

# Guidance and Guideline-recommendations for the treatment of femoral neck fractures

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### Abstract

Two types of femoral neck fractures are nowadays identified: those resulting from low energy trauma, usually by direct by falling on the hip, in patients with affected bone stock (the so-called "fragility fractures") and those produced by high energy trauma, even in younger people, with normal bone stock. These recommendations are addressed to the first category, for which impaired mineral bone density (MBD), osteopenia, and osteoporosis represent major enabling factors.

These recommendations refer to classification-based local and general treatment of femoral neck fractures (excluding the basilar neck ones). The presumptive and definitive diagnoses include the precise description of the fracture pattern, by complete imagistic evaluation. The treatment depends on the type of the patient (demanding or non-demanding), on the type of the fracture (stable or unstable), as well as on the facility of early treatment, in certain cases.

The main therapeutic goal in femoral neck fractures is early social and professional reinsertion of the patient, by gaining a status as close as possible to the one before the trauma; stable stabilization allowing early mobilization has a key role in fulfilling this objective

Therefore, complete evaluation and monitoring of the patient by a multidisciplinary team is mandatory in order to perform a proper evaluation of the anaesthetic and surgical risk (as these patients usually have pre-existing health problems, sometimes severe), a safe and adapted (from the point of view of invasivity) surgery and an appropriate post-operative local and general treatment. Therefore, these recommendations have numerous connections with those involving the intervention of physicians from other specialities with whom orthopaedic surgeons must cooperate in these cases

Keywords: femoral neck fractures, hip fractures, Garden classification, osteosynthesis, arthroplasty, thromboprophylaxis

## I. Aetiology

Femoral neck fractures usually result from falling on the hip. The decrease of mineral bone density (MBD), osteopenia and osteoporosis represent major favouring factors, which is why this fractures are more frequently and after 60 yrs, when they are considered as fragility, low energy fractures.

In young people, femoral neck fractures occur almost exclusively in high energy trauma, usually due to an impact on the knee transmitted to the hip ("Dashboard syndrome"), and are frequently associated with ipsilateral femoral dyaphyseal fractures. Another particular case is that of fractures occurring without any apparent trauma (at a simple movement or spontaneously), usually of tumour-type, primitive or secondary.

*The following recommendations refer to the recent femoral neck fractures resulting from a low energy trauma. They will be applied only with prudence and in accordance with the characteristics of the patient in case of femoral neck fractures resulting from a high-energy trauma in young patients, frequently associated with other osteoarticular lesions, as well as in pathological (tumour) bone fractures.*

*Recommendation: The recommendations will require the harmonization and completion through stipulations specific for the medical fields involved in the treatment of these patients (firstly Intensive Care Unit), established by professional organizations in the field.*

## II. Classification

Many systems of classification can be used for femoral neck fractures [1,2]:

### A. The anatomical classification (Delbet) describes :

- Subcapital fractures located at the junction of the femoral head with the femoral neck
- Midcervical fractures ( those which are

usually related as " femoral neck fractures " FNF)

– Basicervical fractures, which from the point of view of treatment and prognosis, are included in the trochanteric hip fractures group, reason for which the recommendations regarding these fractures will be mentioned in the chapter dedicated to trochanteric hip fractures.

### B. Bööhler classification based on the mechanism:

- Adduction fracture, with a reserved prognosis
- Abduction fracture, with a better prognosis

### C. Pauwels classification refers on the angle between the fracture line and the horizontal line:

- Pauwels I - angle below 30 degrees, with a favourable prognosis
- Pauwels II - angle between 30 and 50 degrees
- Pauwels III - over 70 degrees, with an unfavourable prognosis

### D. Garden classification, the most often used for mediocervical fractures:

- Garden I - incomplete or valgus impacted
- Garden II - complete but without displacement
- Garden III - complete with partial displacement
- Garden IV - complete with total displacement

### Based on the Garden classification, the femoral neck fractures can be described as:

- Stable fractures - Garden I and II, and
- Unstable fractures - Garden III and IV, this classification having therapeutic implications

*Recommendation: Garden classification is recommended for femoral neck fractures, as it*

establishes if the fracture is stable or unstable, which is one of the factors based on which the treatment is established. The description of the fracture can be completed with other classification systems that can provide additional data important from a therapeutic and prognosis point of view [1,2].

### III.Diagnosis in femoral neck fractures

*Recommendation: The presumptive diagnosis of femoral neck fracture is recommended in any patient who has suffered an accidental fall on the hip if one of the elements below is met:*

- groin pain that can be diminished by rest and increased by movement or walking
- partial functional inability to actively move the hip while passive movements are still possible
- support on the affected leg is usually difficult or impossible but the fact that the patient can walk does not exclude the presence of femoral neck fracture
- abnormal position with shortening, adduction and external rotation; the absence of any deformation does not exclude femoral neck fracture

*Recommendation: If a femoral neck fracture is suspected, the first recommended step is to perform an AP ( antero-posterior) X-ray of the pelvis, visualizing both hip joints, with the lower limbs in symmetrical position of neutral rotation*

*If the X-ray does not show any fracture but the clinical evaluation of the patient raises a reasonable suspicion of fracture, it is recommended that the imagistic evaluations are continued with computerized tomography (CT) or nuclear magnetic resonance (NMR) [3].*

*It is recommended to establish the definitive diagnosis as soon as possible taking into account the benefits of early treatment.*

*The differential diagnosis must be established for hip concussion, fractures of pubic rami, fractures of the acetabulum, femoral head fractures, trochanteric hip fractures.*

### IV.Treatment of femoral neck fracture

The therapeutic objective in femoral neck fracture is the early mobilization of the patient and his return to a status as close as possible to the one before the trauma [4]. Considering that, treatment of femoral neck fractures must be established, monitored and adapted by a pluridisciplinary team who, besides the orthopaedic surgeon, must include the anaesthetist and, according to the patient's associated comorbidities, specialists from other medical fields such as cardiology, internal medicine, gastroenterology, etc., to whom the general practitioner ( family physician) must join after discharge. Moreover, the cooperation of the patient and the care and recovery conditions outside the hospital environment should be taken into consideration when choosing the treatment.

From these points of view, the treatment of a patient with a femoral neck fracture involves complex measures that aim the following:

- a. TREATMENT OF THE FRACTURE
- b. GENERAL TREATMENT
- c. PREVENTION OF SPECIFIC COMPLICATIONS

#### a. TREATMENT OF THE FEMORAL NECK FRACTURE will be personalized according to:

- A. Characteristics of the patient
- B. Characteristics of the fracture

##### A. Characteristics of the patient

From the point of view of the patient's status, according to the pre-traumatic characteristics and detectable or known comorbidities, there are conventionally two types of patients:

1. Patients with severe comorbidities , with reduced functional demands, usually elderly ("Old Elderly") – a case in which mortality rate can reach 25% per year [5]

- Reduced mobility before the accident
- Low life expectancy
- Multiple comorbidities
- Mental/ cognitive impairment
- Trauma of low energy/ frailty fracture/ osteoporosis
- Reduced functional demands

2. Patients who are either young or old, but have with significant functional demands ("Young elderly demanding "patient)

- Active before trauma
- High life expectancy
- Without significant comorbidities, normostenic
- High energy trauma/ polytrauma/ fracture associated with ipsilateral femoral shaft
- Optimal bone stock
- High functional demands

*Recommendation: it is recommended that the patient with femoral neck fracture is hospitalized and immediately after admission, at least the following should be performed:*

– *Laboratory tests: hemoleucogram, coagulation tests, urea, glucose, creatinine tests, to which the test indicated by the physician can be added*

- ECG
- Chest X-ray
- Urine test

*Recommendation: It is recommended that the evaluation is completed with anamnesis data (including medical records), interdisciplinary evaluation and paraclinical tests to offer as complete information as possible regarding the biological and psychic status of the patient and to establish the optimal treatment.*

*Recommendation: It is recommended measurements for preventing specific complications should be started immediately after admission*

**B. Characteristics of the fracture** – the main element that dictates the choice of treatment is the probability of fracture healing, which, considering the anatomical elements of the area, is directly proportional with:

- o Interfragmentary contact
- o The remaining post-traumatic vascularity in the fracture site

From the practical point of view, the aspect which is related with the probability of healing is the fracture stability. Garden I and II fractures are considered stable, with higher chances of healing (without being absolute), while Garden III and IV are considered unstable fractures, with low chances of healing, taking into account the intra-articular type of the fracture, as well as the vascular supply of the proximal femur [2].

*Recommendation: Considering the potential local complications, surgical treatment is the method of choice in femoral neck fractures, respecting all the elements regarding [2]:*

- o *Establishing the indication*
- o *Obtaining the informed consent*
- o *Evaluating the risk and the risk-benefit ratio (after the clinical and paraclinical evaluation of the patient)*

The types of treatment that can be used in femoral neck fractures are the following:

1. Non-surgical
2. Surgical

**1. Non-surgical treatment (conservative) is indicated in cases in which:**

- it is believed that it can ensure the healing of the fracture
- it is believed that the risks of surgical treatment exceed the benefits
- the patient refuses the surgery

Non-surgical treatment can have two

possibilities :

- when fracture healing is intended – the mobilization of the patient will be initially without support on the injured leg ; this will start progressively, so that the fracture is protected. The moment of support will be decided individually according to the clinical and paraclinical evolution
- when the only goal is to mobilise the patient, without intending fracture healing, the patient can be immediately mobilized within the limit of pain tolerance, and mobilization with weight bearing on the injured leg can be started early. This way, it is put in the foreground fracture healing in order to prevent specific complications due to prolonged bed rest

*Recommendation: The indications of non-surgical treatment (conservative) in femoral neck fractures (with one of the methods described) are limited to the circumstances presented above*

## 2. Surgical treatment

Recommendations: Surgical treatment is the treatment of choice in femoral neck fractures in the following cases [6]:

- when it is considered to be necessary for optimal functional recovery of the patient, for his social, professional and family reintegration
- in displaced fractures or with risk of displacement
- in patients for whom it is considered that the benefits of the surgical treatment exceed the risks.

The surgical treatment has two methods: osteosynthesis and arthroplasty [6].

*Recommendation: Once the surgical indication is established, preoperative preparing and planning refers to the patient, the team, and the facility, so that the treatment is performed in optimal conditions.*

*Recommendation: Irrespective of the type of*

*surgical treatment indicated for a patient with a femoral neck fracture, the timing and extent of the surgery will be determined following an interdisciplinary assessment, primarily with the intensive care physician so that to achieve the maximum benefit for the patient in conditions of the lowest risk.*

*Recommendation: Irrespective of the type of surgical treatment chosen, the use of continuous traction is not indicated in recent femoral neck fractures.*

## 2 A Osteosynthesis

*Recommendation: Osteosynthesis will be taken into consideration only when it is presumed that there is a good probability for fracture healing; otherwise, arthroplasty will be taken into account.*

*Recommendation: Osteosynthesis will be considered only when material and personnel conditions necessary for an optimal intervention in a timely manner are fulfilled:*

- orthopaedic table
- C-arm (fluoroscopy)
- Surgical and intensive care team
- Personnel trained for handling equipments (operating room personnel, radiology assistant, etc.)

*Recommendation: If there is a suspicion of a pathological bone fracture, intraoperative harvesting of samples for the anatomopathological examination is recommended.*

*Recommendation: it is recommended that osteosynthesis should be performed with minimally 2 parallel cancellous screws of 6.5 mm (to achieve compression). Some studies showed that maximum stability is obtained when 3 parallel screws are introduced. When other implants are used for osteosynthesis, the manufacturer's indications will be respected.*

*Recommendation: It is recommended that*

the indications for osteosynthesis in femoral neck fractures to be limited to:

- Garden I and II stable fractures
- patients in whom the benefits of the surgical treatment exceed the risks
- patients who can respect the limited/ no weight bearing indications established by the surgeon

*Recommendation:* The indication with osteosynthesis using screws in unstable fractures is limited only for the cases in which is presumed that the probability of healing is high, fulfilling the following conditions:

a. recent fracture – the early treatment increases the chances of healing. It is estimated that the best results are obtained if the stabilization is performed within the first 24 hours.

b. fracture reduction is possible under fluoroscopic control (closed reduction), usually in recent fractures, such in Garden III and IV fractures, in young patients, when closed reduction under fluoroscopic control is achieved and optimal stabilization can be urgently performed. In this case, CT might be indicated as an urgent evaluation in order to achieve early stabilization. If closed reduction does not succeed, open reduction and stabilization with screws can be attempted to avoid arthroplasty in young patients. The criteria for an acceptable reduction in femoral neck fracture are the following: valgus max 15 degrees, AP angulation max 10 degrees, varus is unacceptable. If reduction does not fulfil these criteria, osteosynthesis has debatable indications and results.

c. there is no comminution on the posterior wall of the femoral neck in the fracture site

d. benefits of surgical treatment exceed the risks

e. the patient can follow the recommendations for no/limited weight bearing established by the surgeon

## 2B. Arthroplasty

*Recommendation:* Arthroplasty is recommended whenever it is presumed that the benefits of the surgical treatment are greater than the risks and the chances of fracture healing are reduced.

*Recommendation:* the type of arthroplasty will be chosen depending on multiple conditions, such as age, the general status of the patient, possible pre-existing hip osteo-arthritis (OA); one of the following methods can be chosen:

a. Hemiarthroplasty with an Austin-Moore hip endoprosthesis (cementless or cemented) – in patients with comorbidities, with low functional demands or low life expectancy (type “Old Elderly”) [7,8]

b. Hemiarthroplasty with bipolar endoprosthesis (cemented or uncemented, according to the quality of the bone stock) – in young patients, with apparently intact acetabular cartilage [7,8]

c. Total hip endoprosthesis (uncemented or cemented, depending on the quality of the bone stock, the possibilities of mobilization, as well as on the patient's comorbidities) whenever the acetabulum is affected or high risk of further acetabular damage is expected. Risks and benefits will be taken into consideration and a total hip arthroplasty will be indicated whenever the possibility of requiring a reintervention for converting a hemiarthroplasty to total arthroplasty is considerable [7,8]

*Recommendation:* Regardless of the type of arthroplasty, radiological control is recommended to be performed at the end of the surgery.

*Recommendation:* Regardless of the type of arthroplasty, evaluation of the bacteriological load of the patient (nasal, pharyngeal, urinary, axillary, inguinal) can offer supplementary data and can influence the surgical treatment; specific measures may be required for decreasing this load, indicated by the orthopaedic specialist or other specialists from the pluridisciplinary team

*Recommendation: Postoperative treatment will be established by the multidisciplinary team (including the moment of weight bearing) based on the individual characteristics of the patient and the associated comorbidities, on the outcome of the fracture and on that of the patient*

*Recommendation: The goal of the rehabilitation treatment is rapid mobilization, reeducation of walking and muscular recovery. It will be initiated early postoperatively and will be continued after discharge in local facilities.*

## b. GENERAL TREATMENT

*Recommendation: It is recommended that the general treatment of the patient with a femoral neck fracture should be established and monitored in a multidisciplinary team [9].*

General treatment should include measures addressed to associated pathology but also to global optimal functioning, considering the systemic impact of fracture and surgery. Some of these are mandatory:

- Antibiotics treatment, that the dose and duration will be chosen in accordance with the assessment of the multidisciplinary team (Orthopaedics, Intensive Care, other medical specialties), according to the characteristics of each patient [9].

*Recommendation: It is recommended that the antibiotics should be administered with prophylactic intention, at the induction of anaesthesia or at about 30 minutes prior to the incision; prophylactic administration is recommended if the patient's particularities no not require another treatment scheme.*

- Thromboprophylaxis is mandatory, for on average of up to 6 weeks after surgery ( or after trauma, if the patient is not operated) . Hygienic dietetic measures (hydration, breathing gymnastics, early mobilization), mechanical means (elastic stockings,

intermittent compression devices) and pharmacological methods (according to the Guides in force and the patient's particularities), are recommended [10];

*Recommendation: it is recommended that the duration of thromboprophylaxis should be prolonged for as long as the pro-thrombotic factors continue to be in force; the orthopaedic surgeon or any other specialists for the team monitoring and treating the patients can recommend that*

*Recommendation: Interdisciplinary assessment of thromboembolic risk and thromboprophylactic treatment according to this risk must be indicated considering the qualitative (types of methods used, type of medication) and quantitative (dose, duration) aspects.*

*Recommendation: Thromboprophylactic drugs for approximately 6 weeks postoperative are generally recommended depending on the patient's associated comorbidities, respecting the manufacturer's indications for each drug.*

## c. PROPHYLAXY OF SPECIFIC COMPLICATIONS

*Recommendation: Considering the epidemiological characteristics of these patients, the interdisciplinary team will establish the necessary measures to minimize the effects of the associated comorbidities, avoid their decompensation, and prevent specific complications.*

Taking into account the major risk of complications due to immobilization, the following are recommended:

- Use of anti-soar mattresses
- Early mobilization, by passive mobilization and active mobility
- Checking at least daily the integrity of the skin in the areas exposed to pressure and

their protection; removal of pressure factors (folds of linen, etc.) [11]

- Appropriate hydration
- Careful indications for a urinary catheter

and its placement under proper aseptic conditions

- Tapotage and breathing gymnastics.

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