natural knee [1]. Similar to total knee arthroplasty (TKA), periprosthetic joint infections (PJIs) after UKAs can occur with reported rates ranging from 0.2 to 3% [2,3].

There is surprisingly minimal literature regarding the treatment and outcomes of PJIs after UKA. For chronic PJIs, Labruyère et al. demonstrated 100% survivorship in a series of nine infected UKAs treated with one-stage exchange arthroplasty to a TKA at a median of 60 months, five of which were initially unsuccessfully treated with synovectomy, joint lavage and antibiotics [2]. The authors also noted that wedges (n = 6) and stems (n = 5) were required in the majority of patients. Bohm et al. performed exchange arthroplasty in two cases of PJI with one resulting in a femoral amputation [4]. One study revised two cases via a second, single-stage UKA in conjunction with synovectomy and prolonged antibiotic therapy, with the new implants being the same size as the initial implant, and with one implant being cemented with antibiotic cement, while the other case did not have a cemented implant [5]. Four studies revised nine knees to a TKA [6–9], with one study having two re-revisions following initial resection for recurrent infection [9]. Furthermore, Hamilton et al. performed three two-stage exchange arthroplasties, with one initially undergoing irrigation and debridement but ultimately requiring revision to a TKA via a two-stage exchange arthroplasty for recurrent infection [10].

Three studies successfully treated deep infection following UKA with retention of the implant with the first reporting one case treated with debridement and inlay exchange [8], the second reporting two cases treated with washout, debridement and bearing/liner change [9] and the third reporting one case treated with synovectomy and placement of gentamicin chains [11].

It is clear through the current literature that there are several viable options to treat infections following UKAs. The method that the surgeon chooses to use should be selected based on the severity and chronicity of infection as well as the amount of remaining native bone and cartilage. Bone loss is also not uncommon in the setting of infection [5]. In acute infection and in the absence of involvement of other compartments, debridement and retention may be a reasonable option. In patients with bone loss, chronic infections, or with infections that may be difficult to eradicate due to a resistant or challenging organism, a one-stage exchange or two-stage exchange arthroplasty to a UKA or TKA may be performed with the inclusion of a wedge or stem as indicated. If two-stage exchange arthroplasty is being performed, during resection arthroplasty other compartments and the fat pad should also be resected as they may harbor bacteria. This practice also allows for insertion of a proper spacer.

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QUESTION 4: Can sub-radical resection arthroplasty (leaving parts of implants in place) be considered during management of patients with chronic periprosthetic joint infections (PJIs)?

RECOMMENDATION: Sub-radical resection arthroplasty (leaving parts of implants in place) may be considered during management of patients with chronic PJIs when a component is proven to be well-fixed and its removal precludes opportunity for future reconstruction.

LEVEL OF EVIDENCE: Limited

DELEGATE VOTE: Agree: 68%, Disagree: 29%, Abstain: 3% (Super Majority, Weak Consensus)

RATIONALE

Two-stage revision with removal of all prostheses followed by reimplantation has been considered the gold standard to treat chronic PJIs [1–3]. However, the removal process might necessitate the use of additional procedures such as an extended trochanteric osteotomy to perform the removal of a well-fixed stem [4]. This can result in severe compromise of the proximal femur and jeopardize future fixation of a reimplanted stem. Retaining a well-fixed stem or acetabular component can be an option to avoid this in the setting of PJI treatment.

Struhl et al. [5] initially described this technique in 1989. In his case study, a 47-year-old man with a *Staphylococcus epidermidis* infection was treated by removal of the bipolar head, irrigation and debridement, retention of the femoral component and placement of antibiotic-impregnated beads. After seven weeks of intravenous antibiotic therapy, the patient underwent reimplantation of the acetabular component with an uncemented device. At 18-month follow-up, the patient had fully recovered without evidence of

infection. In 2013, Lee et al. [6] reported the results of 17 two-stage reconstructions retaining well-fixed cementless femoral stems in the treatment of PJI. At 2- to 8-year follow-up, 15 patients (88%) had no recurrence of infection and had satisfactory radiological and clinical outcomes. More recently, Ekpo et al. [7] reported on 19 patients with chronic infection whose femoral component was considered to be well-fixed and its removal would result in a marked femoral bone loss. Only two patients (11%), who additionally had failed a prior two-stage exchange, failed their secondary procedure due to recurrence of infection at a minimum of 2-year follow-up. Similar results have been published by Lombardi et al. [7] who had a series of 19 patients. At a mean follow-up of 4 years, 89% were considered to be infection-free. Two more recent publications have looked at results of this procedure with longer follow-up periods [8,9]. In a study by El-Husseiny et al. [8], 18 patients who had partial component retention were evaluated. These were carefully selected cases out of all the 293 patients who were surgically treated for PJIs at their institution. The selection criteria and indications for this approach were those who had complex total hip arthroplasties with ingrown femoral stems or complex acetabular components that were well-fixed [8]. Their reported success rate was 83%. Also, Ji et al. [9] retrospectively analyzed 31 patients. In his series patients underwent retention of components in what they called partial single-stage revision. Either the acetabular or femoral component was retained given that there was evidence of good fixation. Of the 31 patients, 27 were considered to have a good outcome (87.1%) at latest follow-up.

Results of sub-radical resection arthroplasty have shown acceptable success rates ranging from 87-89%. These can be compared to published results of two-stage results, although there is a high variability of reported success rates [10-12]. Only one study reports on one-stage sub-radical resection and retention of well-fixed components with also promising success rates of 87% [9]. We consider that a careful selection of patients with adequate evaluation of fixation is the key to determine if retention of components is a viable option. Although there is a lack of strong evidence, a partial exchange may present a better alternative than complete resection performed in two-stage revision of chronic PJIs when the stem is well-fixed with bone-ingrown stability. We therefore support the use of partial exchange in the treatment of chronic PJIs in selected cases.

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QUESTION 5: Is it possible to have an isolated infection of only a portion of the joint (for example the femur and not the acetabulum, or tibia and not the femur)?

RECOMMENDATION: Unknown. Infection of a prosthetic joint is likely to involve biofilm formation on surfaces of all foreign material. However, there may be rare circumstances when infective organisms may not be able to reach the surface of a well-fixed implant and form a biofilm.

LEVEL OF EVIDENCE: Limited

DELEGATE VOTE: Agree: 75%, Disagree: 19%, Abstain: 6% (Super Majority, Strong Consensus)

RATIONALE

Using a standardized study search protocol, we performed a comprehensive review and analysis of the literature related to this subject matter. There were no specific studies examining the issue of partial infection of an implant. As a proxy, we examined the literature related to the outcome of surgical treatment of chronic periprosthetic joint infections (PJIs) when partial retention of an implant was deemed appropriate. The primary outcome measure was success of treatment at a minimum of two years, defined as infection-free retention of the implant. The search strategy and inclusion criteria were chronic PJI, total hip arthroplasty (THA), total knee arthroplasty (TKA) and partial retention. Subsequently, our search strategy yielded 9 articles for analysis, including 130 revisions (Table 1). The follow-up period was 2-8 years (mean 4.1 years) or less if failure occurred. We also recorded the types of bacteria and the success rates reported in each study.

There were no studies related to partial retention of TKA components. The overall success rates of eradication of infection ranged from 80-100% (mean 90%). There were 113 acetabulum-only revisions