blood transfusion after SA when comparing TXA with placebo (risk rate 0.53, 95% confidence interval 0.17 to 1.64). Due to the fact that the rate of transfusion after SA is low, the current data is too sparse to provide conclusive evidence for the effect of TXA on blood transfusions. In addition, there is insufficient evidence for the effect of TXA upon hematoma formation or other clinical outcomes after SA.

Conclusion

While this meta-analysis confirmed the effect of TXA in decreasing blood loss, the evidence for its effects on direct clinically important outcomes like rate of transfusions or hematoma formation was inconclusive. Blood loss is a surrogate outcome and there are no defined thresholds to associate a determined amount of blood loss to those clinically important outcomes.

The use of TXA in patients at high risk for transfusion or patients undergoing complex revision arthroplasty has not been adequately studied. Patients at high risk for transfusions include those with low preoperative Hb and hematocrit levels (Hb < 13 g/dL and hematocrit < 39.6%) [3,7,8,22,23], operative time longer than 5 hours [24], surgery with a diagnosis of posttraumatic or rheumatoid arthritis [2,3], and patients with diabetes or ischemic heart disease [8,24]. The use of TXA in these at-risk populations might be justified given the higher baseline risk of transfusion and the greater impact of blood loss. However, this is a recommendation that is weak and limited by the lack of direct evidence. Further study of TXA in these higher risk patients is warranted.

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1.3. PREVENTION: PATIENT CHARACTERISTICS

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QUESTION 1: What is the role of medical comorbidities as potential risk factors for periprosthetic joint infection (PJI) following primary or revision total shoulder arthroplasty (TSA)?

RECOMMENDATION: Specific patient medical comorbidities and demographic factors are potential risk factors for shoulder PJI and appropriate preoperative evaluation and perioperative management should be standard practice.

LEVEL OF EVIDENCE: Moderate

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

RATIONALE

PJI after both primary and revision shoulder arthroplasty remains a challenging and costly problem. It is important to recognize medical comorbidities as well as demographic factors that may be risk factors for shoulder PJI. Medical comorbidities can negatively impact surgical outcomes and lead to an increased risk of complications; however, there is limited evidence specifically linking medical comorbidities and shoulder PJI. There are some helpful general measures of health, including American Society of Anesthesiologist (ASA) grading, Charlson Comorbidity Index (CCI) and Functional Comorbidity Index (FCI), among others. These indices can often be linked to surgical outcomes and PJI, including shoulder PJI [1].

A literature review was performed to identify all studies regarding medical comorbidities and demographic factors that may be risk factors for shoulder PJI. Search terms "shoulder replacement," "shoulder arthroplasty," "infection," "comorbidities" and "risk factors" were utilized for PubMed and Google Scholar searches through February 18, 2018. All abstracts were reviewed and full text article review was completed for screening of relevant articles. Ultimately, 13 studies were included for final analysis.

Medical comorbidities that have been shown to be potential risk factors for shoulder PJI include American Society of Anesthesiologists (ASA) grade III or higher [1], rheumatoid arthritis [2], long term corticosteroid use [2], current and former smokers [3], Hepatitis C virus [4], HIV-positive [5], weight loss/nutritional deficiency [6], drug abuse [6] and iron deficiency [7].

Increased body mass index greater than or equal to 35 kg/m^2 has been associated with increased superficial wound infection but was not shown to be associated with shoulder PJI [8]. Patient demographic factors that have been shown to be risk factors for shoulder PJI include younger age [6,7,9–11] and male gender [6,8–11].

There is a limited but growing body of literature to support medical comorbidities and demographic factors that are potential risk factors for shoulder PJI. It is important to recognize and treat potentially modifiable medical comorbidities as well as counsel patients regarding additional non-modifiable comorbidities and demographic factors.

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QUESTION 2: Does previous shoulder surgery (arthroscopic or open non-arthroplasty) increase the risk of periprosthetic joint infection (PJI)?

RECOMMENDATION: Previous ipsilateral non-arthroplasty shoulder surgery likely increases the risk of shoulder PJI.

LEVEL OF EVIDENCE: Limited

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

RATIONALE

Due to the inability of skin preparation solutions [1–3] and antibiotics [3–5] to eradicate bacteria (e.g., *Cutiibacterium acnes*) living underneath the skin surface, transection of the dermal structures leads to inoculation of bacteria into the deep tissues [6]. Therefore, previous non-arthroplasty surgery theoretically may increase the risk of PJI.

To answer this question, we performed a systematic review using the following search phrase: ("previous" OR "history of") AND "shoulder arthroplasty" AND ("infection" OR "culture"). Thirty-nine results were filtered by title and abstract, and reference lists were reviewed for relevant studies. Studies were included for analysis if they compared infection rates for shoulder arthroplasty in a group of patients with and without history of previous non-arthroplasty surgery. Studies that included previous arthroplasty (rather than non-arthroplasty) surgery as a risk factor were excluded.

Two studies have addressed the question of whether previous non-arthroplasty surgery increased the risk for shoulder PJI. Werthel et al. [7] looked at non-arthroplasty surgery as a risk factor for PJI and found that previous non-arthroplasty surgery was a risk factor for deep infection after both a univariate ($p = 0.0094$) and a multivariate analysis ($p = 0.0390$). An increased number of previous surgeries was associated with a greater risk of deep infection ($p = 0.272$).