

Classifications for Femoral Compliance Level of Garden and AO Neck Fractures

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Editorial

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Editorial

In various parts of the world due to increased human survival. While in the elderly, they are related to low-energy trauma and its treatment either through arthroplasty in displaced fractures or fixation in those without deviations; in young patients, the scenario is different, as FCFs occur due to high-energy trauma and are usually related to car accidents or falls from heights. Among the risk factors for FCFs are: female gender, low bone density and reduced mobility. The risk of fracture dramatically increases with age 3. In FCFs, the vascularization of the femoral head is at risk. The most accepted cause of this ischemia would be the rupture or torsion of the Weitbrecht retinaculum, which contains 2 to 4 ascending retinacula sub synovial vessels, which are branches of the medial circumflex artery of the femur and nourish the super lateral portion of the femoral head, the most important region of the femoral head mechanical point of view.

Another characteristic of the femoral neck, in its intracapsular portion, is that it does not have a periosteal layer, making fracture consolidation a primary process, of the end steal type. For this reason, absolute stability is required. The presence of synovial fluid, which prevents clot formation, is important factor. The knowledge of this mechanism is important for a correct diagnosis, which depends on a thorough physical examination and on obtaining radiographs of the pelvis in anteroposterior (AP), of the affected hip in antero posterior and lateral views. In deviated fractures, an anteroposterior radiograph with mild traction and medial rotation can help in interpreting the fracture line. Profile radiography can change Garden's classification in up to 80% of cases, due to the detection of deviations not visible in the frontal image. It is important to include an X-ray of the entire femur due to the possibility of associated injuries.

Computed axial tomography can help identify cervical fragmentation, especially in its posterior portion, a recognized sign of poor prognosis. In cases of suspected occult fracture or associated pathological lesions, magnetic resonance imaging is more useful, being the gold standard exam due to its greater sensitivity to detect stress fractures, incomplete or without displacement, even in early stages. The treatment of this important fracture has evolved over time. In 1820, Sir Ashley Cooper already believed that FCF pseudarthrosis was inevitable due to damage to the vascularization of the femoral head. Thirty years later, this scenario began to change, when Langenbeck described fixation using screws introduced through the femoral neck. In 1935, Frederic Pauwels shed light on the main mechanical problems involved in this type of fracture, showing that, according to the inclination of the fracture line, the resulting force could be either compression or shear.

In 1961, Robert Symon Garden described a more comprehensive classification, which incorporates displacement, fracture integrity and relationship of bone trabecular in the head and neck of the femur. These findings were important so that the appropriate means of treatment were studied and could return the individual to previous levels of function; achieve the reduction anatomical to preserve the blood supply; and, provide a stable fixation, with bone preservation, to achieve consolidation. In elderly people with low-energy fractures, there is a consensus that non-displaced or incomplete fractures impacted in valgus should be fixed, while displaced fractures should be treated with hip arthroplasty. In young people, arthroplasty is not desirable as the first form of treatment due to the high demand and young age, as it can lead to high rates of revision in the long term.

Most authors agree that fractures without displacement (Garden I or II) can be approached and fixed percutaneous. On the other hand, in displaced fractures (Garden III and IV), advocates of the open approach believe that anatomical reduction can only be achieved reliably and reproducibly through direct visualization. In this option, surgical access also allows the use of a more stable fixation, in addition to, obviously, decompressing the intracapsular hematoma. Garden's Alignment Index (Figure 1) is used to verify the quality of the reduction in 2 orthogonal, anteroposterior and lateral views. In case of failure to obtain the reduction by closed means, the anatomical reduction in open air is mandatory.

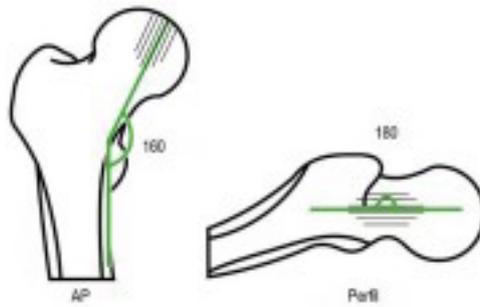


Figure 1. Garden alignment index source.

There are 4 implant options: cannulised screws, sliding pin plate (type DHS), fixed angle locked plates or total hip prosthesis (arthroplasty). In Garden I or II fractures, there is no difference in results with the use of screws or sliding pin-plate devices, with or without the use of an anti-rotational screw. In unstable and deviated fractures Pauwels II or III, Garden III or IV, neither parallel screws nor sliding plate-pin devices associated with anti-rotational screws nor locked plates had good results in the fixation of these fractures. In fixation with cannulised screws, a screw transverse to the fracture site can be used. This method is similar to the fixation method described by Garden in the past. Proposed the technique of using an anteromedial support plate, which can be installed through Hunter's anterior approach and acts as a powerful anti-shear brace. This plate must be combined with screws or pin plate and showed an 80% increase in shear strength compared to traditional methods.

However, for the correct treatment, it is extremely important that the surgeon has knowledge about the classification of FCFs, which is of great clinical importance, as it is often used in the indication of adequate treatment. The main classifications for FCFs are the Pauwels, the Garden and the Arbeitsgemeinschaft fur Osteosynthesefragen (AO) Classification. In this study we will focus only on Garden and AO. Garden's classification is the most popular and most used in clinical practice and is based on the X-ray of the pelvis in the anteroposterior view, determining the stages or degrees of displacement between the fragments according to the alignment of the primary compressive trabecular of the cervix with the trabecular of the acetabulum. It is an evolutionary classification that describes the stages of sequential deviation of the fragments. Garden evaluated 80 patients with FCF, which he classified into types I to IV, and followed these patients for at least 12 months postoperatively. He found that type I and II fractures had a 100% healing rate. While types III and IV had lower union rates of 93% and 57%, respectively.

The four types/stages of Garden are described as follows:

Stage I incomplete sub capital fracture. Fracture of the inferior cortex occurs in a “green stick”, and a minimal deviation creates the illusion of impaction. The distal fragment is slightly abducted and externally rotated;

Stage II complete sub capital fracture without displacement. The inferior cortex has a complete fracture, but no angulation of the femoral head;

Stage III complete sub capital fracture with partial displacement. The 2 fragments are held together by the Weitbrecht retinaculum. There is no fragmentation of the posterior cortex. The head is inclined in relation to the acetabulum, which is radiologically evidenced by the divergent direction of the medial bony lamellae (compressive) of the head in relation to those of the acetabulum;

Stage IV complete sub capital fracture with total displacement. Acetabula trabecular aligned with the compressive trabecular of the cervix; neck is shortened. The retinaculum is broken and the 2 fragments are completely independent. The head returns to its natural position and, radiologically, its medial bony lamellae align with those of the acetabulum.

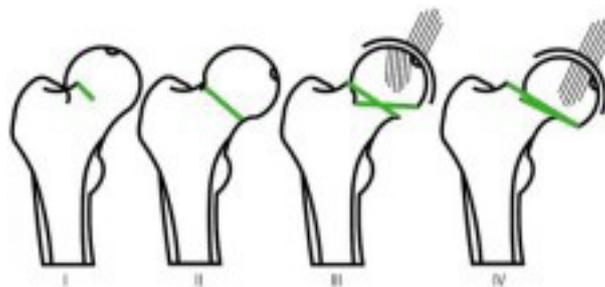


Figure 2. Presents Garden's classification

In Garden's classification, grades I, II and III may have complete vascularization; grades I and II are stable, while grades III and IV are unstable.

The low inter- and intraobserver agreement of Garden's classification made it more useful in the elderly population in which, to direct the treatment, it was simplified into 2 patterns: non-deviated – Garden I and II; and, deviated – Garden III and IV.

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The AO classification was recently modified, making it simpler, more versatile. Among the changes, the term “multi fragmenting” has replaced the term complex as it is more useful and precise. Optional “universal modifiers” have been introduced, which can be used, in square brackets, to describe morphology, deviations, associated lesions or location. Optional “qualifiers” were also introduced, specific to each fracture, which can be used in parentheses. Bones were numbered in a standardized way, including the chest. The femur is identified by numeral 3, with numeral 1 being the coding for the location of its proximal part. Fractures centered between a line drawn on the distal edge of the cartilage of the femoral head and the intertrochanteric line are classified as FCFs or sub capital fractures and are considered type B21.