What Is the Right Age for Fixation Versus Arthroplasty for Displaced Femoral Neck Fractures? An Economic Decision Analysis

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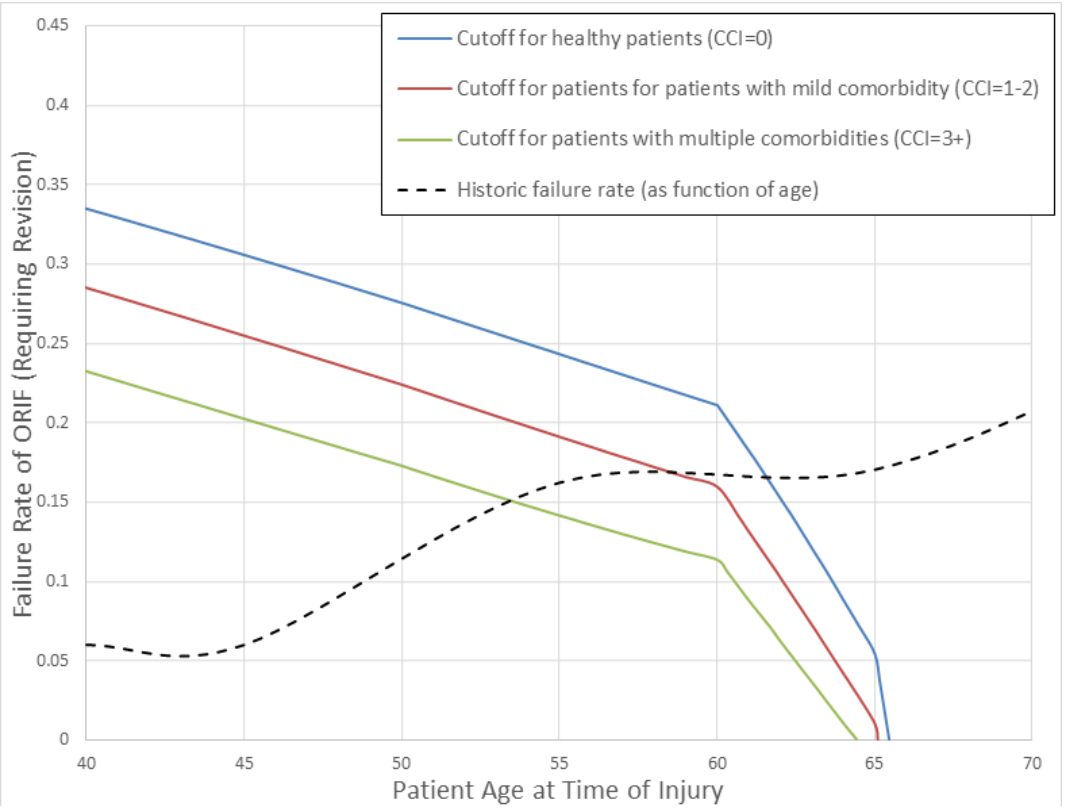
Background/Purpose: Displaced femoral neck fractures occur commonly in elderly patients who sustain low energy falls as well as in younger patients after high-energy trauma. It is generally agreed that active, healthier older patients should undergo total hip arthroplasty (THA), with hemiarthroplasty reserved for the most elderly patients with significant medical comorbidities. Alternatively, acute open reduction and internal fixation (ORIF) is usually the treatment of choice for younger patients. However, the exact age at which the transition between ORIF and THA should be made is poorly defined. For "middle aged" patients, both treatment options have potential drawbacks; ORIF may be unsuccessful and result in nonunion (NU) or osteonecrosis (ON) requiring revision operation, while THA in a relatively young patient carries the concern of future revision within the patient's lifetime. It is unclear which of these factors plays a greater role in clinical outcomes, and at what patient age that balance shifts. The purpose of this study is to employ decision analysis modeling techniques, based on high-quality data, to generate evidence-based treatment recommendations to aid in the decision between ORIF and primary THA for a patient with a displaced femoral neck fracture as both a function of age and medical comorbidity status.

Methods: A Markov decision analytic model was created to simulate outcomes of patients with displaced femoral neck fractures at various ages with three different levels of comorbidity as measured by the Charlson Comorbidity Index (CCI): (1) healthy (CCI of 0), (2) mild comorbidity (CCI of 1 or 2), and multiple comorbidities (CCI 3 or greater). Patients who underwent ORIF were modeled to either heal or go on to failure (NU or ON) requiring revision surgery to a THA, with revision/failure rates taken from those reported in high-quality prospective studies. Patients who underwent THA were modeled to have implant failure requiring revision at rates based on large prospective registry data. Costs were taken from a societal point of view, with operative costs based on Medicare diagnosis-related group reimbursement. Quality-adjusted life year (QALY) outcomes were modeled based on studies explicitly designed to measure utility after THA and revision THA, and the utility of patients who underwent ORIF was taken from large registry data. Perioperative mortality and life expectancy were taken from registry data, clinical reports, and US life tables. An incremental cost-effectiveness ratio (ICER) cutoff of $100,000/QALY was used. The model was run through base case conditions to determine the "cutoff" age above which arthroplasty would be the superior strategy, and then the effect of increasing medical comorbidity on that cutoff age was evaluated. Results were tested using 1 and 2-way sensitivity analysis, and 95% confidence intervals (CId) generated using probabilistic statistical analysis and Monte Carlo simulation.

Results: For an otherwise healthy patient with a displaced femoral neck fracture, primary THA was a cost-effective option for patients over 62 years of age. For patients with mild

comorbidity, that age changed to 59 years, and with multiple comorbidities it dropped to 53 years. The variable that the results were most sensitive to was the success rate of initial ORIF, and is shown graphically in Fig. 1.



Conclusion: The decision between initial attempted ORIF and primary THA in a patient with a displaced femoral neck fracture is a function of age, medical comorbidity, and predicted failure rate of ORIF. Based on current available evidence, primary THA is an economically viable alternative to ORIF for displaced femoral neck fractures in patients aged 53-62 years. Clinicians should consider age, patient comorbidities, and predicted failure rate of ORIF in determining the optimal treatment for an individual patient.

See pages 49 - 106 for financial disclosure information.