

Increased complications with the use of cemented fixation for hip fractures

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Abstract

The purpose of this study is to evaluate the effect of femoral stem fixation on postoperative cardiorespiratory complications.

Introduction

A displaced intracapsular fracture of the femur in an elderly patient is a potential life-threatening injury, and is usually treated with a partial or total arthroplasty([van et al., 2013](#)).

The ideal mode of fixation of the implant is still under debate. Registry data shows an increased mortality risk for cemented fixation on the first 24h after surgery ([Kristensen et al., 2020](#)), but the difference ceased to exist at the 30-day and 1 year evaluations ([Talsnes et al., 2013](#))([Parker & Cawley, 2020](#)). Other review ([Nantha et al., 2020](#)) found that cemented implants are associated with a lower risk of periprosthetic fractures. A pooled analysis of recent randomized trials found no significant difference in the number of general and local complications, when comparing methods of femoral stem fixation ([Veldman et al., 2017](#)).

Other authors argue that perioperative deaths were associated with advanced age and comorbidities, not with the type of fixation ([Hossain & Andrew, 2012](#)) ([Dale et al., 2019](#)).

To complement the evidence available on this topic, we conducted a prospective evaluation of patients operated in our centre with a partial or total hip arthroplasty for a displaced femoral neck fracture.

The purpose of this study was to evaluate the effect of the femoral stem fixation (cemented versus uncemented) on mortality and complications rate.

Patients and Methods

Since June 2015 we maintain a prospective database of all the patients operated at our institution for proximal femoral fractures. From this database we collected all the cases of total hip replacement and hemiarthroplasty for femoral neck fractures operated between June 2015 and June 2019.

Patients with fractures secondary to malignancy, high energy trauma or cases in which a monobloc stem was used were excluded. Patients treated with fracture fixation were also excluded from this study.

The study outcomes were identified using information from the department database, from patient's hospital records, from the nationwide Health Data Platform (Plataforma de Dados da Saúde, PDS) and from the

nationwide System for Electronic Notification of Deaths (Sistema Informático de Comunicação de Óbitos, SICO). Using these overlapping sources is possible to evaluate outcomes even if the patient received further treatment at other institutions and to know the date of death even if the patient was deceased outside our institution.

For each patient we collected information on demographical data (gender, date of birth, Body Mass Index) clinical data (date of surgery, delay from admission to surgery, Charlson Comorbidity Index, type of femoral fixation and implant used) and follow-up data (mortality during inpatient stay, at 30, 90 and 365 days, implant-related complications to date, patient-related complications at 30 days).

In each case the method of femoral fixation was decided at the time of surgery, by the senior attending surgeon. The cemented implant used was the stainless steel, polished CORAIL stem (Depuy Synthes, Leeds, UK) with a contemporary cementation technique, the uncemented implant used was the titanium alloy, hydroxyapatite-coated CORAIL stem (Depuy Synthes, Leeds, UK).

Using a recent multicentric study ([Richardson et al., 2020](#)) as reference for one-year mortality for different types of fixation, we calculated that a total sample size of 408 patients is required, in order to have an 80% power at a significance level of 0.05

Using a recent randomized controlled trial ([Inngul et al., 2015](#)) as a reference for complication rates, we calculated that a minimum of 121 patients per group is required, in order to have an 80% power at a significance level of 0.05

Quantitative variables were evaluated for skewness and distribution and qualitative variables were grouped according to clinical relevance.

Univariate and multivariate logistic regression was used to test for associations between procedure and studied outcomes. Chi-squared test and Student's t-test were used to assess confounding variables.

Patients with incomplete data were excluded from the analysis.

Results

A total of 543 patients were operated in our institution for fractures of the femoral neck during the study period. we excluded Y patients for the reasons stated above (35 fracture fixation, 2 femoral head resection, 44 monobloc implant). The final number of patients with complete data was 462, from these U had cemented fixation and Y uncemented fixation.

Discussion

Patients with a fracture of the femoral neck following low-energy trauma have an increased risk for mortality when compared to the general population ([Abrahamsen et al., 2009](#)).

A recent registry-based study from the Norwegian Arthroplasty Register found an increased mortality risk for cemented fixation on the first 24h after surgery ([Kristensen et al., 2020](#)), a previous study using the same registry found that this risk was more pronounced in the group of patients with more comorbidities([Talsnes et al., 2013](#)). This is in contrast with the findings of another study on the same dataset that defends that perioperative deaths were associated with advanced age and comorbidities, not with the type of fixation ([Dale et al., 2019](#)).

A recent meta analysis failed to find a significant difference in mortality between cemented and uncemented hemiarthroplasty, although cemented implants are associated with a lower risk of periprosthetic fractures (Nantha et al., 2020).

A recent trial on hip fracture patients found a higher perioperative death risk with cemented implants but the difference ceased to exist at the 30-day and 1 year evaluations (Parker & Cawley, 2020)

Another study based on the data from the Australian Orthopaedic Association National Joint Replacement Registry using hip fracture patients only found higher day-1 mortality in patients receiving a cemented monobloc stem, and that difference ceased to exist in patients receiving modular hemiarthroplasties (Costain et al., 2011)

A study on hip fracture patients found that The thirty-day mortality rate was significantly higher for patients who had received a cemented implant, female patients, elderly patients, patients with cardiorespiratory comorbidities, (Parvizi et al., 2004). Another study in hip fracture patients also found a higher mortality in the first 48h in patients receiving cemented implants, this risk was exacerbated in patients with cardiovascular morbidity (Hossain & Andrew, 2012)

The damage to pulmonary vasculature and ensuing cardio-respiratory dysfunction (Rinecker, 1980) seems to be secondary to the activation of the coagulation by the debris from damaged bone marrow, the effect of cement and prosthesis in the femoral canal and the cytotoxic methylmethacrylate monomer (Dahl, 1997).

A component of this excess mortality may be attributable to the surgical intervention since the bone trauma and the preparation of the bone to apply the implant induce activation of the hemostatic system causing a thrombogenic process in the lung vessels, the addition of cytotoxic chemical methylmethacrylate monomer in the case of cemented fixation of the implants is another factor contributing to the circulatory disturbances in the lung (Dahl, 1997).

Since the method of femoral fixation was decided by the attending surgeon this study is susceptible to selection bias, we tried to compensate this in the adjusted analysis using the CCI to compensate for different patient baseline characteristics.

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