Some Trials of L.F.A. for Comminuted Intertrochanteric Fractures (Hip)

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The management of comminuted trochanteric fracture poses special problems and it has been assumed that internal fixation is usually the treatment of choice. Although there have been retrospective trials of internal fixation where anatomical distortion is evident because of comminution and trials of Alloarthroplasty of trochanteric fractures, none has been described specifically in detail.

This is what we are attempting now. As far as classification of intertrochanteric fracture of the femur is concerned, it must be emphasised that the classification is both anatomical and functional (The reference is to Boyd, Anderson, Tronzo and even back to Evans).

One failure of open reduction to secure internal fixation of the comminuted intertrochanteric fracture in the case here presented is obviously due to technical difficulty in maintaining anatomical reduction because of comminution.

It is true that maintenance of reduction with various types of internal fixation devices and various combinations of apparatus prove difficult. It is the purpose of this study to present cases as a preliminary report of a short experience of operation carried out on 2 patients. In these cases the anatomical distortion of the parts by comminuted intertrochanteric fractures (hip) was sufficiently great to offer problem when operating.

In addition some biomechanical considerations of fixation of the endo-prosthesis under these conditions are reviewed in the performance of this operation.

CASE REPORTS

Case 1. A 54 year old house wife was transferred from Neuro-Surgery 3 day after for treatment of a fracture problem. The patient was involved in a car accident on 30th January 1974 and sustained an unstable comminuted intertrochanteric fracture of the right femur and also the pubis on the same side. (Fig. 1)

It was noted that there was some unconsciousness for a short time at the accident and headache persisted after the accident in spite of radiographical findings being normal.

Treatment of the trochanteric fracture was delayed whilst the patient was kept in a Thomas splint with fixed traction. The patient also had some visual disturbance of the right eye with ptosis.
An uncommon trochanteric fracture with reverse obliquity to the fracture line.

Post-operative radiogram after attempting to secure internal fixation. Anatomical reduction failed because of comminution and distortion of the part (case 1). Patient was kept in a Thomas splint with fixed traction after operation.

On 19th February we attempted to secure internal fixation by the use of the Jewett nail after some recovery from the head trauma. Anatomical reduction failed because of comminution and distortion of the part. (Fig. 2)

Thereupon the patient was kept in traction for immobilization. Twenty days after the previous hip surgery, low friction arthroplasty of the right hip was performed with good results (Fig. 3).

The patient was able to walk 2 weeks after surgery. However, the post-operative radiogram 3 months after L.F.A. showed some evidence of ectopic bone formation about the proximal part of the greater trochanter. A final assessment at discharge from the hospital (4 months post-operative) showed post-operative hip function consisting of 5-4-5 of the 6 numerical grading of Merl d'Aubigne.

Case 2. A 69 year old male fell down at home on 28th May 1974, incurring an unstable comminuted intertrochanteric fracture of the left femur. The patient was treated by a general surgeon who ignored the comminution of the unstable fragments and a single hip spica was applied as a conservative measure because of his age. On 22nd July 2 months after immobilization by the hip spica the patient was transferred to us for further necessary treatment. It was obvious that these fractured fragments was unstable. There was
Fig. 4. Type 3: Comminuted fractures in which the lesser trochanter is large. The posterior wall is exploded. The beak of the inferior neck is already displaced into medullary cavity of the shaft fragment. In addition it was difficult to classify Case 2 as Type 2 or Type 3 variant because of leaving the shaft fragment with a transverse plane. But there was no separated appearance of greater trochanter which is confirmed by a trocan ter cone view showing top circle.

also false motion with audible crack during the pre-operative clinical examination (Fig. 4).

Charnley low friction arthroplasty of the left hip was performed on 24th July 1974 with preservation of the periosteal covering of the trochanter and lateral surface of the femur.

A spring-loaded longitudinal wire is used in this case for secure the union of the trochanter (Fig. 5).

He was discharged and went home 4 weeks after the operation, ambulatory with crutches.

DISCUSSION

The most certain way of restoring normal function to near a fractured weight-bearing joint is to obtain perfect reduction of the bony alignment. In fact it is quite obvious a loss of concentric continuity which may lead comminution along the key stone of the calcaneal arch or a posterior fragment involving the shaft usually indicates instability.

Evans was the first to divide intertrochanteric fracture into stable and unstable types. It is general agreement that intertrochanteric fracture must be classified, both anatomically and functionally. Boyd and Anderson classified them into four types. Tronzo classified them into five types in a combined anatomical and functional view points based on the mode of reduction required.

In the cases here presented, we preferred to use Tronzo classification based on his reduction potentials. The clinical cases which led to the study described in this paper raise special difficulties in performing internal fixation of these fragments based on reduction
potentials after Tronzo. It has become accepted argument that most intertrochanteric fractures that transect the longitudinal axis of the femur are best treated by open reduction and internal fixation.

However, the actual patient's conditions of cases 1 (type 5 after Tronzo) made it impossible to secure internal fixation because of the 20 days delay after trauma. It would appear from these patients of an uncommon trochanteric fracture (type 5) is suitable for open reduction and internal fixation unless surgery was not delayed. These fractures can be fixed by notching out the fragments so that the neck can be jammed into itself stabilization with use of a short nail.

The main reason for failure of the first attempt was obviously due to technical difficulties. The presence of abundant callus around the fractured fragments led to distortion of the anatomical reduction because of the difficulty of identifying the comminuted fragments. The radiographical features of Case 2 showed several interesting problems after 2 months of immobilization with a single hip spica as the general surgeon had thought of conservative measures. It was obviously comminuted fracture in which the lesser trochanter was large with exploded appearance of the posterior wall. The beak of the inferior neck was already displaced into the medullary cavity of the shaft fragment. In addition it was difficult to classify Case 2 as Type 3 or Type 3 variant because of leaving the shaft fragment with a transverse plane.

There was no separated appearance of greater trochanter which is confirmed by a trochanter cone view (Fig. 4). The reason for the failure of the first attempt was because of ignoring the principles of reduction potentials at the beginning of treatment.

Unfortunately, elderly patient with trochanteric fractures treated in this conservative manner against accepted argument frequently succumb to the complications of bed rest and hospitalization, namely, pneumonia, thromboembolic disease, and decubitus ulceration. So that open reduction and internal fixation with hip nailing is a treatment of choice but it was impossible to assess under these conditions. Finally there was here an obvious indication for conversion to Charnley low friction arthroplasty of Case 1 as well as good indication for Case 2.

As far as low friction arthroplasty of the hip is concerned, the first question is whether these anatomically distorted hips are suitable to receive the endo-prosthesis or not.

At operation the femoral head and all loose fragments are discarded and prosthesis is cemented with methylmetacrylate into the shaft of the femur.

Frequently there is considerable exposed cement between the collar of the prosthesis and the bone to attempt restoration of the femoral length as in Case 1. (Fig. 5).

It is essential that normal femoral length be maintained and that the prosthesis be positioned in neutral between anteversion and retroversion position to prevent dislocation.

With regard to Charnley teaching, to explain the mechanism of load transmission by acrylic cement, and by the fact that mechanical test shown an improvement of 200 times in loading capacity of the prosthesis compared with the condition without cement.

As we know, when load is applied axillary on a cemented prosthesis the load is transferred to the endosteal surface of the femur through many hundreds of trabeculae. If we divide the total load on a prosthesis by the total area of endosteal surface in contact with the cement, each unit of endosteal surface will receive only a small portion of the total load.
compared with each unit of the much smaller area of bone available in the cut surface of calcar femorale when a prosthesis is used without cement. In case of without cement, the area of cortical bone exposed to the collar of prosthesis can be as little, as 1.29 cm².

On the other hand, if the medullary canal of the femur is filled with cement in its upper 13.5 cm (corresponding to the length of the femoral prosthesis) we shall have a mass of cement corresponding in shape to that of a truncated cone 2.5 cm in diameter at the upper end, tapering down to 1.25 cm in diameter at the bottom. Excluding irregularities on the surface of the cement, this truncated cone will have a surface area approximately 84 cm², compared with the 1.29 cm² of the transverse area of the neck of the femur, this truncated cone offers a surface area 65 times greater, and therefore the load bearing capacity of the bone will be increased by the same factor.

When loaded through the collar of the prosthesis, without cement, the cut end of femur will experienced a compression force. When loaded through the rough endosteal surface of the bone, by means of cement, the load now operates as a shearing force on the bone. Some materials are much weaker towards shearing forces than towards compression, but this difference is not particularly marked in bone. For that reason cement bonding prosthesis has an important role in performing these type of sequela of intertrochanteric fractures.

Furthermore, total hip replacement following revisional surgery of the previous hip surgery (case 1) is somewhat more susceptible to infection. Under these conditions it is preferable to mix an antibiotic (Kanamycin) with methylmethacrylate during polymerization.

Unfortunately, case 1 it has been developed ossification after L.F.A (Fig 6). Para-articular ossification after total hip arthroplasty gives rise to serious loss of function in a relatively large number of patients (Slooff 1972). These ossification should be regarded not as a complication but as a pathophysiological reaction of an unknown nature (Table 1). and obscure etiology which can not be predicted or prevented.

Slooff also stated that such ossifications as occurred in patients with bilateral total hip arthroplasty were always bilateral also. However, it was not so serious at Wrightington compared with paper reported by Slooff. Some one believe that the effect of E.H.D.P. (Disodium-ethane-1, 1-diphosphonate) as prevention of the para-articular ossification after total hip arthroplasty. The administration of E.H.D.P. from the time of operation does not in all cases prevent ossification but may influence the intensity of calcification and the extend of the process. On the other hand
Table 1

ECTOPIC OSSIFICATION
(in musculo-skeletal system)

- non-septic

PARA-OSTEO ARTHROPATHY:
ossification in neurological disorders: paraplegia
arachnoiditis meningioma
multiple sclerosis
poliomyelitis tetanus
sever-burns

ossification in TENDONS

MYOSITIS
OSSIFICATION
a) progressiva
b) circumscripta
traumatica
non-traumatica

ossification surrounding
artificial hip joints

REFERENCES


SUMMARY

It would appear from these two cases of failed previous treatment of unstable comminuted intertrochanteric fracture that in rather older patients it is best to treat by Charnley low friction arthroplasty. During the operations, the writer preferred to use a mixture of an antibiotic (2'-amino-2'-deoxykanamycin, Kanemomycin) with polymethylmethacrylate in order to minimize post-operative infection.

Futhermore, some biomechanical aspects of fixation of the endoprosthesis in these condition is reviewed as used in these operations.

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we do not know whether this is a combination effect of some minor neurological disorder of the patient or not. It was also considered whether this is a matter of the calcification of the incompletely resected portion of the large medial fragment or not. Fortunately, post-operative hip function after 4 months from L.F.A. consisted of 5-4-5 of the 6 numerical grading of merl d'Aubigne. Classification of para-articular ossification after Robinson resulted also class II at the time of writing.