TREATMENT OF FEMORAL SHAFT FRACTURES IN THE SPINAL CORD INJURY PATIENT USING THE WAGNER LEG LENGTHENING DEVICE

By ROBERT A. BAIRD, M.D. and ARTHUR KREITENBERG, M.D.

Divisional of Orthopaedic Surgery, Long Beach Veterans Administration Medical Center, Long Beach, California and Division of Orthopaedic Surgery, University of California-Irvine Medical Center, Orange, CA 92668, U.S.A.

Summary. External skeletal fixation for the treatment of femoral shaft fractures in the spinal cord injury patient is simple to apply, provides good fracture immobilization, affords easy access to the limb for skin care, and permits significant patient mobility and early return to pre-fracture functional status. This paper presents the rationale for the use of, and the technique of application of, the Wagner leg lengthening device for the external skeletal fixation of femoral shaft fractures in the SCI patient.

Key words: Spinal Cord Injury; Paraplegia; Femoral Fractures; Fracture Fixation; Osteoporosis.

Introduction

BECAUSE of disuse osteoporosis and lack of muscular control, lower extremity long bone fractures are not uncommon in the chronic spinal cord injury (SCI) patient. The incidence of long bone fractures in the SCI patient population has been estimated to be between four and eight per cent (Comarr, Hutchinson & Bors, 1962; Eichenholtz, 1963; Ragnarsson & Sell, 1981), with paraplegics found to sustain fractures more frequently than those with tetraplegia; probably because of their higher activity level (Ragnarsson & Sell, 1981). Femoral shaft fractures make up approximately 63 per cent of long bone fractures seen in this chronic SCI group (Comarr, Hutchinson & Bors, 1962). These fractures generally occur following minor trauma such as falls out of a wheelchair, turning in bed, or lower extremity manipulation. Classically, treatment alternatives for femoral shaft fractures have included external splintage and open reduction with internal fixation (Nottage, 1981). For various reasons, open reduction with internal fixation is generally considered a treatment modality with potential risks and complications outweighing its benefits (McMaster & Stauffer, 1975). These factors include:

1. Difficulty in obtaining adequate implant to bone fixation in the osteoporotic femur.
2. The tendency of spinal cord injury patients to sustain intermittent bacteremia which may lead to post-operative wound infection and osteomyelitis.
3. The propensity for lower extremity long bone fractures in SCI patients to heal with exuberant callus formation.

Address Reprint Requests to: Robert A. Baird, M.D., Division of Orthopaedic Surgery, University of California-Irvine Medical Center, 101 City Drive South, Orange, CA 92668.

4. The non-ambulatory status of the SCI patient decreases the need for good weight bearing alignment of healed lower extremity fractures.

External splintage of femoral shaft fractures has been adopted, therefore, as the general treatment of choice by many spinal cord injury centres. Immobilization has been obtained by using pillow splints (Freehafer, Hazel & Becker, 1981), Long Beach splints, specially molded polypropylene splints (El Ghatit, Lamid & Flatley, 1981), or by immobilization in bed using sandbags or other positioning devices. Although generally effective, external splintage of femoral shaft fractures poses several problems for the patient. When treated with bedrest, the patient's mobility and functional status is markedly diminished. If treated with a long leg splint, patient transfer between bed and wheelchair is made significantly more difficult. The wheelchair may need modification to permit elevation of the extended leg. The SCI patient may no longer be able to transfer to and from his car and sit in the driver's seat. If he drives a van from his wheelchair, he may not be able to move his wheelchair close enough to the steering column to reach the steering wheel and manual controls. Contractures of adjacent joints may occur (Ragnarsson & Sell, 1981) which require prolonged physical therapy following fracture union. In total, self-care for the SCI patient may be significantly diminished by the femoral shaft fracture treated with long leg splintage.

To prevent such diminution in functional status during the period of fracture healing, we have successfully treated a number of SCI patients with femoral shaft fractures using external skeletal fixation. Fracture immobilization, alignment, and position may be obtained without immobilization of the knee or hip joints. (Fig. 1) Pin care is easily performed

FIG. 1.
The Wagner leg lengthening device is attached to the femur.

by most paraplegic patients, and patients may be discharged home without significant diminution in their functional status.

Fractures between the lesser trochanter and a point 6 centimeters above the distal end of the femur are amenable to external fixation. Pre-operative assessment should include accurate radiographs demonstrating the absence of fracture comminution into the knee joint, or into the intertrochanteric region. Urinary tract infections or other sources of infection should be cleared prior to the operative procedure.

Technique

The Wagner leg lengthening device is a compact, rigid, unilateral external fixation device of adjustable length originally designed for use in children to correct leg length discrepancies (Fig. 2). Osteotomized or fractured bones are immobilized by placing two 6.0 mm Shanz screws into both the proximal and distal bone fragments, and by fixing the two pairs of screws together with the leg lengthening device. Changes in fragment position

FIG. 2

Special equipment for device application include (A) trocar; (B) sleeve; (C) T-handle chuck; (D) Schanz screws; (E) drill guide; (F) Wagner leg lengthening device.

may be made by adjusting the length of the device and the alignment of the adjustable pin clamps at the ends of the device.

The procedure may be carried out in a formal operating suite, or in a well-equipped treatment room where sterile procedures can be performed. Venous access should be obtained prior to the procedure. Anaesthesia is generally unnecessary, but intravenous sedation may be helpful. The procedure is performed with the patient supine. The entire extremity is draped free to permit manipulation of the fracture and to give easy access for intraoperative radiographic examination. Prior to pin insertion the leg should be brought into alignment. The patella should point anteriorly, and the rotation of the foot should match the patient's uninjured side.

Using standard pre-drilling techniques, the pins are inserted, and the Wagner leg lengthening device is attached to both proximal and distal pins leaving 2 centimetres between the device and the skin of the thigh. Radiographs confirm fracture alignment and pin placement. Further fracture reduction may be done at this time. Excess pin length lateral to the leg lengthening device is cut off using a large bolt cutter, and the pin ends are covered with rubber protectors. The stab wounds through which the pins have been placed may require extension to reduce skin tension. Gauze roll dressings soaked in povidone-iodine solution are wrapped around the pins.

Post-operatively the pulses of the extremities should be observed. The hematocrit is checked the next day. The patient may resume transfers, activities of daily living, and other functional activities on the first post-operative day. The patient, family, or home aid is taught to change the pin-site dressings which are applied daily after washing the skin around the fixation pins with hydrogen peroxide.

After fracture union is achieved, the Wagner leg lengthening device and pins are removed on an outpatient basis, and small gauze wicks are placed in the pin tracks for 48 hours. The patient is placed on oral antibiotics for 5 days after removal of the pins. The patient is permitted to shower or bathe forty-eight hours after removal of the gauze wicks, which the patient may do himself at home.

Illustrative Case Report

P.R. is a 50-year-old male with a complete T12 paraplegia from a gunshot wound to the spine in 1967. In 1983 he sustained a distal femoral shaft fracture while bending over in his wheelchair (Fig. 3). The patient's leg was placed in a sheepskin and canvas (Long Beach) long leg splint.

Three weeks after injury gross motion was still present at the fracture site. The patient was taken to the operating room where a Wagner leg lengthening device was applied without difficulty. The patient returned to using his wheelchair within 48 hours and was able to transfer to and from bed without difficulty (Fig. 4). Because of social reasons, the patient remained in the hospital for 3 weeks after application of the device, at which time he was discharged home fully able to use his wheelchair, perform his daily self-care activities including pin-site dressing changes, transfer to and from his car, and drive his automobile.

Eleven weeks after device placement the fracture showed radiographic signs of healing (Fig. 3). The device was loosened, and the fracture was

FIG. 3
Anteroposterior radiographs left femur fracture: (A) at time of application of device; (B) at time of fracture union, prior to device removal; (C) after removal of device.

found to be stable to manipulation. The Wagner leg lengthening device and pins were removed in the clinic.

FIG. 4

Patient sits comfortably in standard wheelchair with hips and knees flexed.

Discussion

External skeletal fixation of femoral shaft fractures in the spinal cord injury patient is an effective means of fracture immobilization which affords significant functional advantages, with minimal increase in risk to the patient. Early return to prefracture functional capacities and reduced hospital stay may be achieved. The Wagner leg lengthening device requires only four large half-pins for adequate fracture immobilization. It permits controlled fracture compression and is compact in size, permitting both varied patient positions in bed, and use of a standard size wheelchair with the device in place. Use of the Wagner leg lengthening device is simple, and the device may be used for multiple patients decreasing its per patient cost. The device is acceptable to most patients, and is easily hidden by clothing for social and cosmetic reasons.

RÉSUMÉ

Fixation externe squelettique pour traiter les fractures du corps du fémur chez les patients atteints de lésions à la moelle épinière simple à appliquer, immobilise bien la fracture, permet de facilement avoir accès au membre pour les soins de la peau et offre au patient la possibilité de se mouvoir et de retrouver facilement l'usage de son membre tel qu'avant la fracture. Ce travail présente les raisons poussant à l'utilisation du système Wagner d'allongement de la jambe pour la fixation externe squelettique des fractures du corps du fémur chez les patients atteints de lésions à la moelle épinière ainsi que la technique d'application.

ZUSAMMENFASSUNG

Die externe Skelettbefestigung zur Behandlung von Oberschenkelbrüchen bei Patienten mit Rückenmarksverletzungen ist einfach anwendbar, ermöglicht gute Bruchimmobilisierung, gewährt einfachen Zugang zum Bein zur Hautpflege, erlaubt die bedeutende Beweglichkeit des Patienten, und ermöglicht eine frühzeitige Rückkehr zum Funktionszustand vor dem Zeitpunkt des Bruchs. Diese Abhandlung stellt eine Grundlage dar für den Gebrauch von und die Anwendungsmethode der Wagner-Beinverlängerungsvorrichtung zur externen Skelettbefestigung von Oberschenkelknochenbrüchen bei Patienten mit Rückenmarksverletzungen.

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