Percutaneous fixation of subtrochanteric femoral fractures in children

Thesis

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Abstract

The aim of this study is to present our results with percutaneus fixation of subtrochanteric femoral fractures in children using low profile ilizarov.Injuries were due to motor car accident and fall from heights. Pathological fractures and fractures associated with neuromuscular diseases were excluded from this study. Two patients had associated abdominal injuries.Surgery was performed 2-10 days after the injury under general anesthesia with minimal blood loss.In all cases 2 half pins are used to fix proximal fragment, mounted on mini arch, and 3 half pins used to fix distal part, mounted on another arch, where both arches are connected by threaded rods with conical washers. Frontal plane reduction can be done adjusted using the lateral rod whereas sagittal reduction can be adjusted using the anterior and the posterior rods.

Keywords: A.S.D- H-E angle- subtrochanteric- *orthopaedics*

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- **H-E angle**: Hilgenreiner-epiphyseal angle
- **N-S angle:** Neck-Shaft angle
- **CR:** Closed reduction
- **A-P view:** Anteroposterior view of radiograph
- **A.S.D:** Atrial Septal Defect
- **ROM:** Range of motion
- **S.D:** Standard Deviation

Aim of study

This prospective study (on 15 patients) is performed to evaluate the results of **the percutaneus fixation of subtrochanteric femoral fractures in children secured to low profile ilizarov arches** in restoring the normal alignment and orientation, thereby restoring the normal mechanics of the hip joint, overcoming malunion or the angular rotation of fracture.

Chapter one

Review of literature

Introduction

A) Embryological anatomy:

Ossification of the femur begins in **the seventh fetal week.** In early childhood, only single proximal femoral chondroepiphysis exists.

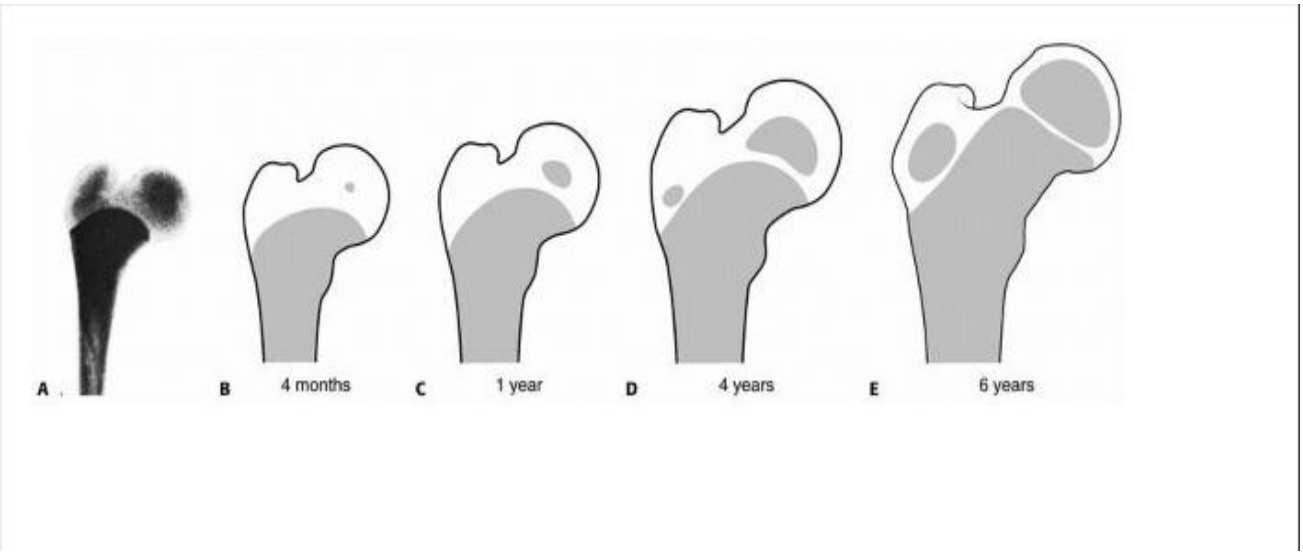
During the first year of life, the medial portion of this physis grows faster than the lateral, creating an elongated femoral neck by **1 year of age .** (1, 2, 3)

Capital femoral epiphysis begins to ossify at approximately **4 months in girls** and **5 to 6 months in boys**. The ossification center of the trochanteric apophysis appears **at 4 years in boys and girls**.

The proximal femoral physis is responsible for the metaphyseal growth in the femoral neck, whereas the trochanteric apophysis contributes to the appositional growth of the greater trochanter and less to the metaphyseal growth of the femur. Fusion of the proximal femoral and trochanteric physes occurs at about **the age of 14 in girls** and **16 in boys.** (1, 2 ,3)

The confluence of the greater trochanteric physis with the capital femoral physis along the superior femoral neck and the unique vascular supply to the capital femoral epiphysis make the immature hip vulnerable to growth derangement and subsequent deformity after a fracture (1, 2, 4) **(Figure 1.1).**

The femur is ossified from **five centers**: one for the body, one for the head, one for each trochanter, and one for the lower end. Of all the long bones, except the clavicle, it is **the first to show traces of ossification**; this commences in the middle of the body, at about the seventh week of fetal life, and rapidly extends upward and downward.(1 ,2 ,4)



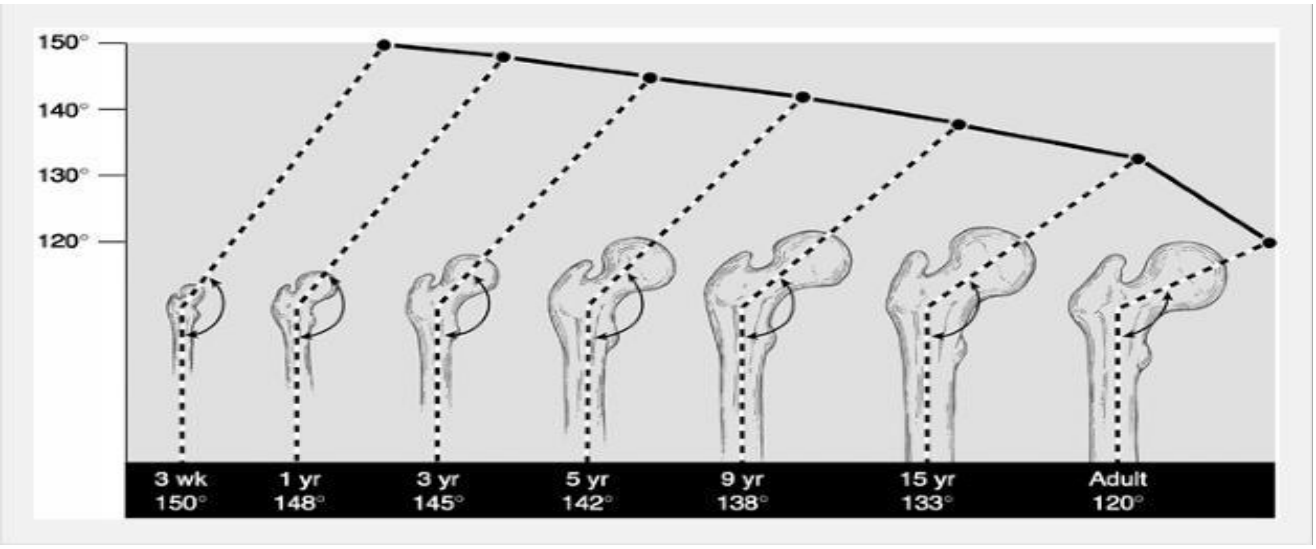
(Figure 1.1): Ossification of femur. (1)

The centers in the epiphyses appear in **the following order**: in the lower end of the bone, at the ninth month of fetal life (from this center the condyles and epicondyles are formed); in the head, at the end of the first year after birth; in the greater trochanter, during the fourth year; and in the lesser trochanter, between the thirteenth and fourteenth years.(3 ,4)

The order in which the epiphyses are joined to the body is the reverse of that of their appearance; they are not united until after puberty, the lesser trochanter being first joined, then the greater, then the head, and, lastly, the inferior extremity, which is not united until the twentieth year. (3 ,4)

In early fetal development, the proximal femoral physis extends across the entire proximal femur. The cartilage columns that make this physis then differentiate into cervical epiphyseal and trochanteric apophyseal portions.

The medial cervical portion matures first, elongating the femoral neck . The neck-shaft angle is determined by the relative amount of growth at these two sites . The **mean angle** of the femoral neck-shaft angle is **150** degrees at **3 weeks** of age, decreasing to **120-130** degrees in adulthood. **(Figure 1.2)** (4, 5, 6, 7)



(Figure 1.2): Evolution of the neck-shaft angle in the normal hip. (4)

B)The vascular anatomy of the proximal femur in children differs from that in adults. **The artery of the ligamentum teres** does not contribute any blood supply until the age of 8 years.

The metaphyseal vessels contribute to the intraosseous blood supply to the femoral head only after the physeal closure, between 14 and 17 years of age, when the vascular anastomoses between the metaphyseal and epiphyseal blood vessels develop.(5, 7)

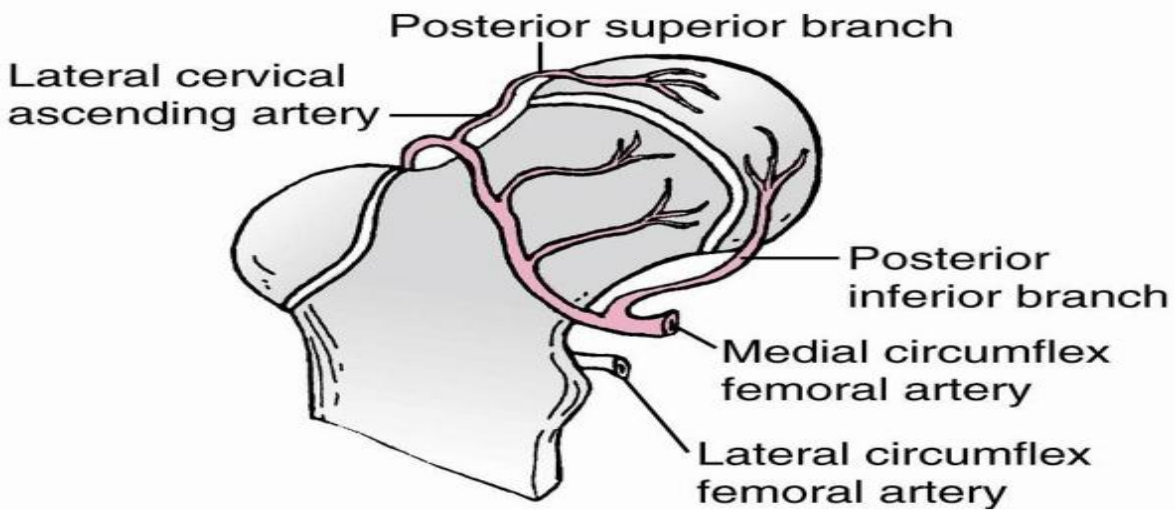
The lateral epiphyseal branches of the medial femoral circumflex system supply most of the femoral head throughout childhood.

The vascularity of the femoral head, therefore, is scarce in children, between 3 and 8 years of age, and this arrangement renders children highly susceptible to avascular necrosis after proximal femoral injuries at that age.**(Figure 1.3)**(5, 7)

The **paediatric femoral shaft** has an **abundant blood supply** that derives from both endosteal and periosteal blood vessels.

The endosteal blood supply is from 2 nutrient vessels, which enter the medullary canal posteromedially at the junction of the proximal and middle thirds and the junction of the distal and middle thirds of the shaft. (5, 7)

The periosteal blood supply comes from the large muscular cuff of the thigh. The periosteal vessels supply the outer one third of the cortex. These 2 systems are interconnected and together provide the abundant blood supply that facilitates both the growth of bone and the healing of fracture (5, 7).



(Figure1.3): Blood supply to proximal femur.(5)

C) Bony anatomy:

The **femur,** the longest and strongest bone in the skeleton, is almost perfectly cylindrical in the greater part of its extent. In the erect posture it is not vertical, but inclining gradually downward and medially. (7 , 8)

The femur, like other long bones, is divisible into a **body** and **two extremities. The Upper Extremity** has a **head, a neck, a greater and a lesser trochanter**.

The Greater Trochanter is a large, irregular, quadrilateral eminence, situated at the junction of the neck with the upper part of the body. It is directed a little lateral and backward, and, in the adult, is about 1 cm lower than the head. It has two surfaces and four borders. (7 , 8)

The **lateral surface** is quadrilateral in form, broad, rough, convex, and marked by a diagonal impression, which extends from the postero-superior to the antero-inferior angle, and serves for the insertion of the tendon of the Glutaeus medius.

Above the impression is a triangular surface, sometimes rough for part of the tendon of the same muscle, sometimes smooth for the interposition of a bursa between the tendon and the bone. Below and behind the diagonal impression is a smooth, triangular surface, over which the tendon of the Glutaeus maximus plays, a bursa being interposed. (7 , 8)

The **medial surface** presents at its base a deep depression, the **trochanteric fossa** for the insertion of the tendon of the Obturator externus, and above and in front of this an impression for the insertion of the Obsturator internus and Gemelli.

The **superior border** is free; it is thick and irregular, and marked near the center by an impression for the insertion of the Piriformis. (7 , 8)

The **inferior border** corresponds to the line of junction of the base of the trochanter with the lateral surface of the body; it is marked by a rough, prominent, slightly curved ridge, which gives origin to the upper part of the Vastus lateralis.

The **anterior border** is prominent and somewhat irregular; it affords insertion at its lateral part to the Glutaeus minimus.

The **posterior border** is prominent and appears as a free, rounded edge, which bounds the back of the trochanteric fossa. (7 , 8) **(Figure 1. 4)**