Injury, Int. J. Care Injured (2006) **37**, 97—108

ELSEVIER

INJURY
INTERNATIONAL JOURNAL OF THE CARE OF THE INJURED

www.elsevier.com/locate/injury

REVIEW

Distal femoral fractures: A review of fixation methods

M.C. Forster *, B. Komarsamy, J.N. Davison

Leicester Royal Infirmary, Leicester, UK

Accepted 15 February 2005

KEYWORDS
Distal femoral fractures;
Fractures;
Supracondylar fractures;
Fixation methods

Summary The treatment of distal femoral fractures has evolved; nevertheless, these fractures remain difficult to treat and carry an unpredictable prognosis. Over the years, many different strategies have been used with varying success. This review outlines the problems presented by distal femoral fractures and the results of current surgical techniques.

Contents

* Corresponding author. Present address: Applegate, 161 Ashbourne Road, Turnditch, Belper, Derbyshire, DE56 2LH, UK. Tel.: +44 1773 550751.
E-mail address: mcforster@doctors.org.uk (M.C. Forster).

0020-1383/$ — see front matter
doi:10.1016/j.injury.2005.02.015

Introduction

The treatment of distal femoral fractures has evolved over the years, but despite this, they remain difficult to treat and carry an unpredictable prognosis. Many different fixation methods have been described. Although many studies have been reported, direct comparison between them is not possible because of differences in patient factors, fracture types and evaluation methods.

There are few comparative studies on which to base decision-making. Distal femoral fractures are often multifragmentary, and/or intra-articular, and are subject to deforming muscular forces that render non-operative treatment a poor option. These factors also place high demands on any surgical implant and may lead to failure. The aim of this review is to assess the current, available literature on distal femoral fractures, with particular reference to the various available treatment methods.

Epidemiology

Fractures of the distal femur comprise 4—6% of all femoral fractures.[34,46] They occur in a bimodal distribution: 15—50 years of age, predominantly in males, sustaining high-energy trauma, and 50+ years of age predominantly in females, with osteoporosis, who sustain relatively low energy trauma.[46] The osteoporosis leads to comminution and may pose problems for fixation. Eighty-five percent of distal femoral fractures occur in the over 50s group.[34]

Anatomy

The main zones of weakness in the distal femur are (1) the transition from diaphysis to metaphysis, (2) the sagittal plane through the intercondylar notch, where the patella can act as a wedge and (3) the junction between the trochlear groove and medial, or lateral, condyle.[1] Coronal splits in the condyles may also occur.

Fractures tend to follow these planes of weakness, but can be associated with significant fragmentation, either as a result of high-energy trauma, or of osteoporosis (Fig. 1).

The quadriceps, adductors, hamstrings and gastrocnemius muscles can all cause displacement of the fracture fragments.[70] The gastrocnemius may cause posterior angulation of the distal fragment: overriding of the fragments may be caused by the combined action of the quadriceps and hamstrings. The heads of gastrocnemius may also rotate and spread intercondylar fractures. The adductors may cause varus or valgus deformities, depending on the fracture configuration and its relationship to the adductor tubercle. Any fixation system needs to be strong enough to resist these deforming forces and yet adaptable enough to deal with the various fracture patterns.

The popliteal artery is relatively fixed in the adductor and soleus canals. It lies in close relation to distal femur and can be damaged by a posteriorly angulated fracture. Fortunately, this is rare, with an incidence of approximately 0.2%.[70]

Classification

Neer et al.,[53] Seinsheimer[66] and Egund and Kolmert[14] have all described classification systems, but the Müller et al.[52] AO classification is currently

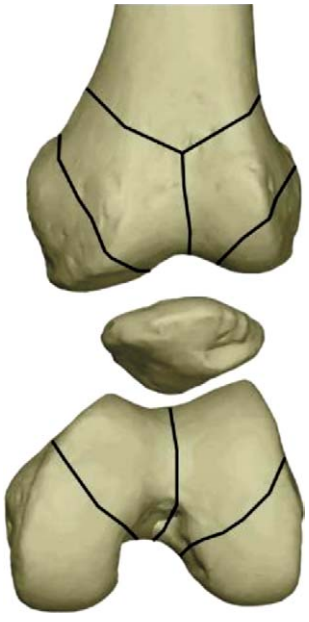

Figure 1 Lines of weakness marked on the distal end of a Sawbone femur.