Author: Arjun Saxena

QUESTION 2: Is acute femoral neck fracture a risk factor for infection in patients undergoing hip arthroplasty?

RECOMMENDATION: There appears to be a higher incidence of infection in patients undergoing arthroplasty for acute femoral neck fracture compared to hip arthroplasty for primary osteoarthritis. The reported rate of infection has a wide range; prospective studies should be performed to determine the true rate of periprosthetic joint infection (PJI) in this subset of patients.

LEVEL OF EVIDENCE: Limited

DELEGATE VOTE: Agree: 96%, Disagree: 4%, Abstain: 0% (Unanimous, Strongest Consensus)

RATIONALE

A study on 58,000 elective, primary total hip arthroplasties (THAs) demonstrated a deep surgical site infection (SSI) rate of 0.2% [1]. There are multiple studies reviewing the outcomes of treatment for femoral neck fractures. Most of the studies are retrospective reviews of small cohorts that are not sufficiently powered to study infection rates. Additionally, many of the studies merge primary hemi or total arthroplasty patients with patients who underwent open reduction and internal fixation, and then subsequently a secondary arthroplasty procedure. While most studies report infection rates, the primary endpoint tends to aim at a controversy in treating these fractures, such as cemented versus cementless, or performing hemiarthroplasty versus total arthroplasty. Infection rates vary from 1.2% to 4% [2–5]. A study on 90-day costs following hemiarthroplasty or THA for treatment of hip fractures demonstrated a 17.7% infection rate, but this was not limited to surgical site infections; urinary tract infections, pneumonias and other infections are included in this percentage [6]. A meta-analysis on outcomes of patients who sustained femoral neck fractures reported a 1.0% SSI rate in patients undergoing THA, 1.7% SSI rate in patients undergoing bipolar hemiarthroplasty and a 2.8% SSI rate in patients undergoing unipolar hemiarthroplasty [7].

A study from the Swedish Hip Arthroplasty compared 10,264 patients who underwent THA for treatment of a subcapital hip fracture with 76,520 patients who underwent THA for other reasons and they reported a 0.5% infection rate in the patients who were treated for fracture [8]. It appears that the rate of infection is higher in patients undergoing arthroplasty surgery for the treatment of acute femoral neck fractures.

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3.4. TREATMENT: PROCEDURE-RELATED

Author: Pedro Caba

QUESTION 1: What is the optimal timing of surgical debridement in open fractures?

RECOMMENDATION: It is not possible to establish a clear cut-off for optimal timing of open fracture surgical debridement after injury. Administration of antibiotic prophylaxis and adequacy of debridement is more important than time to debridement. However, we recommend debridement as soon as the patient and operative conditions are optimal.

LEVEL OF EVIDENCE: Limited

DELEGATE VOTE: Agree: 100%, Disagree: 0%, Abstain: 0% (Unanimous, Strongest Consensus)

RATIONALE

Debridement is only one of the main pillars of initial open fracture treatment. Antibiotic therapy and proper fixation are also important variables. It is difficult to separate the effects of the different treatments and actions on the onset of infection and other complications. Most clinical studies demonstrate small differences in the time to debridement between comparison groups, and time cut-offs are arbitrary based on historical papers. The implementation of early antibiotic treatment in open fracture treatment has changed the infection rate. Examining the relationship between timing of surgical debridement and infection risk is crucial in guiding clinical practice, as there is still significant variability among surgeons' preferences. Most of the orthopaedic doctrine in this issue is based on historical papers or retrospective studies.

The cut-off of six hours for initial surgical debridement is based on the 1898 Friedrich study which demonstrated in an animal model that wounds debrided within six hours had no infection. This finding became incorporated into orthopaedic doctrine as the "6-hour rule." Robson supported these findings with a clinical study in 1973. He described a golden hour or inflection point of 5.17 hours after injury, which is the time needed for bacteria to reach a critical level of contamination ($> 10^5$ bacteria per gram of tissue specimen).

The first systematic review examining the relationship between infection and time to debridement was published in 2012 [1]. This review included 3,539 patients from various studies. The analyzed data did not indicate an association between delayed debridement and higher infection rates. Studies published since 2012, including a metanalysis, indicate that the 6-hour rule is not supported by evidence. Prodromidis performed a metanalysis in 2016 on the specific topic of the 6-hour rule in open tibia fractures [2]. This paper examined seven articles (only two prospective) involving 610 patients. The statistical analysis did not find any differences in terms of deep infection or non-union regarding the time to debridement.

One major limitation in this literature is the arbitrary cut-off times in the different studies. In 2014, the results of a large prospective cohort multicentre study involving 797 fractures was published. This study did not demonstrate differences in the early (< 6h), intermediate (6-12h) and late (> 12h) groups. Median time to debridement was 9h 15 min, indicating that most patients were not treated early. Another prospective study published by Srour et al. reported similar results [3]. They studied a cohort of 351 consecutive patients treated in the same facility comparing three different cut-off times (< 6 h, 6-18h and 18-24 h). They concluded that the time to operating room did not affect the development of local infectious complications, provided that the operation was performed within the first 24 hours after arrival.

Recent papers have focused on the impact of delayed debridement on infection rates, with conflicting results. Kumar et al. performed a large retrospective study of 404 patients treated with contemporary treatment. They reported that the rate of infection in open lower extremity fractures increases when debridement is delayed beyond eight hours [7]. For upper extremity injuries, delayed debridement did not result in any increase in infections. Penn-Barwell, in an experimental study on rats [8], demonstrated the timing of antibiotics had a more significant effect than surgical debridement on the onset of acute infection, especially when initation of treatment is delayed beyond six hours. When antibiotics were started at two hours, a delay in surgical treatment from two to six hours significantly increased the risk of development of infection but delays beyond six hours did not result in any increase in infection indicating that very early debridement, within two hours of the injury, could have a positive effect. Hull et al., in a prospective series of 459 patients, studied the relationship between delayed debridement and deep infection [6]. They reported that there is a 3% increased risk of infection for every hour of delay. As baseline infection risk is higher for Type IIIB and IIIC open tibia fractures than for lower grade tibia fractures, the increased risk in this group of fractures is much higher when the debridement is delayed. According to this study, the predicted probability of infection in a high grade contaminated tibia fracture increases from 35% at four hours post-injury to 45%. They recommend urgent debridement at the first reasonable opportunity after injury.

In summary, urgent debridement is essential in the initial treatment of open fractures, but the cut-off time is not known. There is little current evidence supporting the 6-hour rule. There is moderate evidence supporting the proposition that delayed debridement beyond eight hours could have an impact on infectious complications, especially in high-grade open tibia fractures. There is only limited evidence supporting very early debridement (< 2hrs).

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