanied by pain, but no crepitus.

KNEE JOINT: Movements present without any abnormality noted.

ANKLE JOINT: Movements present without any abnormality noted.
None of the joints are swollen nor tender.

LEFT LOWER LIMB -

Hip Joint: There is limitation of all movements, but not so marked as found in the right hip joint and the pain on movement is much less.
External and Internal rotation are markedly limited.
PHOTOGRAPH NO. 3. Is an antero-posterior X-ray view of the right hip joint, showing disappearance of joint space, sclerosis of the articular bone surface, and definite osteophyte formation at the margins, which is typical of advanced osteoarthritis.
DIFFERENTIAL DIAGNOSIS:

This condition of osteoarthritis is easily diagnosed by the characteristic onset, and progress of the symptoms (pain and stiffness etc.), physical examination result of limitation of all movements, and most definitely by the typical X-ray appearance of the joints, but the following diseases should be remembered and considered:

OTHER JOINTS: Full range of movements obtained.
None of the joints are swollen nor tender.
No displacement of the Great Trochanter is evident.

CARDIOVASCULAR SYSTEM:

Apex beat within mid-clavicular line in the 5th left intercostal space.
Heart sounds closed in all areas.

For the last year, apart from an occasional head "cold", this patient has felt well and on examination appears to be physically fit apart from her hip disorder.

No abnormalities detected in other systems.

X-RAY EXAMINATION OF THE PELVIS:

There is disappearance of the normal joint space, with degeneration of the articular cartilages. The bone surfaces in apposition are sclerosed and condensed, but deep to these sclerosed surfaces, the bone shows signs of degeneration and osteoporosis, with, as yet, no disappearance of the normal amount of bone substance.

At the margins of the articular surfaces, osteophytes are clearly visible, as bony outgrowths. These pathological changes are seen in both hip joints but most marked in the right hip joint. Typical appearance of advanced osteoarthritis.

X-RAY EXAMINATION OF THE UPPER LUMBAR VERTEBRAE:

Between the 12th Thoracic Vertebrae and 1st Lumbar Vertebrae, evidence of osteoarthritis is seen in the form of bony outgrowths or osteophytes, some sclerosis of the articular bone surface with the beginning of underlying bone degeneration.

DIAGNOSIS:

In this case there is advanced osteoarthritis of both hip joints, which is especially marked in the right hip joint. It is a chronic arthritic condition in which there are pathological changes involving both cartilage and bone, with new bone formation at the margins of the affected bones.

Reasons for diagnosis:-

1. Characteristic symptoms of pain and stiffness, which were associated in appearance with injury to her hip. These symptoms have gradually become more severe, taking several years to become incapacitating.

2. On examination 1) there is limitation of range of movements which is accompanied by pain.
   II) no other joints involved in hands, nor legs etc.

3. On X-ray examination - there is seen the very characteristic picture of disappearance of articular cartilages with closure of normal joint space; sclerosis of articular bone surfaces; some osteoporosis of underlying bone and the presence of osteophytes in both hip joints.

THE ANTENNAE:

THE PERIPHERY:

THE MUSCLES:

THE JOINTS:

THE SACROILIAC JUNCTION:

THE CARDIOVASCULAR SYSTEM:

Apex beat within mid-clavicular line in the 5th left intercostal space.
Heart sounds closed in all areas.

For the last year, apart from an occasional head "cold", this patient has felt well and on examination appears to be physically fit apart from her hip disorder.

No abnormalities detected in other systems.

X-RAY EXAMINATION OF THE PELVIS:

There is disappearance of the normal joint space, with degeneration of the articular cartilages. The bone surfaces in apposition are sclerosed and condensed, but deep to these sclerosed surfaces, the bone shows signs of degeneration and osteoporosis, with, as yet, no disappearance of the normal amount of bone substance.

At the margins of the articular surfaces, osteophytes are clearly visible, as bony outgrowths. These pathological changes are seen in both hip joints but most marked in the right hip joint. Typical appearance of advanced osteoarthritis.

X-RAY EXAMINATION OF THE UPPER LUMBAR VERTEBRAE:

Between the 12th Thoracic Vertebrae and 1st Lumbar Vertebrae, evidence of osteoarthritis is seen in the form of bony outgrowths or osteophytes, some sclerosis of the articular bone surface with the beginning of underlying bone degeneration.

DIAGNOSIS:

In this case there is advanced osteoarthritis of both hip joints, which is especially marked in the right hip joint. It is a chronic arthritic condition in which there are pathological changes involving both cartilage and bone, with new bone formation at the margins of the affected bones.

Reasons for diagnosis:-

1. Characteristic symptoms of pain and stiffness, which were associated in appearance with injury to her hip. These symptoms have gradually become more severe, taking several years to become incapacitating.

2. On examination 1) there is limitation of range of movements which is accompanied by pain.
   II) no other joints involved in hands, nor legs etc.

3. On X-ray examination - there is seen the very characteristic picture of disappearance of articular cartilages with closure of normal joint space; sclerosis of articular bone surfaces; some osteoporosis of underlying bone and the presence of osteophytes in both hip joints.

DIFFERENTIAL DIAGNOSIS:

This condition of osteoarthritis is easily diagnosed by the characteristic onset, and progress of the symptoms (pain and stiffness etc.), physical examination result of limitation of all movements, and most definitely by the typical X-ray appearance of the joints, but the following diseases should be remembered and considered:-
PHOTOGRAPH NO 4. Is an antero-posterior X-ray view of the right hip joint, after the cup arthroplasty, showing the position of the vitallium cap over the stump of the femoral neck and in the acetabulum.
1. TUBERCULOSIS OF THE HIP JOINT - most commonly occurs in young children (3 - 7 years) but it has been recorded in adults; the joint lesion usually being secondary to some distant focus of infection and being carried there by the bloodstream. There is pain with a protective limp, but the disease is mono-articular and the X-ray appearance of marked bone destruction, especially of the acetabulum, pathological dislocation of the femoral head etc., and the presence of the primary focus clearly differentiates this condition from osteoarthritis.

2. CHARCOT'S JOINT - "A neuropathic arthropathy" arising as a complication of a syphilitic or other spinal cord affection and usually involving the large joints of the lower limbs e.g. hip, knee (most commonly this joint) and ankle. Is differentiated by the quick onset of swelling of the joint, with destruction and disorganization of the joint mechanism so that it can be moved excessively in any direction and there is no pain associated with it.

3. OTHER FORMS OF CHRONIC INFECTIVE ARTHRITIS - could be due to such organisms as streptococci; gonococci etc. If this form persists, due to a low grade infection, features like pain and especially stiffness are found, because of the fibrous adhesion formation, but there is little other resemblance to this condition of osteoarthritis, especially when the X-ray appearances are considered.

**TREATMENT:**

On 29.10.46 this patient had both hip joints manipulated. The procedure being:— under anaesthesia (Pentothal I.V.) both joints were moved through their full range of movements, the pelvis being controlled by an assistant. This temporary helped the condition with less pain and stiffness, but it soon returned to its incapacitating state of severe pain on any movement and stiffness in both joints. Operation was then decided on and after 3 days rest in bed, during which time the patient was examined routinely, the operation was carried out.

**CUP ARTHROPLASTY OF RIGHT HIP JOINT.**

Date:— 10.12.46. Surgeon:— Mr. Mercer.
Anaesthetic Pre-Medication 1/1000 Omnopon. 1/20 Hypostine.
During Operation Pentothal: Oxygen: Ether.
Operation Details:—

The right hip joint was exposed using the Smith-Petersen incision i.e. the skin was incised along the anterior aspect of the iliac crest and vertically downwards for about 12 cms. on the front of the thigh. The Sartorius and tensor fascia lata muscles were defined and by strong retraction, separated. The exposed gluteal muscles were then separated from the ilium by blunt dissection to expose the capsule of the hip joint in front and above.

After opening the capsule, a large part of the affected head and neck along with the osteophytes were removed.

The vitallium cup was then inserted over the stump of the partially removed neck; the cup being positioned in the acetabulum.

The capsule was closed with stitches, the sartorius and tensor fascia lata muscles being allowed to return to their normal position and the skin incision closed with the usual skin sutures.

After a firm hip spica bandage over dressings and cotton wool had been applied, the right leg was fixed in an Internal Rotation position with some slight traction in a Thomas Splint.

Note that the size of the vitallium cup had been pre-determined by measurement on the X-ray plate.
AETIOLOGY:

1. CONSTITUTIONAL DEFECT: In the articular cartilage - has been blamed when the more likely conditions described above have not been found in association with this condition of osteoarthritis.

DEFINITION:

Osteoarthritis is a chronic degenerative arthritis, involving destruction of the articular cartilage, sclerosis or eburnation (polishing) of the articular bone ends, with hypertrophy of the margins of these bone ends, to form chondophytes and latterly osteophytes and sometimes osteoporosis of the underlying bone substance.

It is a "non-ankylosing" type of arthritis because neither fibrous union nor true bony union rarely occurs between the joint surfaces, even in the advanced and unchecked condition.

ARTIOLOGY:

This condition is most commonly found in males, over the age of 40 years. The onset is usually gradual, with little constitutional disturbance. It is found in other weight-bearing joints e.g. the knee, vertebral, sacro-iliac joints etc.

The actual reason why this disease should affect certain people and their joints, is not known, but certain predisposing factors or conditions have been recognised:

1. Any condition, altering the architecture of the articular surfaces of joints, is often followed by osteoarthritis. e.g. I) fracture of bones with mal-alignment of the neighbouring articular surfaces.

II) coxa vara in children (and the numerous causes of this condition).

2. TRAUMA - a) Gross trauma in the form of a fall or actual injury to the joint. The patient in her history gives details of a fall 7 years ago, but the condition is bilateral and probably has no relationship to the fall.

b) Mild trauma, but repeated - e.g. occupational strains (in agriculture workers - osteoarthritis is commonly found affected the vertebral or hip joints).

c) In form of undue, but continuous pressure on joint surfaces, because of postural deformities such as lumbar lordosis or overweight in women (this factor not present in this case.)

3. INFECTION OR TOXEMIA - either due to a generalised toxemia, or very low grade infection somewhere in the body, localising in the particular joint because of the presence there of some defect.

4. CONSTITUTIONAL DEFECT In the articular cartilage - has been blamed when the more likely conditions described above have not been found in association with this condition of osteoarthritis.
PATHOLOGY: This degenerative condition affects all the normal components of the joint:

THE CARTILAGE is affected first, with swelling and destruction of the cartilage cells, and a process of fibriillation or roughening of the matrix. The softened cartilage is gradually rubbed away to expose the underlying bone, but at the periphery of the cartilage—hypertrophy occurs (due to the better blood supply) of the cartilaginous cells which form excrescences called CHONDROPHIGHTES, which in turn become ossified to give OSTEOPHIGHTES.

THE BONE undergoes degeneration, rarefaction and osteoporosis, but on the articular exposed surface, there is a condensing and polishing (or Eburnation) process of the bone.

THE SYNOVIAL MEMBRANE— in the late stages of this disease it becomes fibrous and fatty with some small tags being scrapped off and these may become cartilaginous in structure and hence form loose bodies in the joint.

THE LIGAMENTS— also become degenerated and rupture easily.

RELATION OF THE SIGNS AND SYMPTOMS TO THE LESIONS:

a) Erosion and destruction of the cartilage causes much pain and hence there is a protective spasm of the muscles surrounding the joint, in order to prevent any movement between the eroded and "raw" cartilaginous surfaces. This patient complains of waking up during the night, because of sharp pain in her hip. This could be due to the protective spasm of the muscle passing off when the muscles relax during the patient's sleep. (This relaxing of the protective spasm with the appearance of sharp pain in the affected joint is particularly common in young children with T.B. joints resulting in them having a certain "night cry" associated with this symptom).

b) The limitation of movement is due to:-
1. Impingement of the osteophytes at the joint margins
2. Protective spasm of the muscles, as described above
3. Fibrosis and degeneration of the synovial membrane.

c) Any atrophy of the surrounding muscles, is mainly due to disuse and not to any toxemic reaction.

d) The distribution of pain down the leg is typical of sciatica and is due to some irritation of the sciatic nerve.

SURVEY OF METHODS USED IN TREATING THIS CONDITION:

Are best described under the following headings:

1. GENERAL TREATMENT—this aims at relieving the pain by rest in bed; reduction in outdoor activities; reduction of obesity if present; improving the health generally by eliminating obvious septic focus; use of analgesics (but otherwise drug therapy has no part in the treatment) etc.

2. LOCAL TREATMENT— in the form of Physiotherapy using heat, massage, diathermy (because the hip joint is so deeply-seated) or even short wave therapy and deep X-ray therapy. This localised treatment improves the metabolism and functioning of the joint generally, with relief of pain etc., but this improvement is only temporary and after a varying period of time the symptoms and signs reappear in a more severe form.

3. ORTHOPAEDIC TREATMENT—this includes:
   a) Manipulation— is limited usually to cases in which the symptoms are thought to be due to adhesions and capsular thickening without very marked bony changes. The process is carried out under general anaesthesia, and the joint is manipulated through its full range of movements; this being followed by active exercises and return to normal activities in a few days time. This was done to Mrs. Grant, with some relief of pain and increase in movement, but the improvement only lasted for a short time.
b) **Fixation in Plaster** - is used in cases where manipulation is contra-indicated and there is the possibility that rest will relieve the pain. A hip spica is applied down to above the knee and is kept on for 3 - 6 months and on removing it, some form of hip support should be worn for about a year. Movement is said to be often increased and there is relief of pain for a varying and indefinite length of time.

c) **Operative Treatment** - is indicated when the osteoarthritic changes are well established with cartilage and bone degeneration and also if there is no possibility of the above treatment relieving the condition. The actual type of operation is decided upon by considering what one hopes to achieve by the particular operation - e.g. is it to relieve pain in elderly people; or is it to restore function in younger persons; or is it to give a stable hip joint, without pain but with little movement etc.? The following operations have proved to be of value in treating osteoarthritis, but differ from one another in having different objectives:

1. **ARTHROPLASTY:** This was performed in this case and consists of partial removal and smoothing off of the affected femoral head and neck and replacing it with a vitallium cap. There is formation of new joint surfaces which become covered with a fibro-cartilagenous lining, allowing the head to move inside the cap and the cap to move inside the acetabulum. The use of the vitallium cap is quite recent and it replaces the use of a covering of fascia which was used previously to cover the raw femoral head, but gave poor results because of the instability and danger of further osteoarthritis.

The advantages of this operation are that there is restoration of movement in the affected hip, which is especially desirable in a young person with bilateral disease and also the time spent in bed is only about 10 weeks. After the operation begins a course of muscle re-education using crutches then sticks etc. The main disadvantage is said to be shock associated with the operation.

II. **ARTHRODESIS:** Using Brittain's method, or an extra-articular flap, fusion of the hip joint is obtained with loss of mobility, but resulting in a stable hip joint with definite relief of pain. Unfortunately with this type of operation, there is an increased strain thrown upon the lumbar vertebral joints, with the likelihood of osteoarthritic changes in those joints, especially in elderly persons, whose spines have lost the ability to compensate by increased vertebral movements.

III. **PSEUDARTHROSES** (Sir Robert Jones Method is still used) is performed in elderly subjects, who are suffering with osteoarthritic changes in both hips and also in the lumbar vertebral joints. There is obtained marked improvement in the range of movements, but the stability of the joint is diminished. The operation consists of an osteotomy through the femoral shaft and a removal of a portion of the femoral neck, with suture of the Great Trochanter to the remaining portion of the head. The upper end of the shaft of the femur now lies underneath the reformed but shortened femoral neck and Great Trochanter.

IV. **OSTEOTOMY (LORENZ'S)** - is simple and easy to perform with little shock and therefore is of value in treating elderly subjects. Relief of pain is obtained by bypassing the hip joint through displacing the osteotomised femoral shaft inwards against the pelvis wall below the acetabulum. Immobilisation for bony union to take place requires about 4 months in a hip P.O.P. spica, which is a disadvantage in elderly patients.
Summary of the above 4 operative methods:

<table>
<thead>
<tr>
<th>OPERATION</th>
<th>TYPE OF PATIENT</th>
<th>RESULTS &amp; ADVANTAGES</th>
<th>DISADVANTAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>RHROPLASTY</td>
<td>Young, with bilateral disease</td>
<td>Increase in range of movements.</td>
<td>Shock of operation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Short time immobilised.</td>
<td></td>
</tr>
<tr>
<td>RHRODESIS</td>
<td>Young, with the disease being due to trauma or deformity</td>
<td>Relief of pain.</td>
<td>Loss of all movements.</td>
</tr>
<tr>
<td>SKUD-ARTHROGIS</td>
<td>Elderly, with bilateral disease.</td>
<td>Increase in range of movement.</td>
<td>Unstability of the joint.</td>
</tr>
<tr>
<td>STETOMY</td>
<td>Elderly subjects.</td>
<td>Relief of pain, with little shock.</td>
<td>Time spent in bed of 4 months.</td>
</tr>
</tbody>
</table>

PROCNOGOSIS & SUMMARY OF CASE.

This most recent type of arthroplasty, using the vitallium cup, seems to be, from the theoretical aspect, the ideal way of treating this degenerative disease of the hip joint, because by forming a completely new joint surface, it restores almost completely normal function, relieves pain and maintains the stability of the joint.

Whereas in the other forms of operative treatment for the relief of the most cardinal symptom - PAIN - some feature has to be sacrificed e.g. movement is sacrificed in arthrodesis or osteotomy; stability in pseudo arthrosis: and although this sacrifice, in the elderly subject, is of little economic importance, in the younger age group it is a decided handicap.

But the success of this form of treatment, largely depends upon the co-operation and response of the patient in constantly performing active movements of the new 'hip joint' even though these exercises are associated with pain to begin with. Hence the patient's psychology should seriously be considered when any form of treatment, which requires much co-operation in the after treatment, is decided upon.

It is too early yet to judge whether Mrs. Grant has benefited from her treatment, which has now lasted for about 4 months. From the psychological aspect and the amount of co-operation in re-learning to walk again, and performing active movements, she has been disappointing, but even so, there is no reason, apart from this lack of co-operation, why this patient should not regain a sound and useful hip joint in the future.

It is difficult to prognosticate for this patient, because there has been few reports on follow-up results in this type of case on which to base one's opinions. The results of the older type of arthroplasty using a fascial covering, proved to be disappointing because of the development of instability of the joint, and the likelihood of further osteoarthritic changes, but these complications are unlikely to occur when a vitallium cup is used.

Just as Smith-Peteresen pinning has proved to be one of the most successful methods of treating a fracture of the neck of the femur, there is every possibility that arthroplasty using a vitallium cup, will prove to be one of the most successful methods of treating this very prevalent and incapacitating disease of osteoarthritis of the hip joint and other weight-bearing joints.
Case No. 4.

Case of RUPTURE of the MEDIAL MENISCUS in the right Knee-Joint.
JAMES D. KERR, Aged 23 years.
16 Seaview Terrace,
Joppa,
Edinburgh.

OCCUPATION:

DATE OF ADMISSION: 31.7.46.

COMPLAINT ON ADMISSION:
I) Pain on the inner side of his right-knee joint.
II) Swelling of his right knee joint.

PRESENT HISTORY: Three months ago, while playing rugby, the patient was tackled and held firmly by the right lower leg, while the upper part of the same leg, along with the body, was twisted inwards or clockwise. There was an acute pain in the joint and the patient fell to the ground and on attempting to stand, he found that he was unable to put any weight on the injured leg at all. After about 10 mins., he was able to continue and finish the game with hardly any discomfort. There was no sudden "locking" of the joint - i.e. the knee could be fully extended.

The next day the joint was very swollen and painful with some tenderness on the inner side of the right joint. The swelling, pain and tenderness disappeared in a few weeks.

Shortly after this while playing badminton, the patient suddenly twisted his right leg, and this caused a sharp and stabbing pain over the inner aspect again and afterwards the joint again became swollen. For the following three months he rested his right knee joint, but then on playing tennis, the same thing happened again with pain, and swelling of his right knee joint.

PREVIOUS HISTORY: Has had no illnesses apart from chickenpox.

FAMILY HISTORY: Nothing of any importance obtained.

SOCIAL HISTORY: An extremely fit young man, who does not smoke nor drink.

EXAMINATION:

RIGHT KNEE REGION:
The right knee was swollen, especially on the medial aspect, but there was no obvious wasting of the Quadriceps muscle, on comparing relative diameters with the left Quadriceps muscle.

On careful palpation - no tenderness could be elicited, even on pressure with thumb over anterior aspect of the medial cartilage, with slow extension of the knee joint.
Fluid could be displaced from side to side and a definite patellar tap was elicited.
No limitation of movement was evident and there was no antero-posterior movement.
With quick extension of the fully flexed knee, the foot laterally rotated, and the knee joint abducted, an audible "click" was obtained when the knee was flexed to about 130° (McMurray's Test).

X-RAY EXAMINATION - No bony abnormality present.

No other abnormalities were obtained on examining the other system.
DIAGNOSIS: In this case, there has been a rupture of the medial meniscal cartilage or meniscus of the right knee joint; the rupture probably being situated in the middle or posterior aspect of the cartilage; with effusion to the joint space.

REASONS FOR DIAGNOSIS:

1. From the history, the following features help in the diagnosis:-
   I) the twisting in a clockwise direction of the femur on the fixed lower right leg.
   II) the patient fell to the ground, and could not stand due to a feeling of weakness rather than a "locking" of the joint in a flexed position (which is usually found when the tear occurs in the anterior part of the cartilage).
   III) pain and tenderness on the inner side of the right knee joint.
   IV) the occurrence of similar attacks on any twisting strain being applied to the right knee joint - but never any locking.

2. From the examination findings:
   a) Evidence of effusion - fluid could be displaced from side to side.
      patella tap elicited.
   b) Evidence of medial cartilage damage, in the middle or posterior aspect
      - no tenderness on palpation over anterior aspect on extending leg
      - no limitation of movement
      - an audible click being obtained by extension of the flexed knee at about 130°.

DIFFERENTIAL DIAGNOSIS: the following conditions have to be considered if there is any doubt in the history or features:-

1. INJURY TO LATERAL MENISCUS: is rarer and the injuring strain occurs by outward or anticlockwise rotation of the femur on the tibia. Tenderness is elicited over the lateral aspect of the knee joint and on active full extension, in the last few degrees, the click is heard or felt. (McMurray's Test).

2. LOOSE BODIES: these give rise to acute pain with locking, but the locking usually lasts for a short time with the pain varying in position, depending upon the position of the loose body. A loose body may be palpable or visible on X-ray examination.

3. b) FRactures of the Articular Surfaces - following severe rotation strain, which results in a very swollen and painful joint.

   Both these are quite obvious on X-ray examination.

4. RUPTURE OF MEDIAL LIGAMENT: caused by an abduction strain with the leg extended. There is no locking, and tenderness is usually elicited over the medial ligament with increase in lateral movements of the joint.

5. RUPTURE OF CRUCIATE LIGAMENTS: caused by direct violence either driving femur backwards on the tibia (ANTERIOR LIGAMENT) or the tibia backwards on the femur (POSTERIOR LIGAMENT), or severe abduction or rotation strains. On examination there is increase in the antero-posterior movements on pressure FORWARD AND BACKWARD DRAWER SIGNS.

6. EXOSTOSIS, OSTEO-ARTHRITIS: (with enlargement of post-patellar pad of fat, which sometimes becomes nipped on extension, causing pain) can be diagnosed on X-ray examination and also true "locking" is not present.
TREATMENT:

It was decided to perform a medial meniscectomy and after a normal routine physical examination, the operation was performed on 2.3.47.

A Medial Meniscectomy.

Surgeon: Mr. Mercer.


A tourniquet was applied to the right thigh and the knee was flexed, hanging over the edge of the operating table. After carefully cleansing the skin of the knee with surgical spirit, followed by brilliant green antiseptic, a sterile muslin swab was draped over the joint. An oblique and straight incision was then made down through the muslin and skin, from the infero-medial aspect of the patella downward and medially for about 8 cms. to the upper edge of the tibia.

The skin incision was deepened, dividing the capsule and the synovial membrane, and with retraction the cartilage was exposed and it was found to be split along its whole length, with the medial part being displaced into the centre of the joint. Attachments of both the anterior and posterior horns were divided with a cartilage knife, and the complete, but torn cartilage was removed.

The synovial membrane and capsule were closed separately and the skin edges were then brought together. After dressings had been put on, a pressure bandage, consisting of layers of cotton wool with a firm bandage, was applied and then the tourniquet was removed.

On examining the removed medial meniscus - the rupture was found to be the typical "Bucket Handle" tear.

POST-OPTERATIVE TREATMENT:

The day after his operation, this patient began Quadriceps Exercises which consists of periodic and rhythmic contractions of the muscle with straight leg raising off the bed.

PROGRESS:

11.8.46. (9 days after operation), the stitches were removed, with the wound completely healed. Because there was still some fluid left in the joint, another firm pressure bandage was re-applied.

13.8.46. Patient was now ambulatory and was discharged with instructions to continue his quadriceps drill and to increase gradually his active movements of the joint.

30.9.46. Patient reported back, and on examination there was no limitation of flexion nor extension and there was no pain on movement. He has been progressively using his knee with gymnastics, running exercises etc.

?.11.46. This patient has now begun to play rugby again without any disability in running, quickly turning etc.

COMMENTARY.

ANATOMY OF THE MENISCI: They are two fibro-cartilages which are roughly semicircular in shape and cover the periphery of the two condyles of the tibia, and forming a closely fitting and accurate articulation for the femoral condyles. On section they are wedge-shaped, with the peripheral margins being thick, convex and attached to the capsule of the joint, and their central margins being thin, concave and without any attachments.

MEDIAL MENISCUS - is roughly "comma" shaped with the anterior form being the smaller of the two and the most mobile. The posterior horn is fixed through the capsule to the medial ligament of the knee.

LATERAL MENISCUS - is circular in shape, with both horns enclosed within the anterior and posterior horns of the medial cartilage. These two horns are just in front and behind the intercondylar eminence.

This cartilage is more freely moveable than the medial one, because its attachment to the capsule is prevented in one area by the popliteus tendon and its bursa sac.
Diagrams showing the various types of Cartilage Lesions.

Upper surface of left tibia with normal cartilages.

Complete displacement of whole Medial Cartilage.

Bucket Handle Tear (which was found in this case)

Central Transverse Tear

Tear of Anterior Horn.

Tear of Posterior Horn.
Functions of the Menisci:
1. To provide a closely fitting socket for articulation of the comparatively flat tibial surface with the rounded femoral condyles.
2. To assist in the "locking" movement of the knee joint.

Movements of the Menisci:

During extension of the knee joint, the cartilages tend to slide forwards and splay out to some degree whereas on flexion, they tend to slide backwards and close in towards the intercondylar eminence.

Movements of the Knee Joint:

The knee is a HINGE joint, with flexion and extension around a transverse axis, but in addition, at the end of extension, there is a change of axis with a rotatory movement inwards, resulting in a "locking" of the knee joint.

This is due to:
1) the extra length of the oblique anterior horn of the medial meniscus.
2) the shape and size of the medial condyle of the femur which although narrower and more curved reaches to a lower level than the lateral condyle.

During extension movement at the knee, the femoral condyles roll or glide upon the menisci, until all of the surface of the lateral cartilage has been used up (it being smaller), but there is still left the oblique portion of the anterior horn of the medial cartilage. To complete the use of this portion of cartilage, the femoral condyle continues to roll inwards and forwards, and with tightening of the medial and lateral ligaments, of the knee, the joint becomes "locked" or "screwed home".

Mechanism of Injury or Displacement of the Medial Meniscus:

With the knee joint flexed and abducted, the cartilage is drawn backwards and inwards towards the centre of the joint, and if the femur is now suddenly rotated medially or laterally on the fixed tibia, some portion of the cartilage will be caught in between the two bony surfaces and crushed.

On medial rotation: there is a tightening of the medial ligaments, which results in drawing medially the posterior and middle portions of the medial cartilage, besides steadying it. This leaves the free anterior horn most liable to be injured.

But if the medial ligament is torn off from the cartilage, by severe violence, the medial cartilage is allowed to slip in towards the interior of the joint, and if extension now occurs, the cartilage is ground between the bone surfaces. This grinding usually produces a longitudinal or BUCKET HANDLE TEAR. This was probably the mechanism behind the lesion found in this case.

On severe lateral rotation: with slight flexion of the knee, there is damage to the posterior part of the cartilage usually.

There can be several types of cartilage lesion - as shown by the diagrams on the opposite page.

The actual piece of the cartilage which is damaged depends upon:
1) the angle of flexion at which the injury took place
2) whether the strain was in the form of a severe medial or lateral rotation.

The characteristic "locking" of the joint in extension is due to a damaged portion of the cartilage becoming caught between the 2 bony surfaces.
INJURY TO THE LATERAL CARTILAGE.

Much less common, (1:5) because of its greater mobility, but severe violence either medial (antero-part) or lateral rotation (posterior part) with the knee flexed, causes tearing of this cartilage.

This form of injury is found most frequently in coal miners because of their position while working - knees flexed - and then sudden rotation strains. But it is also found in participants in most types of sport - soccer and rugby players (this patient received his injury while playing rugby) etc.

DISCUSSION OF TREATMENT OF CARTILAGE INJURIES.

For healing of tears in any tissue, a good blood supply is essential. In the case of cartilage, it is only at the periphery where this is found, the rest of the structure being nourished mainly by the synovial fluid. It therefore follows that the healing by fibrosis or granulation tissue can only occur in injuries in the peripheral vascular zone of the cartilage.

This type of injury can be treated by:

1. Reduction - the movement is similar to McHurray's test and consists of extending the flexed knee, with both lateral and medial rotation of the abducted leg. The patient should be able to extend the knee himself afterwards without pain.

2. Immobilisation - by means of a Jones Pressure bandage for about 14 days, with conscientiously performed Quadriceps drill.

3. Guarding against further strain when ambulatory by raising the inner aspect of the boot, and walking with the toes turned inwards, or even wearing a knee brace or support.

Recurrence is very likely, if any further strain is thrown on the knee in the course of work or play and hence this form of treatment is only of value for sedentary workers.

If recurrence takes place, the treatment of choice is definitely operative with removal of the whole cartilage because it is said that a new fibrous structure is formed from the synovial membrane, to take the place of the removed cartilage.

Complication following operation of removal of the menisci.

I. WEAKNESS OF THE KNEE JOINT: This is due to faulty post-operative treatment. If the Quadriceps is not exercised, atrophy quickly follows. This atrophy is partly due to disuse, but it is also reflex in nature, because the quadriceps muscle is prone to atrophy, with the evolutionary changes which have taken place in the posture of the man.

There are small muscular slips called Articularis Genu, which arise partly from the front of the fémur, but are also continuous with the Quadriceps fibres and one inserted into the synovial membrane. The membrane is drawn up by these fibres during extension of the knee joint. If atrophy of these muscular slips occur the synovial membrane is constantly nipped on extension and this causes synovitis, resulting in further Quadriceps atrophy.

Quadriceps exercises are simply:

1) Rhythmic and frequent tightening of the muscle, by pushing the knee back against the bed.

2) Raising the extended leg off the bed.

3) Raising the extended leg off the bed with a small weight over the ankle.

4) Raising the flexed leg with a weight over the ankle.

Before any operation or immobilisation of the knee, the patient should be instructed and practiced in performing the simple exercises, so that he can perform them satisfactorily after the operation etc.
II. **RECURRENT SYNOVITIS:** can be caused by nipping of the synovial membrane as described above, or it is more likely to be caused by a portion of the cartilage being left in the joint during the operation. If the diagnosis can be made that a piece of cartilage has been left in, operative removal of it should be attempted.

III. **OSTEO ARTHRITIS:** is only likely to occur if arthritic changes were already present before the operation.

**PROGNOSIS AND SUMMARY:**

The prognosis in this case is extremely good. This patient has made a rapid recovery of complete and normal function of his knee, so that he is now able to play complete games of rugby without any discomfort or weakness of his right knee. His rapid recovery for the most part has resulted from his very conscientious practice of the quadriceps drill and the performance of progressive and active movements.

This operation of meniscectomy is one of the most successful orthopaedic operations with perfect result being obtained in about 75% of all cases. In most cases of operative intervention, there is always some residual disability, but in this case we have the return of the patient to his work or sports, with no loss of function, nor any disability whatsoever.
Case No. 5.

Case of CONGENITAL DISLOCATION of the left Hip-Joint.
MISS ISA. BAIN,  
48 Blaney Crescent,  
Cowdenbeath.  
Aged 31 years. 

OCCUPATION: Domestic worker - requiring much walking about and bending movements of the hips. 

DATE OF ADMISSION: 26.4.46. 

COMPLAINT: Painful limp, on the left side, which has been troubling the patient for many years and is getting worse. 

HISTORY: PRESENT: For the last 2 years, this woman has been troubled with pain in the region of the left hip joint. It was at first slight and aching in character, but it has gradually become more severe, especially on walking any distance. Much walking causes considerable pain in her left hip region, but it is relieved by rest and it is not usually present on getting up in the morning. 

PAST: Since she was a child, this patient has always limped, with a lurching motion over to her left side, and although it was not painful nor caused much disability, at the age of 6 years she was manipulated and put into plaster. On two later occasions, the plaster was changed with alteration by manipulation of the original position. After this treatment, the limp was much less obvious, but it was still there. During her later life at school and adolescence, this limp had little effect on her doing well in all gymnastics and games. 

FAMILY: There is no previous history of any congenital conditions in any of her forebears. 

EXAMINATION: Pleasant healthy-looking woman, who has an intelligent interest in her condition. 

GAIT: When the patient walks, there is a definite lurch to the left side, downwards and backwards. Exaggerated Lumbo-sacral lordosis to a slight degree is seen. 

Left Leg is 1" shorter than right leg, and there is 1" difference in the corresponding circumferences on the thigh and the calf of the two legs (the left being less developed than right). 

The Greater Tuberosity on the left side is most noticeable and easily palpable. 

The fold below the buttock on the left side is much more oblique than on the right side. 

Trendelenburg’s sign was present on the left side – i.e. the pelvis tilted over and downwards towards the normal side, this is in this case, the right side. 

Telescoping – with the patient’s hip and knee flexed to a right angle, and downward pressure is applied to the knee, the femoral head can sometimes be felt gliding backwards and forwards on the ileum. This was NOT present in this case. 

Femoral pulsation less marked on the left side. 

MOUVEMENTS: 
Of THE RIGHT HIP - all movements normal and painless. 
Of THE LEFT HIP - all movements were painless. 

{ Flexion movement normal. 
Extension movement limited in amount. 
Adduction movement normal or slightly increased. 
Abduction movement definitely limited. 
Rotatory movements are limited.}
This fall of the gluteal fold is found in all cases where there is malfunction of the Glutei Medius muscle, and hence is found in cases of Acute Poliomyelitis, Coxa vara condition, etc.
It was not easy on palpation to discover the exact position of the displaced femoral head.

X-RAY: ANTERO-POSTERIOR VIEW.

The outline of the left femoral head is seen with an outward displacement of the femur. The neck of the head is markedly forshortened and there is some anteverision.

On examining SHENTON'S LINE (a line formed by continuing the curve of the lower border of neck of femur on to the upper border of the obturator foramen - one continuous curve normally) there is seen marked structural alteration of the relative position of the neck of the femur and the obturator foramen.

The acetabulum has less depth than normal - is flat with a little "cupping" appearance - but the head of the femur shows little upward displacement as would be expected in such an established case.

X-ray appearance is typical of that of Congenital Dislocation of the hip.

DIAGNOSIS: This is a case of unilateral Congenital Dislocation of the left hip because:-

1. Following factors in the history:-
   1) Complaint of unsteady gait with lurch to left side, since early childhood.
   2) Little pain to begin with, but after age of 15 years the pain became a prominent feature - the pain also being relieved by rest from weight bearing.

2. Following factors obtained on examination:-
   1) Characteristic "sailor's" gait on walking with some lordosis.
   2) Shortening of left leg and less development of muscles on the left side, in comparison with the right side.
   3) Prominent left Greater Tuberosity with oblique buttock fold on left side.
   4) Vascular sign + ve - femoral pulsation less marked on left side.
   5) Trendelenburg's sign - +ve. positive.

3. X-ray Examination:- most important feature in diagnosing this case. The features described above of displacement and deformity are very typical of this condition.

DIFFERENTIAL DIAGNOSIS of this type of lesion:-

1. COXA VARA - consists of two main types - acquired and congenital. Is defined as any condition in which there is a decrease in the normal angle (120° - 140°) between the neck of the femur and the shaft.

Differentiated from C-D-H by following points:-
   I pain begins earlier than 15 years, but limp is less marked.
   II "telescoping" is absent and abduction of the thigh is more limited.
   III by X-ray - head is in the acetabulum and is unusually translucent.
   - acetabulum is less deformed.

2. SUPPURATIVE ARTHRITIS OF INFANTS: This condition usually occurs in the very young (1 year old) and has a sudden onset of pyrexia, abscess formation etc. This is followed by arthritis and then dislocation in later life.

Basically differentiated from C-D-H by history and X-ray evidence:-
   I complete destruction of head and even part of neck of femur.
   II acetabulum is usually well developed without much destruction of substance.

Movements are usually abnormally free.
PHOTOGRAPH NO 5. Is an antero-posterior X-ray view of the left hip joint, showing the position of the vitallium plate in the Shantz's osteotomy. The typical features of C.D.H. are also seen:

1. Malformation and displacement of the femoral head upwards and backwards, in the secondary or false "acetabulum".
2. Foreshortening and deformity of the femoral neck.

Diagram of the vitallium plate used.
5. **PARALYTIC DISLOCATION**: Due usually to Anterior-Poliomyelitis, and hence characteristic history of fever, loss of muscle power. (This may be limited to the gluteal muscle groups and the still active adductors gradually dislocate the femoral head posteriorly). X-ray picture shows a dislocation, but the head and acetabulum are normal in appearance.

4. **CONGENITAL SHORTENING OF FEMUR**: In this condition shortening and "telescoping" are present but X-ray examination clearly indicates generalised shortening of the femur and the acetabulum and femoral head are usually normal.

**TREATMENT of this case:**

The patient was admitted on 27.4.46 and on examination was found to be very fit and suitable for the proposed operation. The patient was kept under observation for 5 days and was carefully X-rayed to determine the degree of deformity which existed.

A SHANTZ OSTEOTOMY, using a vitallium plate was decided on and hence, a special vitallium plate was prepared with 30° abduction and a 30° antiflexion angulation. (See diagram)

**Operation.** 3.5.46. 1200 hours. Surgeon - Mr. Mercer.

Anaesthetic. (Pre-Medication Omnopen gr. 3. Hyoscine gr. 1/150. (During operation Pentothal: Oxygen: Ether.

**Description.**

1. Patient with legs abducted to about 30° was placed on an orthopaedic horse.
2. The Left Greater Trochanter and a small area distal to it on the lateral aspect of the shaft of the left femur was exposed by an incision, 12.5 cms. in length, horizontal over this area, down through the Tensor Fascia Lata and Rectus Lateralis muscles which were retracted aside.
3. Left leg was then fully adducted.
4. Proximal limb of the vitallium plate was then screwed into position on to lateral aspect of shaft of femur, and just below Greater Trochanter, using 3 vitallium screws.
5. An osteotomy was now performed, using an electric drill across the shaft of the femur opposite or at the level of the 30° abduction angulation on the plate. It was completed by use of a small osteotome.
6. The shaft of the Left femur was abducted, until its lateral surface was in apposition to the distal limb, and after a slight degree of external rotation had been obtained, it was screwed into place with 2 vitallium screws.
7. The wound was then closed using horse-hair and smaller sutures alternating. After cotton wool padding in the form of bandages and pads had been applied to likely "pressure sore" areas (iliac spines; round waist etc.) a F.O.P. hip spica was then applied to the left hip. The position of the left leg being:- thigh and leg abducted to about 30°: knee flexed to about 45°: ankle joint at 90°: reinforcement of the longitudinal and transverse arches of the foot: slight plantar flexion of toes. The spica extended from a level above the umbilicus down beyond the big toe.

The patient regained consciousness in the evening and had stood the operation well.
PROGRESS NOTES:

4. 5.46 Patient spent good night. P.O.P. trimmed with improvement in patient's comfort.
X-ray of osteotomy - shows good position.
Temperature 100°F. Respiratory Rate 28/min.

5. 5.46 Temperature and Respiratory Rate returned to normal.
P.O.P. again trimmed posteriorly.

7. 5.46 Patient bright and cheerful.

13. 5.46 Patient making good progress with no pain.
X-ray - good position of osteotomy.

15. 5.46 Discharged home in P.O.P.

18. 10.46 Re-admitted.

18. 10.46 P.O.P. off and stitches removed. Wound had healed very cleanly.

13 10.46 Sent to Physiotherapy.
Massage and muscle strengthening exercises begun in bed, for a few weeks, and then she began a walking re-education course, progressing with crutches for longer periods each day, up to walking with aids of sticks only.


19. 2.47 Reported - gait now very satisfactory, but there is limitation of movement in her left knee due to stiffness. Pain in right hip has disappeared.

19. 3.47 Pain in right hip bothering patient, and there is still stiffness in her left knee with limitation of movement.

16. 4.47 Re-admitted for manipulation of left knee.
Left knee X-rayed - negative apart from some degree of osteoporosis.

18. 4.47 After pre-medications of Morphine gr. 1/6 and Atropine gr. 1/100 with anaesthesia of I.V. pentothal, both hips and left knee were manipulated with breaking down of adhesions in left knee joint in particular. There was no great increase in degree of movement obtained.

19. 4.47 Recommended Physiotherapy with massage and muscle-strengthening exercises.

24. 4.47 Feeling far stronger and she feels that she is walking better now. Her range of movement at left knee joint is not much increased from before, but is less "stiff", and her walking is improved.

28. 4.47 Discharged home, but will continue to perform her muscle-strengthening and walking exercises.
X-ray of left hip joint - bony union appears complete after the osteotomy.
11. COMMENTARY.

DEFINITION OF THE CONDITION:

In this condition, there is partial or complete displacement of the head of the femur from the acetabulum, with probable deformity of the head and neck of the femur and also of the acetabulum, or maybe just the acetabulum alone. The amount of deformity is proportional to the age of the condition e.g. the deformity present in a young baby, who has not attained the erect position, is much less relatively than that found in a person who is walking about with it (weight-bearing of the joint).

AETIOLOGY: The cause or causes of this deformity is not yet known, but generally speaking it can be said to result from some disturbance of the foetal growth of the hip and its environment. This disturbance affects either the muscles in the region or the bones of the joint and hence there are two different types of disturbance affects:

1. MUSCULAR TYPE - in which there is said to be some muscular dystrophy with pathological fibrosis, resulting in the movement of the acetabulum and femoral head away from each other, due to disturbance in their normal connections.

2. OSSEOUS TYPE - (which is thought to be more likely than 1.) in which there is some defect in the Postero-Superior aspect of the acetabulum, due to deficient development of the normal SUPRA- FEMORAL BUTTRESS in this region. The actual dislocation is considered to be a secondary effect, resulting from active movements of the head of the femur in the deformed acetabulum. Or it has been postulated that is is due to abnormal pressure being exerted on to this particular area of the acetabulum, by the femoral head, because of exaggerated intra-uterine pressure, during labour, resulting in marked abnormal flexion and adduction of the limb.

3. Or thirdly it has been suggested that it is due to some alteration in the chemical content of the blood supplying the hip joint or the actual synovial fluid in the hip joint itself. One example of congenital deformity is result from alteration in the chemical content of the blood, is harelip, when there is found an alteration in the sodium content of the blood.

Congenital deformity has been discovered as an inherited feature in 10 - 15% of cases, and it is more common in females than males in the ratio of 4 : 1.

The condition in unilateral in about 50% of cases.
The time of development of appearance of the various centres of bone is of some interest because of the delay of the ossification of the upper femoral epiphysis on the deformed side when compared with the normal side - this is seen on X-ray examination in Congenital Dislocation of the hip.

IN THE FEMUR:

The primary centre for the shaft and neck of the femur appears during the 7th week of intra-uterine life and at birth they are ossified.

The secondary centre for the head appears about the first year and the epiphysis fuses in the male at 18 years and in the female about 16 years of age.

IN THE HIP BONE:

Primary centres for the ilium, ischium, and pubis appear about the 3rd, 4th, and 5th month respectively of intrauterine life.

At birth the greater part of the acetabulum is still cartilage and it is only after the 10th year, that most of it is ossified, leaving the TRI-RADIATE area secondary centres to appear about the age of 12 years.

N.B. that the SUPRA-FEMORAL BUTTRESS of cartilage which is said to be absent or poorly developed in congenital dislocation of hip, appears as early as the 3rd month of intrauterine life.

The time of appearance of the dislocation has been used to type it or classify this condition e.g.

1) Ante-natal type - dislocation is present before birth.
2) Pre-ambulant type - dislocation is present before beginning to walk.
3) Post-ambulant type - dislocation is present after walking has begun.

Development of the Established Deformity. (as seen in this case)

1. Before walking, the main variation from normal, would be the delay in the appearance of the ossification centre of the upper epiphysis of the femoral head, with some flattening of its outline, where it is in contact with the acetabulum. The acetabulum is normal apart from being shallow in depth.
2. After walking - it is after weight bearing that the real deformities are established. The femoral head is grossly deformed with foreshortening of the neck and actual reduction in amount of bone substance, and also there is an upward and backward dislocation of the head - only rarely does the displacement not take place towards the front or anteriorly. The acetabulum is very shallow and there is the beginning of "cupping" on its supero-posterior aspect - probably the beginning of a false acetabulum.

Because of the displacement of the head of the femur, there is seen stretching of the rotator muscles - quadratus femoris etc. with atrophy of their substance. Similarly there is some shortening of the long thigh muscles.

The slight exaggeration of the lumbar curvature - i.e. lordosis, is caused by the backward displacement of the "weight-bearing" line of the body. The normal "weight-bearing" line runs down through the sacro-ilial joints, ilium and pubis, through the middle of the acetabulum, down the femoral head and the limbs. The femoral head is displaced upwards and backwards behind the middle of the acetabulum, and resulting from this there is a compensatory increase in the lumbar curvature, forming a lordosis to balance the extra proportion of body weight which is now in front of the new "weight-bearing" line. In this case the posterior displacement is slight and hence the lordosis is not well marked, but when the posterior displaced is very pronounced or it is bilateral, the lordosis is very evident. With an anterior dislocation of the head, there is no exaggeration of the lumbar curvature - lordosis.

The pain, which was the patients most outstanding complaint, could have been caused by:

1. Exaggeration of lumbar lordosis with extra strain thrown on the sacro-ilial joints, with possible arthritic changes.
2. The direct pressure of the displaced femoral head on the ligaments and other soft tissues in the vicinity of the capsule.
3. Excessive strain on the ligaments and capsule supporting the head.

The reasons for the Shantz's Osteotomy can now be understood. The mechanism behind this relief is probably due to the weight-bearing line being brought inward and inwards, so that the force is transmitted more through the acetabulum again, and hence up through the pelvic bones, to the sacro-ilial joints and vertebra with reduction in the lordosis and reduction in the strain on the sacro-ilial joints. With this more direct weight-bearing line there will be less pressure on the capsule, ligaments etc. above the acetabulum.

An arthrodesis to give a stable and painless hip, with some limitation of movement, could have been attempted if the head had not been so grossly deformed.

**OTHER MEANS OF TREATING CONGENITAL DISLOCATION OF THE HIP.**

Treatment most suitable, for this condition, varies directly with the age of the patient and hence for the clearest survey of treatment, it is best to consider it under age groups:-

1. **FIRST YEAR OF LIFE:** - closed reduction, consisting of abduction and medial rotation, without anaesthesia, can be tried. The reduction is maintained for 8 months or so by means of some type of splintage e.g. Putti's splint or a light hip spica of P.O.P. with a special iron bar frame, which keeps the child off the bed and allows for easy nursing.

2. **BETWEEN 2 - 4 YEARS OF AGE:** - reduction is more difficult and anaesthesia is required. In some cases traction by means of a Thomas splint for 2 - 4 weeks, helps to loosen the muscle of the hip region. The reduced position can be maintained by a P.O.P. Hip spica, using a special iron frame for easy nursing.
This is kept on for about 12 months and then the child is given massage and exercises, before being allowed to walk. Two complications can occur in these two age groups - traumatic arthritis and an avascular necrosis of the epiphysis - and are due to over forceful manipulation.

3. BETWEEN 6 - 9 YEARS: reduction by itself, gives poor results because in the majority of cases the acetabular margin fails to grow, and therefore, besides open reduction, a reconstruction or SHELF operation is performed which consists of levering out a flap of ileum above the deficient part of the acetabulum and holding it in place by means of bone wedges etc. This is followed by immobilisation in P.O.P. and sometimes traction is applied because of it giving better result, until there is X-ray evidence of healing.

4. ADOLESCENT AND ADULT LIFE: treatment is mainly for the relief of pain, because reduction is usually impossible, because there is marked deformity of the femoral head and acetabulum by this age. The following operations are designed to relieve this pain (causes of which have already been described):

1. FEMORAL OSTOTOMY - the shaft of the femur is brought forward into the normal weight-bearing line and the weight-bearing surface is increased.
2. LORNEZ BIFURGATION OSTOTOMY - the upper end of the shaft below the ostotomy is forced medially by abducting the leg, until it lies below the acetabulum into which it is forced. After about 4 months immobilisation in P.O.P. spica, the upper fragment unites with the lower shaft, with increase in the stability of the whole process.
3. SHANTZ'S OSTOTOMY - as described in this case.
4. ARTHRODESIS OF THE HIP JOINT - is usually only attempted if the head can be reduced down into the acetabulum, where it is fixed. This gives a very stable and painless hip, but movement is limited.

PROGNOSIS:

As regards leading a healthy and useful life - it is excellent. Although her loss of function and pain was well established before treatment began, she now has no pain and her walking condition has improved, and this improvement will continue on further exercises and more walking. Therefore her immediate prognosis is satisfactory because of the further progress which she will make in improving her gait.

But on considering her remote prognosis, more caution is required, because of the very likely complication of osteoarthritis which always follows any trauma or alteration in the configuration of the femoral head. Besides the osteoarthritic changes affected the hip joint, there is the possibility that they will occur in the other parts of the body which were traumatised in the form of extra strain, secondary to the original deformity, e.g. in the opposite hip joint, lumbar vertebrae and joints, sacro-iliac joints etc.

The slight deformity which is still present, should not prevent this woman from leading a sound economic life in the future, especially if a change of work could be arranged - the work requiring less standing and bending as her old job of a domestic worker.

SUMMARY:

This case illustrates well, that if Congenital Dislocation is diagnosed early in life, it should be treated thoroughly and intensively, because it is progressive and can ultimately cause gross deformity, loss of function and much pain. This woman was treated for "hip trouble" when 6 years old, by manipulation and maintenance in plaster, resulting in improvement of her condition which seemingly lasted for 18 years, before the old symptoms returned in a more severe form. It is interesting that she appears to have had no trouble apart from a limp during her
school days and adolescence and then further symptoms to become more marked with actual pain 3 years ago, especially when there is no history of extra strain or trauma at that time, and the presence of the gross deformity in her hip which must have existed during this period.

This condition must be diagnosed and treated early in order that the normal development of the bones and ligaments can take place. Ideally this should occur in the first year of life, especially with the improved methods of nursing of these young infants. For the normal development of the acetabulum it has been shown that the femoral head must be in its normal position in the acetabulum and therefore if the head can be reduced and maintained in that position for 8-12 months, during the first year of life, excellent results can be obtained.

Unfortunately in this case, we have the established deformity with its secondary manifestations in the form of loss of function and pain, these two disorders being the only part of the fully established condition which was improved or relieved by the operative treatment carried out in the form of a Shanta's osteotomy.
Case No. 6.

Case of early ADOLESCENT KYPHOSIS (or Scheuermann's Disease.)
ROBERT WILLIAMSON, Aged 15 years.
c/o Marrister,
Symverster,
Lerwick.

OCCUPATION - Labourer - His work consists of rolling barrels of cured herrings, on a level surface, for the last 4 months. Before this he worked at home doing odd-jobs, none of this work involved lifting of heavy weights.

DOCTOR - Dr. Potter.

ADMISSION - 21.10.46.

COMPLAINT - Rounding and abnormal prominence of the dorsal spine for 1½ years only.

HISTORY - PAST - Has had a very healthy upbringing on a croft and can only remember having had whooping cough when "very young". Otherwise no other troubles.

PRESENT - His condition of "rounded back" was first noticed by his doctor, who advised him to have an X-ray of his spine at Lerwick, and on the diagnosis of a "symptomless kyphosis", advised him again, to come down to Edinburgh for treatment.

This boy has never felt anything wrong with himself and has never felt any aching nor pain over his back. He thinks that his back was quite normal up to 1½ years ago (just before he left school) but his guardian told him that he had some rounding or "bending of his back" when he was only 5 years old.

At school he played football and badminton well without any feeling of disability and he cannot remember having received any injury or strain during these activities. He states that while at school, he usually "slouched" over his desk, and leant on his left elbow, and also after leaving school, his posture on sitting down anywhere was always very slovenly.

He lives a healthy life with plenty of fresh air and drinks, on the average, about 1½ pints of non-pasteurized milk, per day. (A veterinary surgeon who visited the island a short time ago, declared that "all the cows were healthy" from which he obtains his milk supply.)

FAMILY - His father died when he was six years old and his mother died in 1943 when he was twelve years old. He does not know the cause of death in either case, and only remembers that they were both in their early forties and his mother had very red cheeks, but did not have any night sweats nor any chest trouble. Has no brothers nor sisters.
EXAMINATION - A well built, healthy-looking boy. He is 5 ft. 8 in. in height, which is tall for his age. He is of the asthenic build, but not completely true to "type". On walking - he is not particularly flat-footed, nor has he a prominent abdomen. His I.Q. is average.

SPINE - On inspection, there is seen a well marked kyphosis with marked increase in the normal antero-posterior curve, which begins about the level of the 3rd thoracic vertebrae and extends down to about the 10th thoracic vertebrae. There seems to be complete obliteration of his lumbo-sacral curve, but no scoliosis is present. This prominence does not disappear on lying down.

MOVEMENTS.

1. FLEXION TEST: Patient can only reach to within 9" of his toes, on bending down, and it causes him no pain. (He can never remember being able to touch his toes while doing gym at school.)

2. ROTATION: showed no abnormality, apart from being an abnormal distance away from touching opposite toes.

3. BENDING TO SIDE: Appeared to be bending at level of 10th Thoracic vertebrae, with no impairment of movement.

4. EXTENSION: Quite satisfactory.

5. VERTEBRAL PERCUSION: elicited no pain, nor any abnormality, the spines being regular in position and size.

6. ANVIL TEST: Indirect percussion - elicited nothing.

7. FLEXION OF THIGH: Limited to a right angle on left side, but normal amount on left side.

8. On movement of the knee joint, i.e. full extension, there is some shortening of his hamstring muscles.

RESPIRATORY SYSTEM:

Respiratory rate 20/min.
On inspection, a bulging forward of the chest with a prominent sternum. The circumference of the chest being very large.
On palpation - no "rickety rosary"; no Harrison's sulcus.
Articulation of joints seems normal.
Vocal fremitus normal.
On percussion - no abnormality detected.
On auscultation - breath sounds vesicular.
V.R. normal.

CARDIOVASCULAR SYSTEM:

Rate 79/min. B.P. 119/78.
Pulse regular in time and force with good volume.
Apex beat within mid clavicular line and in 5th left intercostal space.
Heart sounds closed in all areas.

CENTRAL NERVOUS SYSTEM:

Pupil reflexes brisk and equal.
Biceps, triceps jerks normal.
Knee and ankle jerks normal.

ABDOMINAL SYSTEM:

Teeth - some carious and appears to have some pyorrhoea. Otherwise nothing abnormal detected.
PHOTOGRAPH NO 6. Is a left lateral X-ray picture of the mid-thoracic region, showing the early wedge formation of the bodies of the Thoracic vertebrae, with some irregularity of the disc spaces, which is typical of Early Adolescent Kyphosis.
X-RAY REPORT. Taken in Lerwick.

Chest - No signs of T.B.

Spine - No irregularity of the surfaces of the vertebrae.
Slight wedging of bodies of Thoracic vertebrae.
Marked Kyphosis with compensatory Lordosis.

DIAGNOSIS: The condition which is troubling this boy has the features of a very early Scheuermann's Disease (Adolescent Osteochondritis) which is not fully established and hence it would be more correct to call this condition a Postural Kyphosis of adolescence.

Reasons for this Diagnosis:
1. It is a condition of kyphosis, confined to the mid and lower thoracic regions, which does not disappear on his lying down, and found in a boy of the age of 16 years.
2. He complains of no aching nor pain over region and is not troubled with the lesion at all.
3. Radiographic appearances of the thoracic vertebrae indicates very slight wedging, with no irregularity of the vertebral surfaces or any definite fragmentation of the upper and lower epiphyseal plates. The wedging consists of thinning of the anterior edges of the intervertebral discs. With some change in the anterior margins of the vertebrae.

DIFFERENTIAL DIAGNOSIS:

1) The main condition from which this kyphosis condition has to be differentiated is Pott's disease of the spine which is also associated with a kyphotic lesion. Tuberculosis of the spine usually occurs in younger children ages 3 - 5 years and is associated with PAIN, which can be local or referred along a spinal nerve. This may be preceded by general signs of tuberculosis - e.g. loss of weight, lameness, evening rise in temperature etc. Another marked differential point is the muscular rigidity, which limits the spinal movements in cases of T.B. spine. And lastly the X-ray picture - in T.B. although early on there is irregularity of the anterior margins this is always followed by signs of some inflammation e.g. decalcification with destruction of actual bone tissues in the later stages.

2) Other conditions which are easy to differentiate:
- Fracture or fracture dislocation
- Post traumatic osteoporosis
- Early or late rickets - other changes seen in body if present.
- Spondylitis Ankylopoietica - usually accompanied by severe and persistent pains; neuritis, with progressive flexion deformities.
- Vertebral osteochondritis or Calvé's Disease - usually occurs in younger age group 4 - 10 years, and on X-ray it is seen that it is only involvement of one vertebra which causes the deformity in the dorso-lumbar region.

TREATMENT OF THIS BOY'S CONDITION:

On admission 21.10.46 he was ordered complete rest in bed, with a planned course of physiotherapy daily in order to try to increase the toxicity of his abdominal and spinal muscles.

He was taught and daily performed the following exercises:-
- Lying in hyperextended position
- Lying + rest breathing - trained to use the diaphragm for deep breathing without allowing chest to drop.
- Lying abdominal retraction in order to try to flatten the lumbar curve.
- Rib stretching - to improve and gain flexibility of the dorsal spine.
- Sitting and standing exercises.
- Hyperextension of spine, by raising and lowering chest and abdomen off bed.
7. Exercise consisting of lifting up knees, straightening back, lying on back and lifting pelvis off bed.
8. Lying in prone position and lifting head and shoulder off the bed - hyperextension of spine.

Between these courses, his position in bed was supine with pillows below his mid and lower thoracic vertebrae in order to reduce his pronounced posterior convexity, and also a small pillow flexing to about 35°, the knee joints.

He continued the above treatment until 11.12.46, when he had fitted a carefully moulded P.O.P. chest jacket and with detailed instructions on continuing of his exercises, but now ambulatory, he was discharged home.

He reported back on 17.4.47 when it was noticed that his P.O.P. jacket was not fitting closely enough and so another jacket was applied reinforcing and hyperextending his thoracic curvature of his spine, and he returned home to continue his exercises.

**COMMENTS.**

Factors concerned with posture.

1. Sherrington and Hunter have described that muscles are under the influence of 2 proprioceptive areas:-
   1. Somatic, which deals with contractile tone, and
   2. Sympathetic, which deals with plastic tone.

   These two factors work or operate together at the same time, with the somatic element concerned with the contractile tone and hence inhibiting the antagonistic muscles and the sympathetic element via the grey rami communicantes (the non-medullated post-ganglionic fibres) is concerned with maintaining the tone.

   In its most simple form, the somatic elements sets the length of the fibre and the sympathetic element helps to maintain it and the fibre's intramuscular tension, which remains the same over a large part of the fibre's range of expansion and contraction.

   Hence anything upsetting this delicate balance of innervation centrally will influence posture of different parts of the body.

   e.g. lesions affecting the posterior shoulder and spinal nerves, such as trauma or poliomyelitis definitely alters the posture of a normal person.

2. Forces of Gravity act in opposition to the forces of the muscle described above.

3. Capacity of the spine as a support. This can be diminished by such factors as:-
   1. Congenital disc collapse.
   2. In disease - circulatory disturbances, endocrine dysfunction, chemical and metabolic causes, but these can be ruled out in this case.

4. Anything causing increase in the "spinal load" e.g.
   1. Increase in the body weight generally. This boy has grown rapidly in the last few years and is heavy for his age.
   2. Multiple minor trauma (no history of this).
   3. Shortening of the Hamstring muscles e.g.
      Semi-membranosis; Semi-tendinosis; Biceps femoris; This is a definite cause of increase in the thoraco-lumbar junction on attempting to bend over at the level of the hips.
PATHOLOGY:

The pathology behind this lesion is not very clear, and hence there are several schools of thought about its cause:

1. SCHMORL and the Dresden School of pathology explain that the essential lesion is due to a congenital weakness in the cartilagenous plate—like epiphyses on the upper and lower surfaces of the vertebrae, which allows the nucleus palposus inside the intervertebral discs to protrude and interfere with and diminish the blood supply to the anterior part of the epiphysial plate. This produces the characteristic fragmentation and wedge-formation as seen in fully established Adolescent Kyphotic spine.

2. SCHAUMANN suggests that the condition is similar to that described in Legge-Perthes disease i.e. fragmentation of the hip joint region due to slight trauma or mild infection interfering with the blood supply to the area.

3. LAMBRINUDI offers another explanation to that offered by Schmorl, of how the nucleus palposus is allowed to escape. He believes that it is a combination of shortened hamstring muscles and minor trauma which causes haemorrhage into the cartilaginous discs and this causes the discs to fissure and crack and allows the nucleus palposus to flow out.

In later life, the above process is followed by:

1. Senile degeneration of the cartilage
2. Osteoporosis of the vertebral body, with less support for the cartilage
3. Approximation of the anterior edges of the vertebral—"wedges."

Relation of the above aetiology and pathology to this case.

Defects in either 1) the vertebrae, or
2) the intervertebral discs, or
3) the posterior shoulder and spinal muscles, will be seen as derangement of the antero-posterior curvature in the thoracic region.

In this case:

1) there is no evidence of alteration in the vertebral structure by X-ray.
2) there is seen narrowing of the anterior edges of the intervertebral discs, associated with a marked kyphosis. This could have been caused by the evident shortening of this boy's hamstring tendons with some trauma (Lambrinudi) rather than by any congenital defect (Schmorl)
3) associated with 2) as a likely cause of this condition, is the evident bad posture. Gravity has overcome the muscle strength of the support of the spinal column, with lengthening of the muscle fibres.

If we apply Sherrington and Hunter's ideas of muscle conditions, we see that the new state of the muscle fibres i.e. lengthened, is being maintained in Plastic tone by the sympathetic nervous system. But the whole process is reversible and hence if we can teach the boy to hold back his shoulder voluntarily, the somatic nervous system will cause the muscles to contract and be maintained in their new position and be held there by the Plastic tone, and after a time the patient will involuntarily hold his shoulders back.

The initial "weakening" and stretching of the back muscles was probably due to the boy having grown too quickly with poor muscular development.
Associated changes in the body with Kyphosis.

1. The most noticeable change, and is seen in this case, is a compensatory lordosis - i.e. an increase in the anterior lumbar curve, which endeavours to maintain the normal control of gravity.

2. Other features, not very well marked in this case
   a) Flat foot - due to the weight being thrown forward on to the feet, with strain on the arches of the foot and the calf muscles.
   b) "Attitude Ligamentaire" - strain upon the body ligaments, particularly the sacro-iliac, lumbo-sacral, and the inter-spinous ligaments (shoulder tends to fall with last mentioned).
   c) Mouth - breathing, with increase in lymphoid tissue for added protection.
   d) Reduction in the normal antero-posterior diameter of the chest, with the ribs more oblique and flattened. There is a reduction in the diaphragmatic movements, which forces the viscera downwards and causes a
   e) Bulging of the anterior abdominal wall.

Possible means of treating this type of case:-

IN YOUNG CHILDREN - it is possible to prevent prophylactically the full establishment of this condition by correcting obvious errors in posture and the underlying causes of these errors in posture.
   e.g. 1) Correction of poor sitting posture - shoulders hunched over work on a desk, etc.
   2) Adjustment of the downward drag of clothing, and prevent the clothes limiting full expansion of the chest.
   3) Light muscular exercises - e.g. movements of swimming - full and deep breathing exercises etc.

The above measures, if applied conscientiously and taught to the child, will definitely prevent the development of any kyphosis.

ESTABLISHED CASES IN ADOLESCENTS -

The full condition of adolescent kyphosis is said to have appeared clinically, when a period of aching in the back has ceased (it is said to have become consolidated). Usually fragmentation and marked "wedging" is evident on X-ray.

The patient is placed in a bed with fracture boards with a firm mattress and he performs the muscle strengthening exercises, as described for this case. At a later stage, by using a head-halter with the body weight, as the source of traction, extension of the cervical spine can be encouraged.

As in this case, once the patient has made the maximum improvement in his posture, a P.O.P. jacket can be fitted with full hyperextension of his spine, which is retained for 6 months to 1 year. During this time, the patient is ambulatory and continues his exercises and can return to his work.

The P.O.P. thorax jacket, if the muscles have still not undergone active shortening and regained good tonicity, can be replaced by a spinal brace e.g. Goldwaith type.

IN VERY ADVANCED CASES - where the bone is ossified and the conservative methods have failed and symptom of pain continued, operation with removal of bone can be considered. Very rarely is this ever carried out now.
PROGNOSIS:

As regards life it is excellent, because there is no accompanying nor secondary lesion present.

Because he is so young, his muscles and ligaments will respond well to the exercises, and if he perseveres and carries them out faithfully, there should be a marked improvement of his deformity.

The only likely complication which might appear when he is older, is osteoarthritic of the spinal joints, particularly the lumbosacral joints, but apart from this, because the deformity has been recognised and treated early, there should be no further trouble.

SUMMARY OF CASE:

This case is of particular interest, because it is an example of the most important aspect of orthopaedic surgery, that is - preventive orthopaedics. By this I mean that by using conservative means of exercises and supports, it has been possible to correct, almost completely, this boy's deformity and prevent the establishment of a spinal column. It should be noted that gross deformity is usually accompanied by secondary disease and disorders of functioning of the body, for example, diseases of the respiratory system due to incomplete aeration of the lungs, with its repercussion on the functioning of other parts or organs of the body, or the degenerative changes in the vertebral bodies themselves may become, in the future, the site of infection etc.

Minor degrees of this type of lesion of deformed posture is probably a strong etiological factor in the case of diseases - respiratory in particular - found in young children, who live in the poorer districts of a city where slow development and muscular weakness, due to malnutrition, is fairly common. This lesion should be recognised in its early stage by competent health workers and physical instructors, who should be careful to realise that the child's poor posture is not due to undeveloped muscularity and hence force the child to perform "developing" exercises which will aggravate the condition by causing more fatigue of the muscles, which in turn causes more strain upon the body ligaments. But that the necessary treatment is complete rest in bed, with carefully planned use of more supervised exercises for several months - exactly similar to that which this boy had for his kyphosis. There need be, during this time in bed, no loss in education, because in most orthopaedic hospitals, school work is taught in the wards, and economically there can be no loss, because most of the cases occur before the child leaves school (12 - 16 years).

In this case, recognition of the deformity was not by the patient himself nor his relatives, but by the doctor noticing him when he was passing. This brings out another point and that is, this condition is usually only recognised by an observant onlooker, when the child is carrying himself in the usual manner and not when the child realises that he is being watched and becomes conscious of his slovenly posture and accordingly corrects it temporarily e.g. by a school medical examination.

Finally, this boy, Robert Williamson, has had his deformity corrected, almost completely, by this treatment, with the prevention of the fully established condition and its pathological accompaniments. This correction can be permanent if, in the next few years while his development is still taking place, he continues his simple exercises and subconsciously is always aware of maintaining a good posture.
There are many definitions of orthopaedic surgery, but a simple accurate one would be - it is the surgery of diseases and injuries to the Locomotor System which includes the skeletal, the articulatory, and the muscular systems.

correction and prevention of deformities in children, which may be congenital or due to disease, injuries, or bad habits of posture etc.

The last group - 3) must be added to the definition because the word "ortho" (of Greek derivation) means "children free a deformity", and therefore orthopaedic surgery, is really the art preventing deformity in children.

Orthopaedic surgery covers a vast field of conditions or conditions, but these can be best grouped under the following six

eings:

Affections of BONES (skeletal, part of locomotor system).
Affections of JOINTS (articulatory, part of locomotor system).
Affections of MUSCLES, TENDONS, AND SOFT TISSUES (muscular, part of locomotor system).

Affections of NERVOUS SYSTEM

Hence, in choosing the cases to be reported on, one example was en for each group with the exception, that two examples were chosen, the "joint" group No 2, and no example was chosen for the "nervous system" group No 3.

For the Affections of BONES group - a case of chronic osteomyelitis was chosen because even though chemotherapy is playing an ever increasing part in the treatment of this condition, the orthopaedic surgeon still plays a major role in combating this common and serious disease of the young.

Fractures are included in this group, but no fracture case has been reported on, because the subject of fractures and their treatment, is too extensive to be properly covered and to give a balanced picture of it, in one case report.

In the Affections of JOINTS group - examples in the form of 2 cases have been reported on:

I) a case of osteoarthritis of the hip joint, in which the condition was well established with pain, loss of function, deformity, in a middle aged woman.

II) a case of a "bucket handle" tear in the medial meniscus of the knee joint, with pain and some deformity, in a young man.

Both these cases are important from the economic point of view and are quite common in occurrence. The treatment is directed towards different objectives in the two cases. In the osteoarthritis case, the treatment was directed towards relief of pain, some restoration of function, but the underlying lesion was not touched, whereas in the cartilage case, the treatment successfully eradicated the original lesion with relief of pain and restoration of normal function and has prevented the likelihood of any future trouble.
In the AFFECTIONS OF MUSCLES ETC. GROUP - the example chosen for this, is a case of Spastic Paralysis. This case is important because it illustrates how essential it is to treat this affection early and correctly, because it is found in infancy and early childhood with the result that normal development is prevented and established deformities result. These deformities influence the patient, both mentally and economically for the rest of the patient's life. Some attempt had been made to relieve this woman's spasticity when very young, but it was not intensive enough, and when the woman once again came up for treatment because of pain, the condition was so well-established, that treatment could only be directed toward relieving the pain and to try to correct some of the deformity in order that this patient might lead a more economically useful and happier life. But as described in this case's summary, besides an established physical deformity being present, before treatment, there was a slight mental defect present as well, which limited much of the co-operation which is required from this type of case.

Unfortunately no example of AFFECTIONS OF NERVES GROUP has been reported on by itself. But the case of Spastic Paralysis with its Stoeffels operations could be considered an example of this group.

In the CONGENITAL ABNORMALITIES GROUP - the example reported on, is a case of congenital dislocation of the hip in a woman aged 31 years. As in the case of Spastic Paralysis treatment was directed towards the relief of pain (again the symptom which brought this patient to her doctor) with some correction of deformity. Treatment has relieved her pain and her walking is greatly improved, with the prospect that she will now be able to lead a most useful life, but there is still some residual deformity left. Once again treatment was begun when this patient was very young, but it was not continued long enough and her deformity became established.

In the STATIC DEFORMITIES GROUP - a case of postural Adolescent Kyphosis has been reported on, because firstly it is quite common in some degree or other in too many of the present-day adolescents and secondly, treatment conservative in nature, was started well before much deformity had become established. This case is a good example for the classical definition of the word "orthopaedics", and also the place which orthopaedic surgery can play in preventative medicine.

These cases reported on in this paper, were chosen, partly as described, but also because in three of the cases - Adolescent Kyphosis: iliac Lesion; and Osteomyelitis - treatment began soon after the onset of the disorder and hence was directed towards eliminating that order and preventing the likelihood of any secondary manifestations, in contrast to this, in the other three cases - Spastic Paralysis: arthritids; and Congenital Dislocation of the Hip - treatment only in several years after the onset of the disease and therefore the treatment could only be directed towards the relief of the secondary manifestations and to try to restore some useful function in these cases. All these cases, with the exception of the cartilage lesion which due to trauma, could either have been prevented or corrected by procedures, with having to undergo the major operations which performed in four of these cases. As described in the C.D.H. and Spastic Paralysis cases' summaries, this type of treatment would have possible in infancy, with normal development subsequently taking place. Even osteomyelitis is preventable, in the sense that by living living conditions, general health of this particular age group (7 - 14 years), the disease would become very much less common, now, although osteoarthritis is a degenerative condition accompanying the process of aging, it is recognised that this process of degeneration can be prevented or retarded by treating, in the form of correction, of the predisposing factors e.g. occupational strains on susceptible persons, obesity in women, especially, mal-posture in
In both medicine and surgery, the tendency is towards preventive treatment replacing all the radical measures of the present past, and if any branch of surgery should lead the way in the practice of preventive treatment, it surely must and should be the orthopaedic branch of surgery.

Another interesting factor, which becomes evident on studying comparing these cases, is the effect of the patient's psychology of the improvement which results, following the treatment. In one of the cartilage lesions, we find that rapid improvement with return to normal function, took place in a very short time, mainly because of this young man's willingness to co-operate with one of the essential features of orthopaedic treatment and that is the practice of post-operative active exercises. In the other case, osteoarthritis - which is admittedly of an older age, different sex, the condition being of longer duration - the patient poorly responded and her co-operation in performance of these post-operative exercises for restoration of function, was disappointing, which resulted in a much slower convalescence and a slower and less complete return of function. Although the cases described above are of extremes, they clearly demonstrate that the patient's character as well as his her affection should be considered and the treatment adjusted accordingly.

Finally, these six cases, were chosen and hence reported on, because they are truly representative of some of the commonest orthopaedic problems which have to be solved and treated by the orthopaedic surgeon.

--------------------

May 1947,

Robert B. Duthie.