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INTERNAL FIXATION OF COMMINUTED TROCHANTERIC FRACTURES

By

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Closed treatment of trochanteric fractures of the femur by skeletal traction and balanced suspension is my preference where the life expectancy of the patient is limited to a few weeks. Where open operation is not precluded by complicating systemic disease or associated injury, closed reduction by skeletal traction followed by internal fixation is elected to avoid prolonged recumbency.

Non-comminuted intertrochanteric or subtrochanteric fractures tend to be stable following anatomic reduction and generally can be fixed securely during operation by any one of many devices that are commercially available. Subsequent breakage of the apparatus or its loosening from the bone commonly does not occur provided excessive stress, such as unprotected weight bearing, is avoided until bone continuity has been restored.

Comminuted intertrochanteric and subtrochanteric fractures are likely to remain unstable even after anatomic reduction and notoriously require either prolonged traction or firm internal fixation to prevent displacement until some structural integrity is restored by initial bone healing. Internal fixation devices of current design do not provide sufficiently reliable supplemental support before bone healing is well advanced to permit unprotected weight bearing without the threat of loss of reduction or delayed healing [2, 7, 8]. These complications can follow mechanical failure of fixation as a result of either structural incompetency of the device or displacement at the interface between bone and metal.

Structural incompetency of the device can be manifest by bending, by breakage, or by seperation of its main elements [1, 3, 5, 6, 7]. The

point of failure is likely to occur at or near the apex of the angle formed by the cervical and diaphyseal sergments of the device. Therefore, a high factor of safety is desirable at this juncture.

This report summarizes observations gathered during the past 12 years from a small series of patients with comminuted trochanteric fractures who have been treated by internal fixation with a heavy plate and nail device.

CLINICAL MATERIAL

Fifteen comminuted trochanteric fractures in patients whose ages varied between 39 and 88 years were selected for treatment. There were two general criteria of selection. (1) that alternative closed treatment which might require prolonged immobilization of the patient was undesirable and (2) that there was comminution.

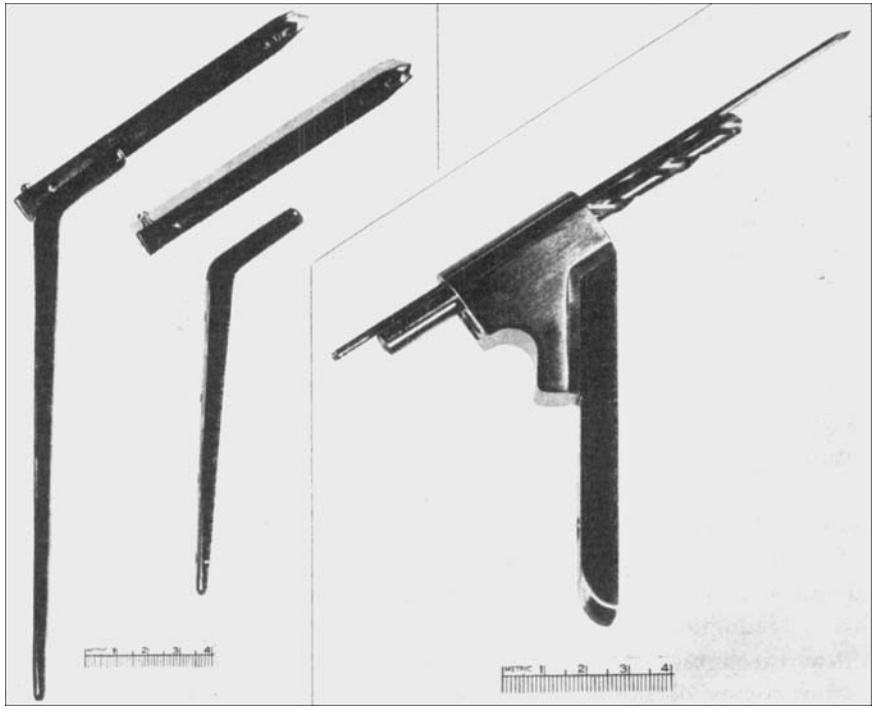

Fig. 1.

Fig. 2.

Fig. 1. Photograph of the "T" beam nail and 2 sizes of plates.
Fig. 2. Photograph of the jig used to facilitate application of the fixation apparatus.

APPARATUS

Two main elements, a nail and a plate (Fig. 1) comprised the internal fixation device used in treatment of these patients. The length of the nails varied in one-fourth inch increments from 3 to 5 inches. The cross section of the shaft of the nail was a "T" modification of the familiar I-beam structural design. The base of the nail accepted a one-fourth inch, 4/24 thread of the common surgical nail-driver. When completely seated in the plate, a small setscrew in the base of the nail engaged a pit in the plate to prevent disengagement of the two elements.

The plates were of two lengths; the diaphyseal segments measured either 4 or 6 inches. The longer plates accepted six, and the shorter four standard bone screws. The angle between the cervical and diaphyseal segments was either 125 or 135 degrees. The cervical segment of the plate had a keyway to accept the bottom flange of the nail. Because of close tolerance of manufacture, the apparatus became semirigid whenever it was assembled with the setscrew tightened.

All devices were made of Type 317 steel except four which were made of commercially pure titanium metal[4].

A special jig facilitated insertion of the device at the time of operation (Fig. 2).

POSTOPERATIVE TREATMENT

If there was no conflicting circumstance, the patient was permitted to sit in a wheelchair within a few days after operation. Only this activity was advised for those of the older age group until there was x-ray evidence of bone continuity across the fracture clefts. Generally, it was the order of 5 or 6 months after operation that partial weight bearing was instituted and subsequently increased by graded increments. Only the most agile patients in the fourth and fifth decades were encouraged to use crutches without weight bearing prior to restoration of bone continuity.

COMMENTS

No postoperative infection occured among the patients of this small series. There was no death in the six months period after operation.

A single example of mechanical failure of the device manifest by breakage of screws was thought to be caused by unsupported weight bearing prior to firm healing of the fracture. Refixation of the fracture was necessary.

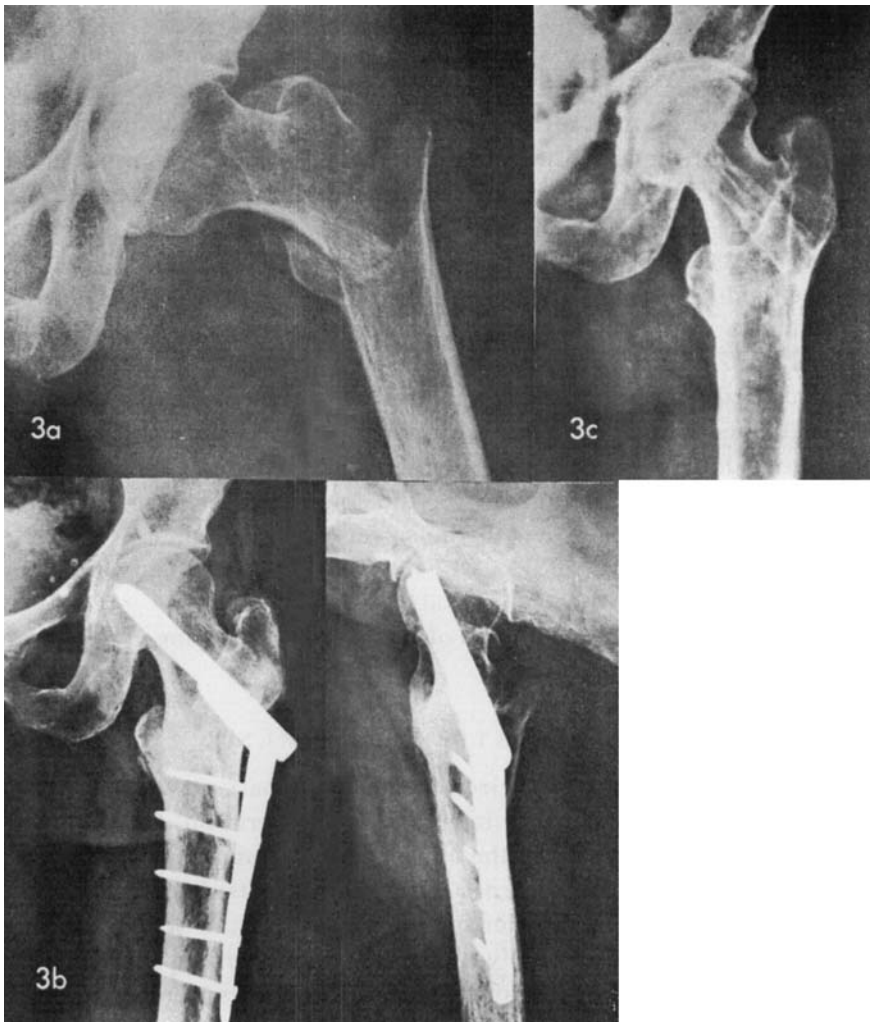

Fig. 3.

a. October 17, 1950. A 68 year old female. A conmminuted intertrochanteric fracture fracture of the femur associated with bone atrophy.

b. October 24, 1951. One year after closed reduction and internal fixation. Bone continuity has been restored but tubulation was not complete since the cortex and medullary cavity had not been reconstructed.

c. November 20, 1957. Seven years after operation and one and one-half years after removal of fixation apparatus. Tubulation was complete but deformity of the greater trochanter persisted because of inaccurate reduction.

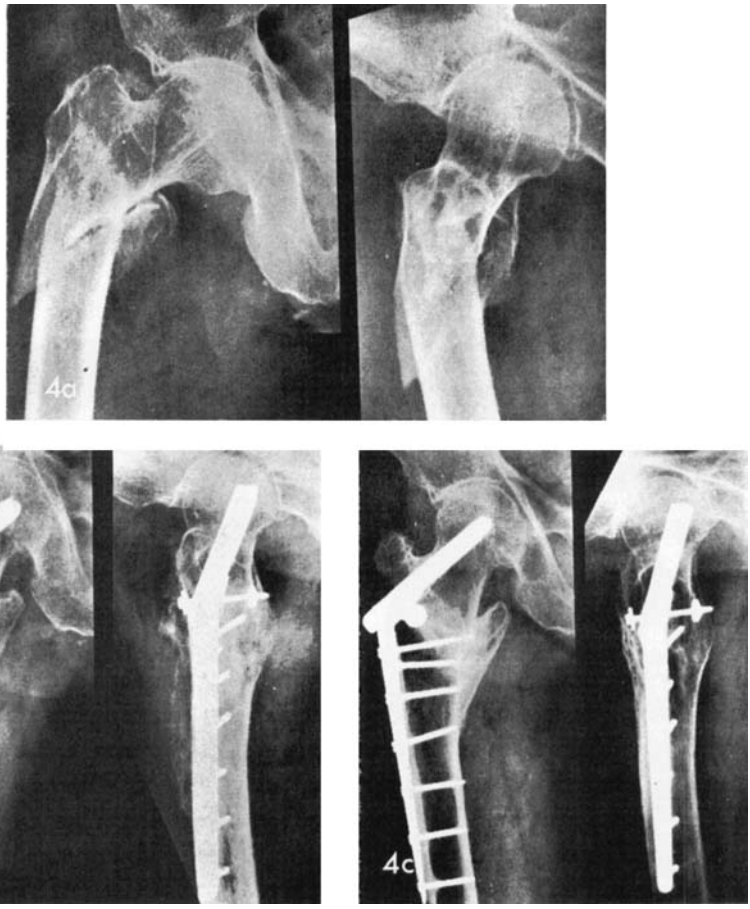

Fig. 4.

a. May 8, 1954. A 62 year old male. A comminuted intertrochanteric fracture.
b. July 19, 1954. Two months after closed reduction and internal fixation of the fracture. The lesser trochanteric fragment was inaccurately reduced.
c. November 5, 1958. Four and one-half years after operation. Incorporation of the trochanteric fragment on the osseous mass medially supplied needed structural support to this important area.

Atrophic bone associated with post-menopausal osteoporosis provides poor anchorage for any internal fixation device (Fig. 3). If the apparatus remains firmly attached until bone continuity has been restored, the device may add structural integrity during that prolonged period necessary for tubulation to be completed (Fig. 3b and 3c). Deferment of removal of internal fixation apparatus until this late phase of healing

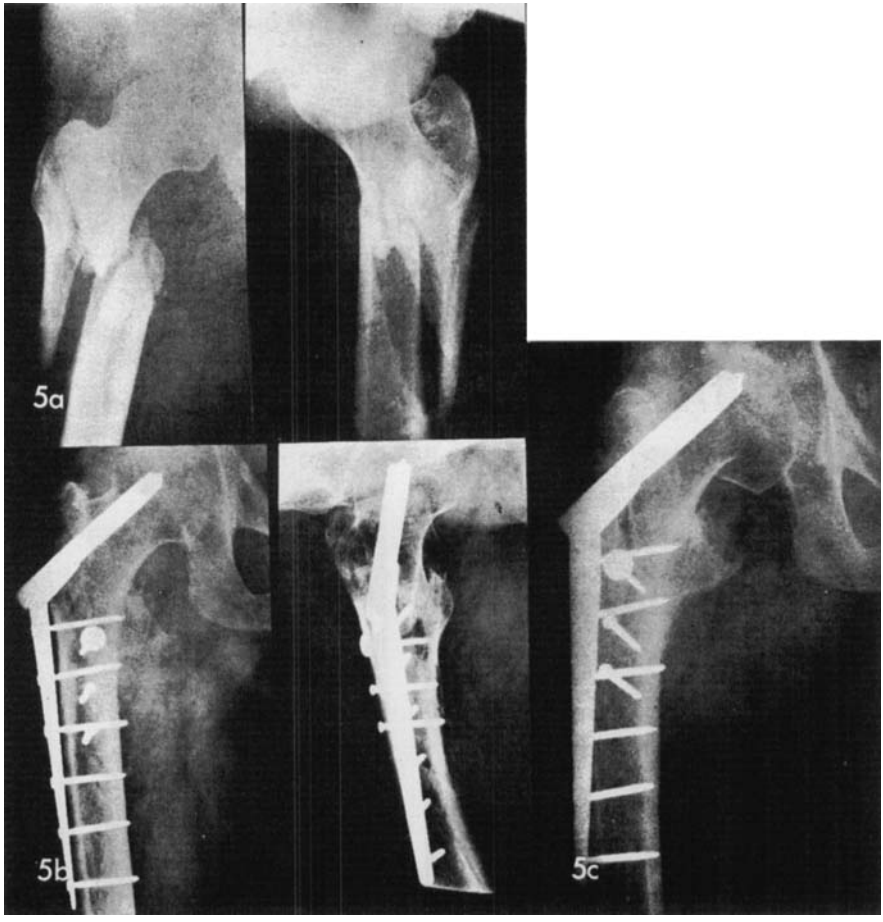

Fig. 5.

a. August 20, 1954. A 39 year old male. A comminuted trochanteric fracture after 2 weeks of treatment by skeletal traction. Although fair reduction had been obtained, it was feared that healing might be delayed.

b. January 24, 1955. Five months after open reduction and internal fixation. Bone continuity had been incompletely restored although it was sufficiently advanced to permit weight bearing without support.

c. February 3, 1955. Soon after a fall down a flight of steps in which a subcapital fracture was sustained. There was no mechanical failure of the fixation apparatus or displacement of the trochanteric fracture.

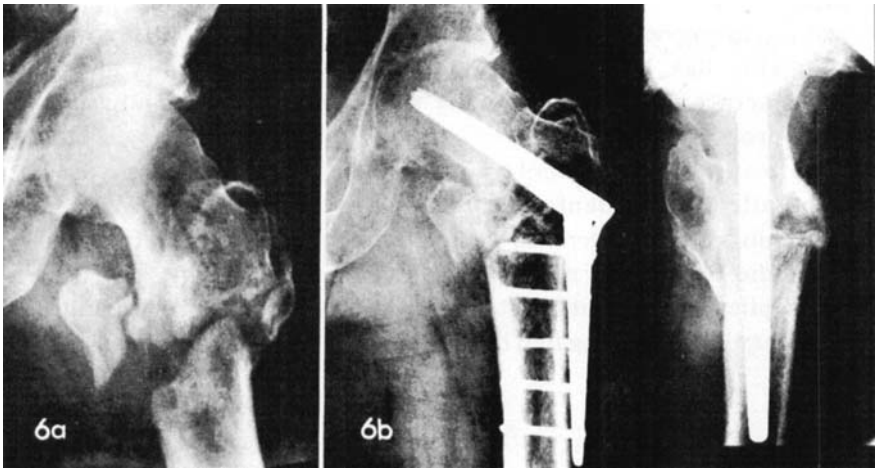

Fig. 6.

a. April 4, 1960. A 66 year old male. A comminuted trochanteric fracture after 3 months of treatment in skeletal traction. Only fibrous healing was present and continued traction was necessary to prevent varus deformity.

b. October 19, 1960. Six months after internal fixation. The patient was bearing weight unsupported. The fracture cleft was still visible and healing was incomplete.

has been accomplished may prove to be a significant factor in reducing the incidence of refracture.

Even though desirable, anatomic replacement of the lesser trochanteric fragment was not always feasible (Fig. 4). This important segment can add stability during the early phase of healing and ultimately can provide added structural solidarity to the healed bone. Although accurate anatomic replacement may not be possible, approximation of the fragment to the site of the defect, and prolonged support of the cervicocapital fragment in relation to the major diaphyseal fragment by adequate fixation apparatus can aid in restoring structural integrity (Fig. 4b and 4c).

Extensive comminution (Fig. 5a) can require supplemental fixation by either transfixion screws (Fig. 5b) or a second plate to obtain rigidity or to assure approximation of intermediate fragments. Rigidity of fixation and initial bone healing can provide sufficient structural solidarity that subsequent trauma will cause fracture at a location other than the original site (Fig. 5c).

Occasionally, internal fixation must be deferred until some complica-

ting factor has been rectified. Where prolonged skeletal traction is necessary to prevent deformity, it can be a factor in abetting delay of healing (Fig. 6a). Late internal fixation can provide rigidity of support to the fracture fragments allowing the patient to be mobilized while healing progresses (Fig. 6b).

This heavy "T"-beam nail and plate device also has been used for fixation after subtrochanteric osteotomy in adults.

Loosening at the interface with migration of the nail through the head of the femur was not encountered in these patients. Absence of this complication was attributed to avoidance of weight bearing until preliminary bone healing had been evident by radiographic examination.

SUMMARY

Observations gathered during a 12 year period following treatment of 15 comminuted trochanteric fractures by internal fixation with a "T"-beam nail and heavy plate are summarized. The fixation device was designed to provide a high factor in safety near the apex of the angle formed by its cervical and diaphyseal segments. Weight bearing was not advised until restoration of bone continuity by initial healing was considered to be present by radiographic examination. Mechanical failure of fixation was encountered only once and was manifest by breakage of screws used to fix the plate to the femoral diaphysis. Failure in this patient was attributed to weight bearing prior to restoration of bone continuity.

ACKNOWLEDGEMENT

I am indebted to Mr. Henry Rafael, Jr., the photographer.

RESUME

Compte rendu sommaire d'observations recueillies durant une période de 12 ans ayant suivi le traitement de 15 fractures trochantériennes broyées par fixation interne au moyen d'un clou en forme de tige en T et de fortes plaques. La formule de fixation était apte à assurer un facteur élevé de sécurité à proximité du sommet de l'angle formé par les segments cervical et diaphysaire. La charge du corps n'est pas conseillée avant qu'un examen radiographique ait montré le rétablissement de la continuité de l'os par guérison initiale. Un défaut mécanique de fixation n'a été constaté que dans un cas et s'est manifesté par la rupture des

vis utilisées pour la fixation de la plaque à la diaphyse fémorale. L'échec du traitement chez ces malades fut attribué à la charge du corps avant le rétablissement de la continuité de l'os.

ZUSAMMENFASSUNG

Beobachtungen, die während einer 12 jährigen Zeitspanne nach Behandlung von 15 trochantären Splitterbrüchen mittels innerer Fixation mit einem "T"-Balken Nagel und einer starken Platte gesammelt wurden, werden zusammengefasst. Die Ruhigstellungsvorrichtung wurde konstruiert um einen hohen Sicherheitsgrad in der Nähe der Spitze des Winkels, der von ihrer cervicalen und Diaphysensegmenten gebildet wird, zu geben. Belastung wurde nicht gestattet ehe nicht Röntgenuntersuchungen die Wiederherstellung der Knochenkontinuitet durch beginnende Heilung nachweisen konnten. Mechanisches Versagen wurde nur einmal angetroffen und wurde durch den Bruch der Schraube, die zur Befestigung der Platte an der Femurdiaphyse verwendet worden war, angezeigt. Der Versager bei diesem Patienten wurde der Belastung vor der Wiederherstellung der Knochenkontinuitet zugeschreiben.

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