SH55. Should pre-operative antibiotics be held until after cultures are obtained in revision shoulder arthroplasty?

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Response/Recommendation:

Pre-operative prophylactic antibiotics should not be held until after cultures are obtained in revision shoulder arthroplasty. Recent studies have shown that pre-operative antibiotic prophylaxis does not adversely affect intraoperative culture results. In addition, there is substantial evidence demonstrating that failing to administer antibiotics prior to the skin incision increases the risk of postoperative wound infection. We recommend not to hold pre-operative antibiotics in revision shoulder arthroplasty.

Strength of Recommendation: Moderate

Rationale:

The purpose of preoperative prophylactic antibiotics in all shoulder arthroplasty is to prevent post operative wound infection, as well as colonization of the implants which might lead to later failure. There have been recommendations to hold administration of antibiotics until after cultures have been obtained in revision shoulder arthroplasty cases in order to minimize the chance of obtaining false negative culture results. However, there is also concern that failure to administer prophylactic antibiotics prior to the skin incision will increase the risk of postoperative wound infection. Therefore, resolving this conflict regarding the effect of prophylactic antibiotics on the results of intraoperative cultures obtained during revision surgery needs to be resolved in order to optimize the diagnostic evaluation for shoulder periprosthetic joint infection (sPJI), especially in cases without obvious infection.

AlBuhairan et al performed a systematic review using the Cochrane Library, MEDLINE, EMBASE, and CINAHL (Cumulative Index to Nursing and Allied Health Literature) databases. A meta-analysis of 7 of the studies (3065 cases) demonstrated that prophylactic antibiotics reduced the absolute risk of wound infection by 8% and the relative risk by 81% compared with no prophylaxis ($p < 0.00001$).

It goes without saying that identification of the specific pathogen and pathogen-specific antibiotherapy are extremely important in the treatment of PJI.[Bedenčič, Tarabichi] In the Report of the Third International Consensus Meeting, holding preoperative prophylactic antibiotics before obtaining cultures was not recommended for the operative treatment of knee and hip PJI [4,5]. [Ghanem, Zmistowski] However, it has been stated that antibiotics might be held in cases where the pathogen is not identified preoperatively. [Ghanem] In contrast to more virulent bacteria that cause suppurative infection and sepsis, low virulent *Cutibacterium acnes* (*C. acnes*) is responsible for the majority of sPJI. [Dodson, Achermann] Traditional culture techniques are reported to have low sensitivity for *C. acnes*.[Dodson] Given these difficulties, it is important to understand whether pre-operative intravenous antibiotic prophylaxis reduces culture sensitivity.

Several revision shoulder arthroplasty studies reported that clinicians have a tendency to hold pre-operative antibiotic prophylaxis in the revision shoulder arthroplasty. The Clinical Practice Guideline of the Infectious Diseases Society of America published in 2013 emphasized the importance of evaluating preop PJI risk in the decision to hold antibiotic prophylaxis. If the preoperative evaluation including history, physical examination, ESR, CRP level, and preoperative aspiration suggest that the risk of PJI infection is low, holding perioperative prophylactic antibiotics is not recommended. Holding perioperative prophylactic antibiotics was only recommended in cases where the infection is strongly suspected.[Osmon]

More recently, DeGroot, et al performed a retrospective study of 490 patients who underwent revision of aseptic failed THA. At least three intraoperative tissue cultures were obtained and cultured for a minimum of 2 weeks. 61 patients received prophylactic antibiotics prior to incision while antibiotics were held until after cultures in 429 cases. There was no significant difference in the rates of positive cultures (4.9% pre vs. 5.4 %, post; p=0:89) or the rates of contaminated culture results (23.0% pre vs 22.6% post; p=0.95). The equivalent rates of positive cultures support a conclusion that administering perioperative prophylactic antibiotics prior to obtaining cultures does not inhibit bacterial growth in culture. Of additional interest was the finding that the post-operative incidence of PJI was 1.6% for pre incisional antibiotics and 3.0% for post-incisional antibiotics providing further support for preferring routine pre-incisional prophylactic antibiotics. Of further interest, the bacterial species identified in positive cultures differed substantially between the pre and post-incisional antibiotic cohorts. Although the numbers were small, 2/3 (67%) of the positive cultures in the pre-incisional group were C. acnes with 1/3 (33%) being S. epidermitis compared to 5/23 (22%) C. acnes and 12/23 (52%) S. epidermitis in the post-incisional group. In contrast, there was no difference in distribution of these specific bacteria in the contaminated cultures between the pre and post incisional antibiotic cohorts. It is not unreasonable to assume that antibiotic prophylaxis would have different effects on different bacteria. These results suggest that giving prophylactic antibiotics before the incision and cultures is protective against *Staphylococcal* species and administered after culture sampling there is greater risk of *Staphylococcal* species contaminating the surgical wound.

Wouthuyzen-Bakker, et al performed a systematic review to determine the effect of the timing of administration of prophylactic antibiotics on the results of intra-operative cultures. They included 7 studies, all level III retrospective comparative cohort studies expect for one prospective controlled trial, that were published between 2010 and 2017, and included 739 patients, the vast majority being revision total knee or hip arthroplasty. 527 patients had a confirmed PJI prior to surgery. The pooled culture yield was 88% (145/165) in the prophylaxis group versus 95% (344/362) in the control group without prophylaxis (P =0.004. A subanalysis of patients with a chronic PJI (n =146), found that the pooled culture yields were not significantly different between the prophylaxis and the nonprophylaxis groups (88% [78/89] versus 91% [52/57], respectively; P = 0.59). In cases with a suspected chronic PJI (two studies, n =439), culture yield depended on the pretest probability of having an infection (e.g., 26 to 27% in patients with presumed aseptic loosening and/or chronic pain versus 56 to 60% in patients with at least one minor or major diagnostic criterion for infection as defined by the Musculoskeletal Infection Society. In both studies, a there was a 4% difference in culture yield between the prophylaxis group and the control group without prophylaxis (P=0.78). With limited numbers, they did report that pre-incisional prophylactic antibiotics in cases with more obvious signs of

infection appeared to have a greater effect on the culture results. In cases with acute infection the pooled culture result yield was 93% in the prophylaxis group and 96% in the nonprophylaxis group (p=0.66). They noted limitations of their analysis. In 5 of 7 studies the number of tissue cultures was less than four and/or included swab cultures, which may have underestimated the diagnostic yield.

Anagnostopoulos et al. assessed the influence of antibiotic prophylaxis administered within 30 to 60 minutes before revision shoulder arthroplasty surgery on time to positivity of intraoperative cultures and the proportion of positive intraoperative cultures. 72 patients underwent revision shoulder arthroplasty. Among the 64 patients with *P. acnes* infection there was 71.6% (95% CI 64.1-79.1) culture positivity in the patients without perioperative prophylactic antibiotics while the culture positivity was 65.9% (95% CI 55.3-76.5) in the patients with perioperative prophylactic antibiotics which was not a statistically significant difference (p=0.39).

Matsen et al. studied 10 male patients undergoing primary shoulder arthroplasty and reported the despite appropriate administration of pre-incisional prophylactic antibiotics [16], intraoperative positive cultures for *P. Acnes* were. Phadnis et al. studied 50 patients who were undergoing open shoulder surgery. Pre-incisional prophylactic antibiotics were administered cultures obtained from the skin surface and dermis. 7 of 50 postpreparation skin surface swabs (14%), 26 of 50 dermal swabs (52%), and 20 of 50 dermal biopsy specimens (40%) had cultures positive for *P. Acnes* , demonstrating that antimicrobial precautions do not eradicated *P. Acnes.*

Based on the available limited literature that demonstrates that pre-incisional antibiotic prophylaxis does not consistently effect the results of intraoperative cultures, and considering the importance of preventing post-operative wound infection, and protecting newly implanted hardware from infection we recommend that pre-operative antibiotics should not be held until after cultures are obtained in revision shoulder arthroplasty

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