G23: Does the use of anabolic steroids increase the risk of SSI/PJI in patients undergoing major orthopedic surgery?

Felipe M Borim; Cindy Zeng; Serban Dragosloveanu; Prieto Hernan; Ernesto Guerra, Seok Ha Hong; Seung-Beom Han; Timothy Lording

Response/Recommendation: The current evidence remains insufficient to conclude if anabolic steroid use increases the risk of surgical site infection (SSI) or prosthetic joint infection (PJI) in patients undergoing major orthopedic surgery.

Strength of the Recommendation: Weak

Delegate Vote:

Rationale:

Anabolic steroids refer to synthetic derivatives of testosterone, and differentiating between its usage for performance enhancement versus testosterone replacement therapy (TRT) is essential. Use of anabolic steroids for performance-enhancing purposes involves supraphysiological doses and is a public health risk linked to hypogonadism, cardiac impairment, neurodegeneration, coronary artery disease, and sudden cardiac death [1]. Ethical concerns and unreliable survey data in target populations limit knowledge of the long-term effects of anabolic steroid abuse. In contrast, TRT aims to restore physiological levels in cases of hypogonadism and age-related testosterone decline. The Hypogonadism in Males (HIM) study reported a 38.7% prevalence of hypogonadism (TT < 300 ng/dl) in men aged 45 and older, with higher rates in those with conditions such as hypertension, diabetes, and obesity [2]. Testosterone levels decrease by about 1% annually after age 40 [3], and TRT has demonstrated benefits for bone density, muscle mass, body composition, sexual function, mood, erythropoiesis, and quality of life [4]. Most TRT prescriptions are written by primary care physicians, predominantly for older men with age-related testosterone decline [5]. In this review, all studies address anabolic steroids in the context of TRT.

This systematic review identified only one study directly examining the association between anabolic steroid use and SSI/PJI risk in orthopedic patients [6]. This retrospective study, involving 367 cases of joint-related complications in patients with TRT undergoing total hip arthroplasty (THA) and 1,151 in those with TRT undergoing total knee arthroplasty (TKA), revealed significantly higher rates of revision surgeries and PJI. This may be explained by the potential immunosuppressive effects of anabolic steroids and increased skin flora burden. Additionally, pre-existing bone health deterioration from prolonged low testosterone levels prior to initiation of hormone replacement therapy may not be fully mitigated by TRT, leading to increased postoperative complications.

A recent meta-analysis on sex-related differences in PJI treatment with debridement, antibiotics, and implant retention found higher infection eradication rates in women, suggesting a potential immunosuppressive effect of testosterone [7]. Additionally, a correlation between serum testosterone levels and infection risk has been observed following total shoulder arthroplasty (TSA), with male gender identified as a risk factor for deep periprosthetic infections [8]. This increased risk may be partly due to the skin burden of C. acnes, which causes about 19% of infections post-TSA, and has been identified as a predictor of deep C. acnes infection in revision cases [9,10]. Elevated testosterone levels in patients on TRT may promote C. acnes colonization [9]. Longwolf et al. similarly identified a significantly higher risk of vascular graft infections in hypogonadal men on TRT, particularly in lower extremities and procedures near the groin, where skin flora pose increased risks [11].

Despite these findings, current data does not support the routine discontinuation of TRT in the perioperative period.

TRT may be correlated with increased risk of musculotendinous injury and subsequent repair failure [6]. Recent studies indicate that TRT is associated with a threefold increase in rotator cuff tears and a twofold increase in distal biceps ruptures, with TRT patients being more likely to require repeat rotator cuff repairs; meanwhile, androgen deficiency has also been linked to higher rates of rotator cuff tears. Thus, further prospective studies are needed to better understand TRT's effects on musculotendinous injuries and healing [12-14].

Using the PearlDiver claims database, Collins et al. compared patients receiving perioperative TRT with controls undergoing THA and TKA. Within two years post-THA, the TRT cohort exhibited higher rates of all-cause revision (3.57% vs. 2.34%; OR 1.46; 95% CI, 1.21–1.75) and PJI (2.16% vs. 1.43%; OR 1.67; 95% CI, 1.31–2.09). For TKA, the TRT group also had significantly elevated rates of septic revision (1.40% vs. 0.95%; OR 1.44; 95% CI, 1.19–1.76), aseptic revision (3.05% vs. 2.48%; OR 1.20; 95% CI, 1.05–1.37), all-cause revision (3.62% vs. 2.78%; OR 1.27; 95% CI, 1.13–1.44), periprosthetic fracture (0.27% vs. 0.21%; OR 1.53; 95% CI, 1.00–2.29), and aseptic loosening (0.97% vs. 0.73%; OR 1.34; 95% CI, 1.06–1.69). Notably, the TRT cohort had fewer instances of manipulation under anesthesia/lysis of adhesions (4.30% vs. 4.63%; OR 0.90; 95% CI, 0.81–1.00). However, the authors caution that while TRT is associated with poorer outcomes post-arthroplasty, this does not imply causation [6]. The increased complication risk may reflect the long-term effects of untreated low testosterone levels, such as reduced bone mineral density, prior to the initiation of TRT and joint replacement.

The limited scope of available studies presents significant challenges to the reliability of these findings. Therefore, more comprehensive research on TRT in orthopedic contexts is necessary to elucidate its safety, efficacy, and potential impacts on clinical outcomes.

Conclusions:

TRT-THA has been associated with higher rates of all-cause joint revisions and PJI [6]. Similarly, TRT-TKA has been linked to significantly increased rates of septic revision, all-cause revision, periprosthetic fractures, and aseptic loosening [6]. In TSA, a correlation has been observed between serum testosterone levels and infection risk [8]. Despite these risks, TRT may offer orthopedic benefits, including accelerated rehabilitation, improved recovery, enhanced bone-implant integration, and increased overall bone mineral density [15]. Clinicians must carefully weigh the potential immunomodulatory risks of anabolic steroids against the adverse effects of chronic low testosterone levels on bone health, particularly in high-risk patients. Further research is essential to better understand the safety, efficacy, and clinical implications of TRT in orthopedic settings.

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