

QUESTION 4: What is the threshold for glycated haemoglobin (HbA1c) that is predictive of subsequent surgical site infection/periprosthetic joint infection (SSI/PJI) in patients undergoing orthopaedic procedures?

RECOMMENDATION: The upper threshold for HbA1c that may be predictive of subsequent SSI/PJI is most likely to be within the range of 7.5 to 8%.

LEVEL OF EVIDENCE: Moderate

DELEGATE VOTE: Agree: 88%, Disagree: 3%, Abstain: 9% (Super Majority, Strong Consensus)

RATIONALE

A wide range of complications have been reported among patients with diabetes undergoing orthopaedic procedures, namely SSIs. Therefore, it is thought that maintaining appropriate glycemic control during the perioperative period is crucial for potentially decreasing the risk of such complications [1–3]. Serum HbA1c is a surrogate for patient glycemic status over a two- to three-month period and is widely used as a marker for perioperative glycemic control [4].

The American Diabetes Association (ADA) guidelines recommend a maintenance of an HbA1c level of less than 7% for patients with diabetes in order to minimize potential complications [5]. However, the orthopaedic literature is less conclusive regarding a specific threshold that would reduce the risk of complications. Several studies were not able to reach significance between a specific HbA1c threshold and postoperative infection [1,3,6–10], while others reported a significant association between infections and HbA1c level, but with no clear consensus on one predictive value among the studies [2,5,11–21]. It is worth noting that many of these studies adopted the ADA recommended HbA1c value of 7% as a cutoff level in their design phase to stratify their cohorts (diabetic vs. non-diabetic) and attempted to validate this previously-established threshold rather than examining HbA1c as a continuous variable [1,3].

With regards to total joint arthroplasty (TJA), Han et al. found an HbA1c level of more than 8% to be significantly associated with a higher risk of postoperative wound complications for patients undergoing total knee arthroplasty (TKA) [15]. Similarly, Hwang et al. found that a HbA1c greater than 8% is associated with superficial SSIs following TKA in patients with diabetes, while the HbA1c level of 7% was not detected as a significant cutoff value for higher likelihood of infection or wound complications, in contradiction to the guidelines of the ADA [17].

Cancienne et al. found that patients having a HbA1c level equal to or more than 8% were more likely to have an infection within one year of performing TKA compared to those having HbA1c levels less than 8% (adjusted odds ratio (OR): 1.7, 95% confidence interval (CI) 1.2 to 2.4, $p = 0.004$). However, it was indicated that this threshold of 8% is of limited clinical utility when taken as an independent predictor for postoperative infection due to its poor sensitivity and intermediate specificity [2]. In another parallel study of total hip arthroplasties [14], Cancienne et al. also identified that a perioperative HbA1c of more than 7.5% is a significant risk factor for the development of postoperative PJI, yet, is of poor clinical utility as a stand-alone predictor for PJI [5]. Stryker et al. reported that patients with a preoperative HbA1c level of more than 6.7% have nine times the odds of having increased risk of wound complication following primary TJA compared to those having a HbA1c less than 6.7% (95% CI 1.14 to 71.20, $p = 0.03$) [19]. Jansen et al. identified a threshold of HbA1c of 6.5% above which the rates of PJI were significantly higher [18]. On the other hand, a recent study by Tarabichi et al. presented receiver operating characteristic (ROC) curves and used Youden index to estimate the optimal cutoff value of HbA1c predictive of complications to find the threshold of 7.7% to be predictive of PJI in TJA (95% CI 6.25 to 8.05, Youden index 0.38, cutpoint 0.019) [20]. A systematic review and meta-analysis by Yang et al. indicated that the cutoff HbA1c value of 7% as predictive of PJI remains controversial [21]. Similarly, a recently released systematic review and meta-analysis by Shohat et al. indicated that the orthopaedic literature has failed to agree on the optimal HbA1c value predictive of SSI in TJA [22].

Cancienne et al. reported an HbA1c level of 7.5% to be a significant threshold predictive of infection [12] in spinal and cervical surgery. Hikata et al., on the other hand, found that preoperative HbA1c values were significantly higher in patients with diabetes who developed postoperative SSIs and recommended that HbA1c levels should be maintained below 7% to prevent SSIs [16].

In one of the very few studies addressing foot and ankle surgeries and HbA1c threshold, Domek et al. reported a significant association between greater HbA1c values and infections, yet they were not able to identify an HbA1c value that could potentially predict a greater risk of infection [13].

Among the minimal number of studies on arthroscopy, Cancienne et al. recently reported that a perioperative HbA1c of 8% could serve as a threshold, yet they found limited clinical applicability due to low sensitivity [11].

Generally, Dronge et al. reported findings from a cohort of 490 diabetic patients who underwent non-cardiac surgery, of which 63 underwent orthopaedic surgeries, and detected that HbA1c levels less than 7% were associated with a significantly lower risk of postoperative infections [14].

In conclusion, studies on different types of orthopaedic procedures reported a broad range of HbA1c threshold levels that may be predictive of postoperative infections. No consensus was reached, neither within studies addressing the same orthopaedic procedures nor across studies targeting different orthopaedic surgeries. The ultimate HbA1c threshold remains controversial; however, the literature indicates that this threshold is most likely in the range of 7.5 to 8%. Larger studies examining the optimal threshold for HbA1c as well as studies examining alternative markers of glycemic control are necessary [10].

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