Multidimensional prognostic index in the elderly with hip or neck femur fracture

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Abstract

Hip and neck femur fracture surgery was associated with high post-operative mortality and poor functional results. The decision-making process with regards to the elderly with hip or neck femur fractures was of great importance, requiring consideration of ethical, medico legal and economic factors in addition to the purely medical ones. An important component in the decision-making process was the precise knowledge of the expected mortality. We considered here several articles from 1 January 2002 to 31 August 2010 that identified the possible scoring system to predict mortality in the elderly undergoing hip or neck femur fracture surgery. We found seven studies which included a total of 12,177 patients that were assigned to hip/neck femur fracture surgery. Each study identified the possible scoring system to predict mortality in the elderly undergoing hip/neck femur fracture surgery. By reviewing the literature available, it was shown that there were more multidimensional prognostic indexes in the elderly after hospitalization than multidimensional prognostic indexes with hip or neck femur fracture which could be used as a simple point scoring system at the bedside to predict mortality in the elderly undergoing hip or neck femur fracture surgery. Although, all the prognostic indexes searched worked well for a general population, but they were of limited validity in the specific, relatively homogeneous population of hip/neck femur fracture patients.

Introduction

In the past, hip and neck femur fractures were frequent in elderly individuals and their incidence was rising. Today, like 20 years ago, hip and femur fractures lead to significantly reduced life expectancy and, for about 50% of patients, to an often dramatic deterioration in health and social conditions. More than 80,000 patients in Italy sustained among hip and neck femur fractures annually. As elderly people still remains the fastest growing section of our society, this number will continue to climb, in spite of attempted at primary and secondary fracture prevention. Both, hip and neck femur fractures created an enormous burden, both clinical and economic, on the health service. The most important consequences of these fractures were the ensuing high mortality rate, and decrease in functional ability. Many works have been published, focusing on the factors which influence patients’ outcome after hip/neck femur fracture and numerous factors had been shown to affect morbidity and mortality. Risk factors associated with a higher probability of mortality were age, male sex, non-white ethnic group and co morbidity. To date, however, these factors had been of limited utility in clinical practice. Preoperative recognition of patients at particularly high risk for adverse outcome might be useful for several reasons: appropriate informed consent; timing of surgery; access to higher level care before or after operation; and intra- and interdepartmental audit. Scoring systems to predict outcome were available.

Materials and Methods

A computerized search of the Medline, PubMed and Embase databases was conducted from 1 January 2002 to 31 August 2010. Keywords used for the research were: elderly with hip fracture; elderly with neck femur fracture; orthopedic prognostic index; orthopedic geriatric multidimensional index. The search limited to literature published in English language which better explain or would to validate a predictive multidimensional index which could define the percentage of probability of survivor after hip or neck femur fracture surgery in the elderly. We included articles identifying predictors of mortality independent the time of surgery, which considered patients that were more than 50 years of age with hip/neck femur fractures and, moreover, we included studies with a minimum of follow-up of one month. On the other hand, we excluded studies which only monitored functional postoperative disability and treated only anthropometric and nutritional status. Further, all reference lists were hand-searched for other relevant articles. The selected articles were reviewed by the authors and judged on their relevance and contribution to the subject of this study.

Results

A total of twenty-one articles were found. Moreover, fourteen articles were excluded because they dealt with more in general prognostic index in elderly, so they were not specific for elderly with hip or neck femur fracture. Finally, only seven articles were found which well respected the inclusion criteria above-mentioned. These studies included a total of 12,177 patients that were assigned hip/neck femur fracture surgery. There were many differences in the statistical technique used by each study, so it could be inappropriate to attempt a quantitative meta-analysis on the effectiveness of a preoperative scoring system to predict mortality in the elderly undergoing hip or neck femur fracture surgery. Supplementary Tables 1, 2 and 3 summarize the material adopted by each study considered in this review. Supplementary Table 4 shows the variables considered for each study and the statistical methodology adopted to correlate them.

Discussion

By considering these studies and their results, it was showed that all the scoring systems considered worked well for a general population, but they were of limited validity in the specific, relatively homogeneous population of hip/neck femur fracture patients. However, we could individualized some scoring systems which could be useful in the practice, but we could not indicated an only alone, which could be completed. In fact, in the first study reported, the EuroQol (EQ-5D) appeared to be an easy-to-use instrument even for elderly patients with femoral neck fractures. This study demonstrat-
ed the substantial decrease in health-related quality of life after a femoral neck fracture. The decrease was significantly larger among patients with fracture healing complications. There was a good correlation between the EQ-5D score and other outcome measures such as pain, mobility, independence in activities of daily living (ADL), and independent living status. The results implied that the EQ-5D, an easy-to-use, yet validated, method for measuring quality-of-life weights, is suitable for use in elderly hip-fracture patients in a routine clinical setting. Firstly, as indications for surgical treatment of complications due to a femoral neck fracture were relative and mainly related to pain, changes in the quality of life might be useful as a screening method to pinpoint patients that might benefit from intervention. Secondly, quality-of-life measures were important in economic assessment studies when constructing quality-adjusted life years (QALYs), a benefit measure frequently used in cost-effectiveness analyses. Finally, the EQ-5D also appeared to be a relevant clinical endpoint in outcome studies, but it focused more on postoperative quality of life in the elderly, but not predict mortality.

The Javier Alegre-Lopez et al. study had several limitations. Although the study never set out to assess whether the predictive factors of mortality and limited functional ability were the same as, or different from, those for the non-fracture population, the presence of a control group would nevertheless have helped us better ascertain the role of such factors. However, this circumstance in no way affects the validity of the results or the objectives of the study. Account might be taken of the socio-health characteristics of the setting in which the study was undertaken, such as the lack of programmed, standardized postoperative rehabilitation, and an intermediate care centre where patients could try to recover, an ADL status that was as close as possible to their prefracture level. There might also be potential discrepancies in patients' memories with respect to prefracture functional assessments made during the baseline interview. Furthermore, in cases where patients were unable to answer for themselves, subjectivity in relatives' and carers' answers might well cast doubt on the accuracy of such replies. In order to minimize this situation, validated measurement instruments were administered, and the same relatives or carers were interviewed at discharge, at 3 months post-fracture, and 1 year post-fracture. So, the findings of the present study indicated that male gender, poor mental status, limited prefracture functional ability, and institutionalized disposition at discharge were the variables most significantly and independently associated with mortality. In addition, female gender, age over 80 years, poor mental status, and limited pre-fracture functional ability were the independent predictors that served to explain functional limitation 1 year postfracture. Special attention was thus called for in the case of all patients displaying one or more of the predictive factors described.

The Franzo et al. study demonstrated that longer waiting time for surgery was not associated with mortality after adjusting for patient risk factors, and taking into account hospital level variability.

Differences between hospitals in mortality after hip surgery that were partially explained by the volume might be due to the effects of several aspects of the management of hip fracture in the elderly population.

The Takashi Shimizu et al. study considered the excessive shortening at the fracture site on the anteroposterior radiograph in the femoral neck fracture of Garden stages I and II to predict poor outcomes from in situ osteosynthesis. Moreover, there were several important limitations to this study: the number of patients was small. They were studied in a retrospective manner. The observation time was only 2 years at shortest. Only non-union and late segmental collapse were regarded as endpoints, the definitions of which were not very clear. Taking the variety of postoperative periods when these two complications were shown, the variety of the follow-up periods in the study patients might have some bias for the incidence of those complications. Due to these weak points in the design of the present study, the usefulness of the capital index in assessing the clinical outcome of femoral neck fracture after osteosynthesis could not strongly be confirmed. This study only suggested the possible usefulness of this index. Finally, additional studies were required to determine the optimal treatment for excessively impacted femoral neck fractures.

The Maxwell et al. study developed and validated a scoring system that reliably predicts the probability of mortality at 30 days for patients after hip fracture. For this score system, it had to fulfill several criteria: it should use readily available and verifiable clinical information; it should have been developed and validated in the population in whom it was to be used; and it should be free from confounding factors. The score system used data that were easily collectable for any patient presenting with a fractured neck of femur. Unlike, they had deliberately excluded surgical and anaesthetic data. This was because they believed it was possible for surgical and anaesthetic techniques to be influenced by preoperative patient factors to unknown and varying degrees with a fractured neck of femur. The concept of summarizing the number of diseases present was not a new one, and they realized that the use of a semi-quantitative value of 'number of co-morbidities' might appear controversial to some. However, they believed that this approach should not be regarded as any more or less rigorous as considering whether specific diseases were present or absent. The universally used the American Society of Anesthesiologists classification made no attempt to define the nature of the diseases which were causing limitation or threat to health. It was also important to remember that arbitrary cut-offs always existed when defining whether a particular disease was significant or not. The information on number of co-morbidities in this study was based on the admission clerking, so it therefore reflected what the admitting orthopaedic doctor felt were important ongoing medical problems. The number of co-morbidities was a semi-quantitative substitute for the anaesthetist's end of the bed feeling before surgery. Residence before hospital admission was a surrogate for general fitness, and might be affected by various factors unrelated to eventual outcome, such as proximity and ability of family carers. Often tests such as nutritional screening and ability to perform specific tasks might appear more rigorous; however, two problems existed with performing these measurements. First, they were largely impractical to implement in routine practice, and secondly, documentation of pre-morbid activity only occurred after the fracture had occurred, when recalled and other biases tend to make such measures imprecise.

The Burgos et al. study considered the visual analogue scale for risk (RISK-VAS) scale, the operative severity score for the enumeration of mortality and morbidity (POS-SUM) scoring system and the Charlson index that reached a sufficient predictive value with regard to serious post-operative complications. The Barthel index and the RISK-VAS scale were those most useful for predicting ambulation at 3 months. None of the scales proved to be capable of predicting 90-day mortality. As conclusion, a simple index such as the RISK-VAS scale was the best predictor of serious post-operative complications. The functional level before the fracture, measured with the Barthel index, had a major influence on the ambulation recovery.

Finally, in 2010, the Philipp N. Streubel et al. study concluded that periprosthetic fractures and fractures in patients with dementia, heart failure, advanced renal disease, and metastasis led to reduced survival. The age adjusted Charlson Comorbidity Index might serve as a useful tool to predict survival after distal femur fractures. Surgical delay greater than 4 days increases the 6-month and 1-year mortality risks. Mortality after native fractures of the distal femur in the geriatric population is high and similar to mortality after hip fractures.
Conclusions

By reviewing the literature available, it was shown that there were more multidimensional prognostic indexes in the elderly after hospitalization than multidimensional prognostic indexes with hip or neck femur fracture which could be used as a simple point scoring system at the bedside to predict mortality in the elderly undergoing hip or neck femur fracture surgery.\(^1,2\) However, the variability of the aspects which each prognostic index included, emphasized the importance of considering multiple domains when assessing prognosis in older patients and added the understanding of the complexity of mortality prediction in the elderly population with hip or neck fracture.\(^2\) Our review provided further evidence supporting routine assessment of functional status in hospitalized elderly. We found that measures of functional status added important information about risk for mortality beyond that provided by medical diagnoses or psychological measures. This was probably because functional status reflected the severity and ended result of many different illness and psychological factors. However, the importance of assessing functional status extended well beyond its value as a prognostic measure.\(^3\) By combining functional status, co morbidity, sex, and laboratory values the Maxwell et al. study\(^6\) developed and validated a scoring system that reliably predicted the probability of mortality at 30 days for patients after hip fracture. Our review had several limitations. First, we did not have information about clinical care of patient preferences after discharge so that in some cases poor survival might have been affected by decisions to limit treatment. Also, since the patients were involved in a study to predict mortality after surgery, it was possible that the selection process for study or the process of being observed in a study could affect the generalizability of the index.\(^4\)

In comparison with the prognostic indexes considered, we could underline that:
- the EQ-5D focused more on postoperative quality of life in the elderly, but not predict mortality;
- the Javier Alegre-Lopez et al. study\(^13\) found that male gender, poor mental status, limited prefracture functional ability, and institutionalized disposition at discharge were the variables most significantly and independently associated with mortality, but they did not validate a predictive index of mortality;
- the A. Franco et al. study\(^19\) demonstrated that longer waiting time for surgery was not associated with mortality after adjusting for patient risk factors, and taking into account hospital level variability, but they did not validate a predictive index of mortality, too;
- the Takashi Shimizu et al. study\(^25\) only suggested the possible usefulness of their index, which did not predict mortality;
- the M. J. Maxwell et al. study\(^26\) developed and validated a scoring system that reliably predicted the probability of mortality at 30 days for patients after hip fracture.

The E. Burgos et al. study\(^27\) considered the RISK-VAS scale, the POSSUM scoring system and the Charlson index that reached a sufficient predictive value for predicting ambulation at 3 months, but none of the scales proved to be capable of predicting 90-day mortality.

The Philip N. Streubel et al. study\(^28\) concluded that periprosthetic fractures and fractures in patients with dementia, heart failure, advanced renal disease, and metastasis lead to reduced survival, but they did not precise the time.

References