Treatment of Femoral Neck Fractures in Young Adults

Thuan V. Ly and Marc F. Swiontkowski

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Intracapsular femoral neck fractures are common in the elderly population after a simple fall. However, femoral neck fractures in physiologically young adults are less common. These younger patients are active, have minimal medical problems, and have good bone quality. Understanding the differences between elderly, frail patients and physiologically young and active patients facilitates treatment. Characteristic differences are seen in the osseous and vascular anatomy, the mechanism of injury, the associated injuries, the fracture pattern, and the goals of treatment.

Femoral neck fractures in young adults are associated with higher incidences of femoral head osteonecrosis and nonunion. The reported rate of osteonecrosis after a femoral neck fracture in young patients ranges from 12% to 86%. This complication may lead to collapse of the femoral head and osteoarthritis. Salvage procedures, such as osteotomy, and other reoperations have high failure rates, and arthroplasty procedures are not ideal, given the patient’s young age and higher level of activity. While achievement of an anatomic reduction and stable internal fixation is imperative, the effects of other treatment variables, such as the time to surgery, the role of capsulotomy, and specific fixation methods, have been debated. Knowledge of these treatment options and potential complications aids in the understanding and management of femoral neck fractures in young adults.

Anatomy

The femoral head blood supply comes from three main sources, the medial femoral circumflex artery, the lateral femoral circumflex artery, and the obturator artery. In adults, the obturator artery provides little and variable amounts of the blood supply to the femoral head through the ligamentum teres. The lateral femoral circumflex artery gives rise to the inferior metaphyseal artery by way of the ascending branch and supplies the majority of the inferoanterior aspect of the femoral head. The largest contributor to the blood supply of the femoral head, especially its superolateral aspect, is the medial femoral circumflex artery. The lateral epiphyseal artery complex originates from the medial femoral circumflex artery and courses along the posterosuperior aspect of the femoral neck before supplying the femoral head. These terminal branches supplying the femoral head are intracapsular; thus, disruption or distortion of these terminal branches due to displacement of the femoral neck fracture plays a substantial role in the development of osteonecrosis. Variables that have been hypothesized to contribute to femoral head osteonecrosis include...
vascular damage from the initial femoral neck fracture, the quality of the reduction or fixation of the fracture (whether flow has been restored to the distorted arteries) and elevated intracapsular pressure.

Diagnosis

Femoral neck fractures in elderly patients usually occur as a result of a fall from a standing height. Poor bone density, multiple medical problems, and a propensity to fall are major risk factors for a femoral neck fracture in these individuals. In physiologically young adults, the mechanism of injury often involves high-energy trauma, such as a motor-vehicle collision or a fall from a height. A substantial axial load with the hip in an abducted position is required for the femoral neck to fracture in these young individuals. The clinical evaluation of these patients should include a thorough trauma work-up, as they frequently have other injuries. Diagnosis and treatment of femoral neck fractures in young adults should be done immediately after other life and limb-threatening injuries have been managed. Patients with a femoral neck fracture have a shortened, flexed, and externally rotated lower extremity. Radiographic evaluation should include anteroposterior and lateral plain radiographs of the entire femur as well as an anteroposterior radiograph of the pelvis. Ipsilateral femoral neck fractures have been reported in association with 2% to 6% of all femoral shaft fractures. These concomitant ipsilateral injuries can be challenging to reduce, and the best methods of fixation are debatable.

The fracture pattern seen in young adults is different from that observed in elderly patients. An elderly patient with poor bone quality who has sustained a low-energy injury, such as a fall from a standing height, usually sustains an intertrochanteric hip fracture or a femoral neck fracture, which is often subcapital. It is common to see a transverse fracture pattern with impaction at the fracture site. In young adults with better bone quality, the higher-energy mechanisms of injury (usually an axially loaded, high-energy force applied to an abducted hip) result in a basivertical or more distal neck fracture. The fracture pattern has a tendency to be more vertically oriented and, thus, biomechanically more unstable. These characteristics have important implications with regard to obtaining and maintaining stable fixation, both of which are necessary for healing to occur.

Despite its known limitations, the Garden classification is frequently used to describe femoral neck fractures in elderly patients. In this age group, treatment is based on whether the fracture is nondisplaced (Grade I or II) or displaced (Grade III or IV). The Garden classification is not as useful for describing femoral neck fractures in young adults. The Pauwels classification is more descriptive of femoral neck fractures in young adults. The fracture pattern can indicate the relative stability of the fracture and predict the difficulty of obtaining stable fixation. A femoral neck fracture line <30° from the horizontal plane is Pauwels Type I, one that has an angle with the horizontal between 30° and 50° is Pauwels Type II, and one that has an angle of >50° is Pauwels Type III. The Type-I femoral neck fracture has more intrinsic stability than the others. Type-III femoral neck fractures, which are the least stable, are seen in young adults more frequently than in elderly individuals. Type-III fracture patterns are more difficult to treat and are associated with increased risks of fixation failure, malunion, nonunion, and osteonecrosis.

Principles of Management and Treatment Algorithm

We generally consider patients who are younger than sixty-five years old as “young” and those over seventy-five years old as “elderly.” Patients between sixty-five and seventy-five years old are judged to be young or elderly on the basis of the physiological age. Those who are active and have high functional demands, good bone quality, and minimal medical problems are considered “young,” whereas those who have low functional demands (use an assistive device to walk), chronic illnesses, or poor bone quality are considered “elderly.”

For an elderly patient, the goals are to restore mobility with weight-bearing as tolerated and to minimize complications seen with prolonged bed rest. A hemiarthroplasty or total hip replacement often accomplishes these goals best. The patient’s age makes...
preservation of the femoral head of little importance.

For a physiologically young and active adult, the goals are to preserve the femoral head, avoid osteonecrosis, and achieve union. Avoiding an arthroplasty is ideal. It is generally agreed that anatomic reduction and stable internal fixation are paramount for a good outcome. Nevertheless, other issues such as the use of closed or open reduction, the role of capsulotomy, and the time to surgery remain controversial. The specific method of fixation is a less controversial variable.

The fracture pattern alone determines the treatment of nondisplaced fractures. These should be treated with internal fixation. Nonoperative management of an nondisplaced femoral neck fracture is associated with higher complication rates and an increased risk of displacement. Proper selection of patients for internal fixation can be more difficult when the fracture is displaced. The factors to consider when deciding whether to proceed with open reduction and internal fixation of a displaced femoral neck fracture are the patient’s chronological and physiological ages, level of activity, bone quality, associated comorbidities, and fracture pattern and characteristics. While multiple treatment algorithms have been utilized and published, the best protocol remains debatable.

**Surgical Approach**

After the patient is medically optimized, surgical fixation of the femoral neck should proceed expeditiously. The injured limb should be left shortened and externally rotated while the patient awaits surgery. Several authors have shown that the intracapsular pressure changes with the hip position in patients with a femoral neck fracture. Intracapsular pressure is highest when the hip is in extension with internal rotation, and it decreases substantially when the hip is in flexion with external rotation.

Once the patient is under anesthesia, closed reduction is attempted by flexing the hip to 45° with the hip slightly abducted and then extending and internally rotating the lower limb while applying longitudinal traction. The quality of the reduction is judged on the basis of fluoroscopic imaging before the surgeon proceeds with percutaneous fixation. Only an anatomic reduction should be accepted; if it is not possible, one should proceed with an open reduction and internal fixation. Our preference is to have the patient in the supine position, on a radiolucent table, and the leg draped free, but some prefer the patient to be in traction on a fracture table. The supine position provides optimal visualization for fracture reduction and facilitates fluoroscopic imaging. Furthermore, other orthopaedic or surgical teams can address associated injuries with the patient supine.

A Watson-Jones approach is used (Fig. 2). A straight lateral incision is made over the proximal-lateral part of the femur. Proximally, the incision is curved anteriorly toward the gluteal pillar of the ilium. The tensor fasciae latae are retracted anteriorly while the gluteus medius is retracted posteriorly. The pericapsular fat is then swept off to visualize the anterior aspect of the hip capsule. The vastus lateralis can be elevated slightly off the greater trochanteric ridge for further visualization. A T-capsulotomy, with release of the capsule from the intertrochanteric ridge, is performed in line with the femoral neck. This allows decompression of the hematoma and direct visualization of the femoral neck fracture. The edges of the capsule can be tagged with a suture for retraction. Inserting a small, pointed Hohmann retractor outside the capsule onto the anterior part of the acetabular rim can aid in visualization.

For the reduction, a bone-hook or a 5-mm Schanz pin can be applied to the distal fracture segment. The bone-hook can be placed onto the greater trochanter for lateral traction, and the lower extremity can be manipulated and externally rotated. This will disimpact the fracture and facilitate reduction with an internal rotation maneuver. The
alternative is to place a Schanz pin from anterior to posterior several centimeters distal to the fracture site to aid in manipulation of the distal fragment. For the proximal segment, 2.0-mm Kirschner wires can be inserted into the femoral head, to function as joysticks to lift the proximal fragment anteriorly and reduce the fracture. Once the femoral neck fracture is anatomically reduced by direct visualization of the anterior cortex and confirmed by fluoroscopic
imaging, a Weber clamp or 2.0-mm Kirschner wires can provisionally hold the reduction. Definitive fixation can be obtained with three cannulated or noncannulated cancellous screws (Fig. 3). Closure is routine. Another approach, with use of a modified Smith-Petersen surgical exposure, has been described62. This allows direct access to and visualization of the femoral neck fracture, especially in the subcapital region. However, a separate incision is required for implant insertion.

The postoperative regimen that we use includes antibiotics for twenty-four hours, prophylaxis against deep venous thrombosis with low-molecular-weight heparin or Coumadin (warfarin) for four to six weeks, depending on the patient’s ambulatory status, and physical therapy consultation. Patients are rapidly mobilized and are instructed to use toe-touch weight-bearing with crutches or a walker for twelve weeks. Patients can progress to full weight-bearing when they have the strength and balance to do so. They are instructed to wean off of crutch support when they are able to walk without a substantial limp. Monthly radiographs are made to assess healing and to identify any evidence of femoral head osteonecrosis. A reasonable clinical indicator that the femoral head is still viable is relative femoral head osteopenia on the injured side as compared with the normal side on an anteroposterior pelvic radiograph. A single-photon-emission computed tomography (SPECT) scan can be obtained to evaluate the chance of femoral head osteonecrosis developing. If the uptake is <90%, there is an increased chance of osteonecrosis developing63. Magnetic resonance imaging is not a good predictor of posttraumatic osteonecrosis64,65. We have found that patients in whom femoral head osteonecrosis develops usually have persistent groin and trochanteric pain that does not resolve with time. If the patient does not have pain and has normal radiographic findings at twenty-four months, osteonecrosis is unlikely to develop. A femoral neck fracture is deemed to be healed when the patient is asymptomatic and the fracture is no longer visible. If there is any question (due to persistent pain) about healing at four to six months postoperatively, a computed tomography scan should be obtained to assess the fracture line.

Fixation Methods

The type and number of cancellous screws necessary for effective treatment of femoral neck fractures have been evaluated in multiple clinical and biomechanical studies66-68. A major limitation of these studies is that their conclusions are all based on osteoporotic bone models. However, the basic biomechanical principles should still apply to young adults with good bone density. Fixation with multiple cancellous lag screws is recommended for most femoral neck fractures (Figs. 4-A through 4-E). Three cancellous lag screws placed parallel to one another and perpendicular to the fracture line provide optimal compression at the fracture68. Pauwels Type-I and II fracture variants are most amenable to this type of fixation. These three cancellous lag screws should be in an inverted triangle configuration (Fig. 4-B) because there is less risk of a subtrochanteric fracture with this apex-distal screw orientation than there is with the apex-proximal orientation69,70. The most inferior screw should rest on the medial aspect of the distal femoral neck fragment to resist varus displacement. A fourth screw does not increase mechanical strength enough in most femoral neck fractures to justify its use, but if there is posterior comminution, a fourth screw is recommended70,71. Two cannulated screws are inadequate for fixation of a displaced femoral neck fracture70,72.

Basicervical femoral neck fractures with comminution are a variant in
which a sliding hip screw provides more stable fixation than three cancellous screws.44,45 Blair et al. recommended sliding-hip-screw fixation on the basis of their biomechanical cadaver study in which they evaluated three different fixation techniques for the treatment of a basicervical femoral neck fracture. They found that a derotational screw located superior to the sliding hip screw does not enhance fixation. However, we still use a derotational screw to prevent rotation of the femoral head during insertion of the compression screw.

The Pauwels Type-III fracture remains a difficult challenge. The dominant shear force with this high-angle fracture pattern lends itself to higher rates of failure and nonunion.32-41,73 Our preference for treating Pauwels Type-III fractures is open reduction and internal fixation with three cannulated screws. Obtaining an anatomic reduction and adequate fixation remains the key to successful treatment of femoral neck fractures in young adults, as it is in the treatment of any other fracture. Failure is often a result of not adequately achieving these goals, which are best accomplished through an open approach to visualize the fracture, anatomic reduction of the fracture, and achievement of fracture compression with three screws, optimally placed in parallel. The first screw should be placed inferiorly, along the calcar; the second should be placed posteriorly, along the neck; and the third should be placed superiorly, at the tensile surface of the fracture. Postoperatively, we instruct the patient to maintain strict toe-touch weight-bearing for a total of twelve weeks and to advance to weight-bearing thereafter. Others use a sliding hip screw for more vertically oriented femoral neck fractures (Pauwels Type III). Baitner et al. found that fixation with this device resulted in less inferior femoral head displacement, less shearing displacement, and a greater load to failure when compared with the findings following fixation with three cannulated cancellous screws.44 Bonnaire and Weber evaluated four different methods of fixation of Pauwels Type-III femoral neck fractures in cadavers; these methods included a sliding hip screw with a derotational screw, a sliding hip screw without a derotational screw, cancellous screws, and a 130°-angled blade-plate. They concluded that the sliding hip screw with the derotational screw is the best implant for this
fracture pattern. Routine use of one of these large compression hip screws raises several concerns, including the amount of bone removed if subsequent reconstruction is required for treatment of nonunion, the risk of disrupting the blood supply to the femoral head if the hip screw is imperfectly placed, and its inability to adequately control rotation without insertion of an additional derotational screw.

In a comparative study, Aminian et al. examined the biomechanical stability of the fixed-angle proximal femoral locking plate, three 7.3-mm cannulated screws, the 135° dynamic hip screw, and the 95° dynamic condylar screw for fixation of Pauwels Type-III femoral neck fractures. Using cadaver femora, they found that the strongest construct was the proximal femoral locking plate, followed by the dynamic condylar screw, the dynamic hip screw, and lastly the three-cannulated-screw model. The locking plate allows multiple fixed-angle points of fixation into the femoral head. However, proper anatomic reduction and compression of the fracture are necessary prior to fixation, as this plate does not allow fracture compression. The reported clinical experience with the proximal femoral locking plate is insufficient to allow a recommendation for its routine use at this time.

Role of Capsulotomy
The role of capsulotomy in the treatment of femoral neck fractures remains controversial, and the practice varies by trauma program, region, and country. There are both animal and clinical studies that suggest that capsulotomy is beneficial. Animal studies have shown that increased hip intracapsular pressure results in a tamponade effect and may reduce blood flow to the femoral head. Clinical studies have shown that decompressing the intracapsular hematoma by means of a capsulotomy or aspiration reduces the intracapsular pressure. This decrease in the intracapsular pressure results in improved blood flow to the femoral head and may reduce femoral head ischemia. Most of these studies have been of small series at single institutions and were uncontrolled.

Bonnaire et al. reported that 75% of the patients with a femoral neck fracture in their study had increased intra-articular pressure. They believed that an increase in joint pressure was associated with reduced perfusion of the femoral head. Harper et al. used a transducer to measure intrasosseous pressure and to quantify blood flow. They showed that aspiration of the hematoma led to a significant decrease in intrasosseous pressure and increase in pulse perfusion pressure within the femoral head. They suggested that there is an increase in femoral head blood flow, initiated by relief of the tamponade. Strömqvist et al. and Holmberg and Dalen used technetium-methylene diphosphonate (Tc-MDP) scintimetry to evaluate intracapsular pressure and its effect on femoral head circulation. Strömqvist et al. showed an increase in uptake in the femoral head after aspiration of the hematoma at the site of a femoral neck fracture. Holmberg and Dalen reported that four of nine patients had an intracapsular pressure of >80 mm Hg and an associated low scintimetric rate, which indicated decreased blood flow to the femoral head. These studies suggested that intracapsular distention of the hip may be one cause of femoral head osteonecrosis. Other studies, however, do not support the concept of increased intracapsular pressure as a major factor in the development of osteonecrosis.

Maruenda et al. measured preoperative intracapsular pressure in thirty-four patients and followed them for an average of seven years after internal fixation of a femoral neck fracture. They found that five of six patients in whom femoral head osteonecrosis developed had an intracapsular pressure that was less than the diastolic blood pressure. They suggested that osteonecrosis may be a result of the vascular damage that occurred at the time of injury and not of the tamponade effect.

Other variables hypothesized to be related to osteonecrosis include the amount of initial fracture displacement, disruption of the blood supply at the time of fracture, the quality of the fracture reduction or postreduction malalignment, the time between...
the fracture and reduction\(^4,7,10,77,78\), the postoperative time to full weight-bearing\(^7,79\), fracture nonunion\(^6,11,12\), loss of fracture reduction\(^10\), and an associated fracture of the ipsilateral femoral shaft\(^35,36,38-41,80\). There is no solid evidence indicating which factor, or combination of factors, places the patient at a greater risk for femoral head osteonecrosis.

There are too few femoral neck fractures in young patients to allow the performance of randomized controlled trials of a sufficient sample size to evaluate the role of capsulotomy. Table I summarizes the available literature on femoral neck fractures in young adults, including the rate of femoral head osteonecrosis and its relationship with capsulotomy. Table I provides a comprehensive overview of the available literature, as well as the rate of femoral head osteonecrosis and its relationship with capsulotomy. Table I also includes the pooled evidence indicating that intra-capsular pressure plays a role in approximately 15% of cases. There is no evidence of complications associated with the performance of an open anterior capsulotomy (with visualization of the capsule). We have seen the blade detach from the knife handle during a percutaneous capsulotomy (Fig. 5), but the blade was easily retrieved. For femoral neck fractures that are successfully reduced with closed means and are pinned, we recommend performing a percutaneous capsulotomy with a number-10 blade (Figs. 6-A and 6-B). After making sure that the blade is fully seated on the knife handle, the surgeon should slide the blade over the anterior aspect of the trochanter and in line with the center of the femoral neck as seen on the anteroposterior c-arm image. Then the capsulotomy should be performed while the blade is viewed on the lateral view (with the surgeon making sure that the blade is right on top of the femoral neck both by feel and by c-arm imaging). If a small incision (5 cm) has been made and the iliotibial band has been split for pin placement, a flash of hematoma should be seen to ooze out when the capsulotomy is complete.

**Time to Surgery**

The timing of surgery for femoral neck fractures remains controversial, and the available data remain inconclusive. Advocates of early surgery suggest that the main advantages of prompt reduction of a displaced femoral neck fracture are unkinking of the vessels and performance of an intracapsular decompression to remove the hematoma that increases intracapsular pressure\(^7,17,81\). This improves and restores blood flow to the femoral head, minimizing the risk of femoral head osteonecrosis\(^12,28,30,31,33\).

Jain et al.\(^79\) retrospectively reviewed and compared early fixation (within twelve hours) and delayed fixation (at more than twelve hours) of subcapital hip fractures in thirty-eight patients who were sixty years of age or less (average, 46.4 years of age). Radiographic evidence of osteonecrosis developed in 16% of the patients, all in the delayed-fixation group. Only one of the thirty-eight patients had undergone aspiration of the intracapsular hematoma. Age, the degree of fracture displacement, and the method of fracture fixation did not influence the development of osteonecrosis. Using the Short-Form 36 (SF-36) and the Western Ontario and McMaster Universities (WOMAC) Osteoarthritis Index instruments, Jain et al. did not find a difference in the functional results between the patients in whom osteonecrosis developed and those in whom it did not. They concluded that delayed treatment was associated with an increased rate of
osteonecrosis but did not affect the functional outcome. The power of this comparison was low, and long-term follow-up is needed to evaluate more fully the late development of femoral head osteonecrosis and hip arthritis.

There are several studies that demonstrated no difference in the rate of osteonecrosis following surgery that was delayed for more than twenty-four hours. Haidukewych et al. retrospectively reviewed a series of seventy-three femoral neck fractures in patients between the ages of fifteen and fifty years. Osteonecrosis developed in 23% of the series as a whole, in thirteen (25%) of the fifty-three patients in whom the femoral neck fracture had been treated within twenty-four hours after the diagnosis, and in four (20%) of the twenty patients who had been treated more than twenty-four hours after the diagnosis. Given the small sample size, the difference was not significant. Upadhyay et al. performed a prospective randomized study comparing open reduction and internal fixation with closed reduction and internal fixation in 102 young adults with a Garden Grade-III or IV femoral neck fracture. Of ninety-two who were available for follow-up, forty-four had been randomized to treatment with open reduction and internal fixation (a Watson-Jones approach with a T-shape incision in the capsule) and forty-eight, to treatment with closed reduction and internal fixation. There was no significant difference in the osteonecrosis rate between the two groups (15% in the closed-reduction group and 18% in the open-reduction group) at two years postoperatively. Risk factors such as age, sex, time to surgery (less than or more than forty-eight hours), and posterior comminution did not appear to affect the development of osteonecrosis. Most patients in this series were treated more than forty-eight hours after the injury.

The multiple factors mentioned above make it difficult to come to a final conclusion regarding the timing of surgery. The influence of time to reduction and fixation on the outcome has been specifically evaluated in several articles, and until conclusive data are available we recommend that surgery be done on an urgent basis. This implies that open reduction and internal fixation of the femoral neck should be performed as soon as the patient is considered stable and cleared to undergo anesthesia. An urgent operation allows early reduction, capsular decompression, restoration of the anatomy, and restoration of femoral head vascularity by unkinking the vessels.

**Outcomes of Internal Fixation**

Preservation of the femoral head with internal fixation is desirable in younger and more active patients with a femoral neck fracture. A healed femoral neck fracture, without the development of osteonecrosis, leads to a good functional outcome. The ability to achieve a good outcome by decreasing fixation failure and the rate of nonunion depends on several factors that the surgeon can control—namely, the quality of the reduction and obtaining a stable fixation. Jain et al. compared early and delayed fixation of subcapital hip fractures in patients...
who were sixty years of age or less. After a minimum of two years of follow-up, they did not find any significant difference between the early and delayed-fixation groups with regard to functional outcomes as assessed with the SF-36 and WOMAC. There was also no significant difference in outcome between displaced and nondisplaced fractures. However, a study of a larger number of patients with longer follow-up is needed to determine, more accu-

Fig. 6-A

**Figs. 6-A and 6-B** Intraoperative c-arm images. **Fig. 6-A** Anteroposterior view of a percutaneous capsulotomy with a number-10 blade.

Fig. 6-B

Lateral view of a percutaneous capsulotomy with a number-10 blade.
TABLE I Summary of Literature on Femoral Neck Fractures in Young Adults*

<table>
<thead>
<tr>
<th>Authors</th>
<th>Year</th>
<th>No. of patients</th>
<th>Osteonecrosis</th>
<th>Capsulotomy</th>
</tr>
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<tbody>
<tr>
<td>Protzman and Burkhalter⁴</td>
<td>1976</td>
<td>22</td>
<td>19</td>
<td>Not reported</td>
</tr>
<tr>
<td>Kofoid⁵</td>
<td>1982</td>
<td>17</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Swiontkowski et al.⁷</td>
<td>1984</td>
<td>27</td>
<td>5</td>
<td>17</td>
</tr>
<tr>
<td>Tooke and Favero¹⁴</td>
<td>1985</td>
<td>32</td>
<td>6</td>
<td>Not reported</td>
</tr>
<tr>
<td>Visuri et al.¹¹</td>
<td>1988</td>
<td>12</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Shih and Wang⁹</td>
<td>1991</td>
<td>121</td>
<td>32</td>
<td>Not reported</td>
</tr>
<tr>
<td>Gerber et al.⁸³</td>
<td>1993</td>
<td>54</td>
<td>5</td>
<td>47</td>
</tr>
<tr>
<td>Robinson et al.²</td>
<td>1995</td>
<td>46</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>Gautam et al.¹⁵</td>
<td>1998</td>
<td>25</td>
<td>3</td>
<td>25</td>
</tr>
<tr>
<td>Jain et al.¹⁰</td>
<td>2002</td>
<td>38</td>
<td>6</td>
<td>1 (aspiration)</td>
</tr>
<tr>
<td>Lee et al.¹⁰</td>
<td>2003</td>
<td>42</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>Upadhyay et al.¹³</td>
<td>2004</td>
<td>48</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Haidukewych et al.¹²</td>
<td>2004</td>
<td>73</td>
<td>17</td>
<td>22</td>
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<tr>
<td>Total</td>
<td></td>
<td>601</td>
<td>138 (23%)</td>
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rately, if there is indeed a difference between the two groups. El-Abed et al.⁶⁰ reported the outcomes of hemiarthroplasty and dynamic hip screw fixation for the treatment of displaced subcapital hip fractures. Function was measured by a physician using the Matta functional hip score and by the patient using the SF-36. According to the Matta scoring system, 70% of the patients treated with internal fixation had a good or excellent result compared with 42% in the hemiarthroplasty group. There was a significant agreement (r = 0.64) between the patients’ perception (SF-36 score) and the physicians’ perception (Matta functional hip score) of outcome.

Overview
Femoral neck fractures in young adults are uncommon. They usually occur as a result of high-energy trauma and are often associated with other injuries. Osteonecrosis of the femoral head and nonunion are the two most common and challenging complications associated with femoral neck fractures. Initial fracture displacement and disruption of the femoral head blood flow are contributing factors that are outside of the surgeon’s control. However, there are multiple factors within the surgeon’s control that can minimize and prevent these complications. The key factors in the treatment of femoral neck fractures include early diagnosis, early surgery, anatomic reduction, capsular decompression, and stable internal fixation.

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