Injury, Int. J. Care Injured 46 (2015) 441–444

Contents lists available at ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

The perfect reduction: Approaches and techniques

John C. Kurylo [a,1], David Templeman [a,b,1], Gudrun E. Mirick [a,*]

[a] Hennepin County Medical Center, Department of Orthopaedic Surgery, 701 Park Ave, G2.140, Minneapolis, MN 55415, United States
[b] University of Minnesota, United States

ARTICLE INFO

Article history:
Received 14 July 2014
Accepted 17 November 2014

Keywords:
Femoral neck fracture
Open reduction
Smith-Petersen
Watson-Jones
Approach

ABSTRACT

Anatomic reduction of femoral neck fractures is difficult to obtain in a closed fashion. Open reduction provides for direct and controlled manipulation of fracture fragments. This can be accomplished via multiple approaches. The anterolateral, or Watson-Jones, approach or Smith-Petersen, or direct anterior, approach are the two most frequently used. Percutaneous techniques have also been described, though they lack the visual confirmation of reduction of a traditional open approach. These can be performed using a fracture table or with a free leg on a radiolucent table in either supine or lateral positions. Knowledge of the hip and pelvis anatomy is crucial for the preservation of critical femoral neck vasculature. Intra-operative fluoroscopy together with direct visualization provides the framework for successful manipulation of the fracture fragments, temporary stabilization, and ultimately fracture fixation.

The key to the perfect reduction is approaching the fracture with the understanding that if an anatomic reduction cannot be obtained closed, direct visualization of the fracture is mandatory. Multiple studies have documented improved outcomes with anatomic reduction [14–25].

To obtain the desired perfect reduction one must enter the operating room with all needed information to have a clear operative plan in place (and a backup plan) such that no surprises are encountered during surgery. Therefore all patients need pre-operative anterior–posterior (AP) pelvis, AP hip, and lateral hip radiographs. The AP pelvis radiograph provides an uninjured contralateral hip to judge the reduction, off set, neck-shaft angle, angulation, and length that one should aim to achieve. In addition to radiographs, a pre-operative CT scan will visualize the area of comminution that may not be seen with routine radiographs (Fig. 1). Recognizing the fracture pattern and understanding the biomechanics of the fracture guides implant choice and prevents loss of reduction. For example, the fracture pattern seen in young adults is different from that observed in elderly patients based on their bone quality and injury mechanism. Young adults typically suffer higher energy mechanisms of injury which result in basicervical or distal femoral neck fractures which is more vertically oriented and more unstable [28–32].

Before beginning any reduction manoeuvres, visualizing the fracture in the AP and lateral planes is paramount. One must be able to see the fracture in multiple views to judge reduction (Fig. 2). Often the non-operative extremity needs to be flexed into a "frog-leg up" position or extended and lowered down to the floor to see a true lateral of the injured femoral neck.

Patient positioning and table choice are paramount for a perfect reduction. The surgeon needs direct access to the fracture site and limit the need for "hands on" constant fracture reduction. Multiple table options exist: fracture table with traction, fracture table without traction, or using a radiolucent flat top table with the leg draped free. Additionally supine versus lateral position is possible for all tables. All options need to be considered with the goal of having direct access to the fracture with the ability to obtain a perfect reduction. Supine positioning will allow you direct access to the femoral head, neck, shaft, and pelvic brim. Additionally it will allow fixation to be placed from lateral to medial. Performing the anterolateral approach, the Watson-Jones, can be performed in the lateral position; however, gravity may cause medialization of the operative extremity and impact the femoral neck/head reduction. Using a table with traction and a perineal post will allow a temporary or permanent reduction to be obtained. With constant traction pulled through the operative extremity and the counter-force at the perineal area, the femoral neck can be reduced. One must be cautious to limit the amount of time in

* Corresponding author. Tel.: +1 612 873 2490; fax: +1 612 904 4280.
E-mail addresses: john.kurylo@gmail.com (J.C. Kurylo), templ015@umn.edu (D. Templeman), gmirick@gmail.com (G.E. Mirick).
[1] Tel.: +1 612 873 4220; fax: +1 612 904 4280.

http://dx.doi.org/10.1016/j.injury.2014.11.027
0020–1383/

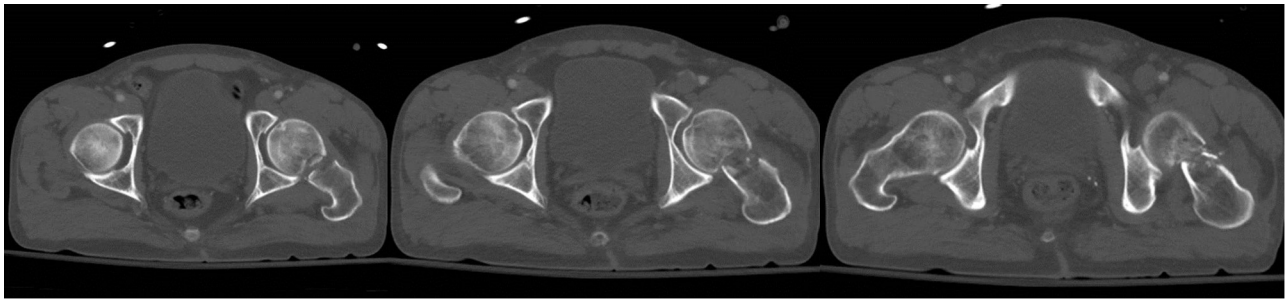

Fig. 1. Axial CT cuts reveal a femoral neck fracture with previously unrecognized anterior comminution.

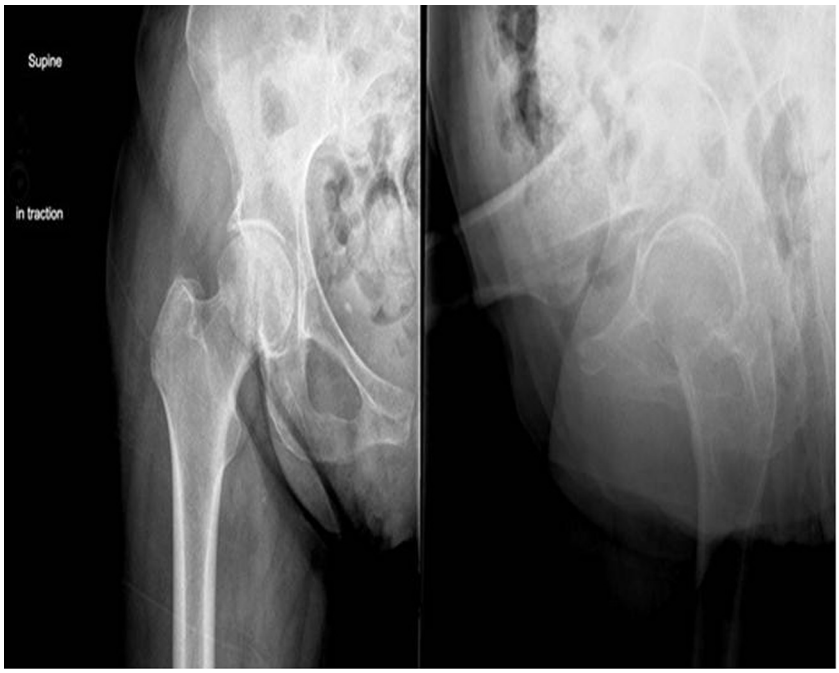

Fig. 2. Pre-operative radiographs include the AP of the proximal femur and a cross table lateral. Before starting a surgical procedure, it is essential that these same fluoroscopic views can be obtained.

traction to help reduce the risk of pudendal or femoral nerve palsies and compartment syndrome [1–3].

It is always important to discuss the surgical plan in terms of paralysis with the anaesthesia team. General anaesthesia with endotracheal intubation allowing for complete muscle relaxation is needed during the case. Fighting soft tissue tension from non-relaxed muscles can result in a malreduction or a loss of reduction.

A wide array of treatment algorithms have been described in the literature when deciding between closed reduction and percutaneous fixation and open reduction internal fixation of a femoral neck fracture [13,33–38]. While no single algorithm can capture all patients their chronological and physiological age, current and future expected level of activity, bone quality, associated comorbidities, and fracture pattern must all be considered when making a surgical fixation decision. Acceptable closed reduction parameters have historically been defined as a neck shaft angle between 130 and 150 degrees, less than 15 degrees of valgus with no varus angulation, and 0–15 degrees of anteversion [25]. Overall, the rates of avascular necrosis (AVN) are lower with closed reduction [12]. The use of capsulotomy in the treatment of femoral neck fractures has not been definitively established. A prospective cohort study showed that with intra-capsular pressure difference >30 mm between the injury hip and the uninjured hip were found to have a higher rate of AVN [9,11]. Checking intra-capsular pressure and the routine use of a capsulotomy remains controversial and varies.

The decision to abandon closed reduction and proceed to the open approach to achieve the desired reduction must be balanced with the cost of the dissection and the potential insult to the vascular supply to the femoral head. An accurate reduction and stable fixation reduce the relative risk of fracture healing complications by a factor of 13 [25]. A more anatomic reduction leads to higher union rates and lower failure [27], and reduction method and quality of bone has a more pronounced effect on healing than surgical timing [8]. The two methods for direct fracture fixation are the Watson-Jones anterolateral approach and the Smith-Petersen direct anterior approach.

The Watson-Jones anterolateral approach, usually performed in a lateral position, starts with an incision just posterior to the anterior superior iliac spine (ASIS) [4]. It is extended distally vertically along the anterior margin of the trochanter. The tensor fascia lata and gluteus medius are identified. The interval between is divided allowing these muscles to be separated up to iliac crest. The anterior portion of the gluteus medius and minimus are raised from the greater trochanter and retracted posteriorly. A stay suture is frequently placed at the split to prevent damage to the superior