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# Is There a Difference in Outcome of Conversion Total Joint Arthroplasty When Staged Versus Concurrent Hardware Removal Is Performed?



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## Is there a difference in outcome of conversion total joint arthroplasty when staged versus concurrent hardware removal is performed?

**Response/Recommendation:** The literature indicates that there is no significant difference in perioperative complications, specifically periprosthetic joint infections, between staged and concurrent hardware removal during conversion total joint arthroplasty. Thus, it appears that concurrent hardware removal can be performed safely during joint arthroplasty, provided that a preoperative infection workup is negative and no contraindications for implantation of the prosthesis are present.

**Faculty Votes:** Agree: 66.1%, Disagree: 21.8%, Abstain: 12.1%.

**Level of Evidence:** Moderate.

## Rationale

Numerous studies on this topic have been published, ranging from small single-institution retrospective studies to meta-analyses and large population-based evaluations. Large, randomized controlled studies are not available, likely due to their cost-prohibitive size given the relatively low incidence of

complication rates [1]. In summary, the majority of publications support the equivalence of staged and concurrent hardware removal in terms of perioperative outcomes, with no significant evidence suggesting the superiority of one approach over the other.

Several key studies have concluded that there is no significant increase in infection risk with concurrent hardware removal [2,3]. Specifically, analysis of data from multiple studies [2–15] revealed that concurrent hardware removal was associated with either a lower or no difference in the odds of complications such as periprosthetic joint infection (PJI). Our analysis revealed that there is no significant difference between concurrent and staged TJA ( $P = 0.56$ ). A PJI after 90 days was 2.77% (95% confidence interval [CI] 1.57 to 4.84) and 3.72% (95% CI 0.84 to 14.91) in the concurrent and staged groups, respectively. For PJI proportion after the longest follow-up, in the concurrent group, the PJI proportion

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after the longest follow-up was 3.11% (95% CI 1.83 to 5.25) and in the staged group it was 4.14% (95% CI 0.86 to 17.72%) with no significant statistical difference between the groups ( $P = 0.6$ ).

The analysis based on joint type showed that PJI proportion for knee joint after 90 days was 2.88% (95% CI 2.54 to 3.25) and 4.86% (95% CI 0 to 99.93) for concurrent and staged TJA, respectively. For the hip, the proportion of PJI after 90 days and the longest follow-up was the same. In the concurrent TJA, the PJI rate was 3.01% (95% CI 0 to 99.59) and in the staged group, it was 2.36% (95% CI 0.8 to 8.96). However, there was no significant difference between the groups for either knee ( $P = 0.5$ ) or hip ( $P = 0.73$ ) joints. Furthermore, after the longest follow-up, the PJI rate in concurrent TJA was 3.52% (95% CI 2.44 to 5.05), and for staged TJA 5.91% (95% CI 0 to 99.96%) with no difference between subgroups.

It must be noted that the mechanism of action by which these benefits are exerted, although speculative, may be linked to effective infection workup and surgical techniques that minimize risk. Modern surgical techniques and rigorous preoperative evaluations can achieve these outcomes, ensuring safe and effective concurrent hardware removal during TJA.

Based on the voting and discussions in the meeting, it appears that there is a major evidence gap related to this issue. Some surgeons are unwilling to embrace the concurrent hardware removal, as they feel infection workup using serology or even aspiration of the joint is inadequate in ruling out underlying infection. The feeling of some surgeons is that removing the hardware in one operation during which samples of deep tissue can be obtained is useful in identifying and treating a subclinical infection before definitive implant placement. The latter, although plausible, has not been proven in any studies and remains a pure speculation. Subjecting the patient to two operations alternatively carries major financial cost and added comorbidities. We, therefore, feel that there is a desperate need for a prospective study that can generate the much-needed evidence to answer this specific question.

#### CRedit authorship contribution statement

**Ahmad Abbaszadeh:** Writing – original draft, Supervision, Methodology. **Adolfo Llinas:** Writing – review & editing, Investigation. **Umile Giuseppe Longo:** Writing – review & editing, Investigation. **Marcelo Lizarraga:** Writing – review & editing. **Camilo Restrepo:** Writing – review & editing, Formal analysis. **Javad Parvizi:** Writing – review & editing, Supervision, Conceptualization.

#### References

- [1] Liu J, Wilson L, Poeran J, Fiasconaro M, Kim DH, Yang E, et al. Trends in total knee and hip arthroplasty recipients: a retrospective cohort study. *Reg Anesth Pain Med* 2019;44:854–9. <https://doi.org/10.1136/rapm-2019-100678>.
- [2] Klatte TO, Meinicke R, O'Loughlin P, Rueger JM, Gehrke T, Kendoff D. Incidence of bacterial contamination in primary tha and combined hardware removal: analysis of preoperative aspiration and intraoperative biopsies. *J Arthroplasty* 2013;28:1677–80. <https://doi.org/10.1016/j.arth.2013.02.017>.
- [3] Sequeira SB, Hasenauer MD, McKinstry R, Ebert F, Boucher HR. Decreased risk of periprosthetic joint infection with concurrent hardware removal during conversion total hip arthroplasty compared to staged removal: a matched cohort analysis. *J Am Acad Orthop Surg Glob Res Rev* 2023;7:12. <https://doi.org/10.5435/JAASGlobal-D-23-00261>.
- [4] Apinyankul R, Hui AY, Hwang K, Segovia NA, Amanatullah DF, Huddleston JL, et al. Complications, implant survivorships, and functional outcomes of conversion total knee arthroplasty with prior hardware. *J Arthroplasty* 2023;38: S66–70.e2. <https://doi.org/10.1016/j.arth.2023.01.049>.
- [5] Baker HP, Seidel H, Vatti L, Weaver D, Wallace SS, Scott BL. Concurrent hardware removal is associated with increased odds of infection following conversion total knee arthroplasty. *J Arthroplasty* 2023;38:680–684.e1. <https://doi.org/10.1016/j.arth.2022.10.029>.
- [6] Chen Z, Sax OC, Bains SS, Hebditch CS, Nace J, Delanois RE. Is conversion total knee arthroplasty a distinct surgical procedure? A comparison to primary and revision total knee arthroplasty. *J Knee Surg* 2023;36:1157–63. <https://doi.org/10.1055/s-0042-1750059>.
- [7] Hameed D, Bains SS, Dubin JA, Chen Z, Nace J, Delanois RE, et al. Staged approach to tibial nail removal poses increased risk for infection in the setting of total knee arthroplasty. *J Arthroplasty* 2024;39:891–895.e1. <https://doi.org/10.1016/j.arth.2023.10.022>.
- [8] Hrubina M, Necas L, Sammoudi D, Cabala J, Lisy P, Holjencik J, et al. Dynamic hip screw in proximal femoral fractures followed by "single-stage" hip arthroplasty-retrospective analysis. *Eur J Orthop Surg Traumatol* 2024;34: 1087–93. <https://doi.org/10.1007/s00590-023-03695-8>.
- [9] Klatte TO, Schneider MM, Citak M, O'Loughlin P, Gebauer M, Rueger M, et al. Infection rates in patients undergoing primary knee arthroplasty with pre-existing orthopaedic fixation-devices. *Knee* 2013;20:177–80. <https://doi.org/10.1016/j.knee.2013.02.004>.
- [10] Kreitz TM, Deirmengian CA, Penny GS, Maltenfort MG, Deirmengian GK. A current procedural terminology code for "knee conversion" is needed to account for the additional surgical time required compared to total knee arthroplasty. *J Arthroplasty* 2017;32:20–3. <https://doi.org/10.1016/j.arth.2016.06.040>.
- [11] La Camera F, de Matteo V, Di Maio M, Verrazzo R, Grappiolo G, Loppini M. Clinical outcomes and complication rate after single-stage hardware removal and total hip arthroplasty: a matched-pair controlled study. *J Clin Med* 2023;12:4. <https://doi.org/10.3390/jcm12041666>.
- [12] Scholten R, Fussenich W, Somford MP, van Susante JLC. High incidence of early periprosthetic joint infection following total hip arthroplasty with concomitant or previous hardware removal. *Arch Orthop Trauma Surg* 2019;139:1051–6. <https://doi.org/10.1007/s00402-019-03149-z>.
- [13] Smith EJ, Heng M, Bedair HS, Melnic CM. Total knee arthroplasty following intramedullary tibial nailing. *Knee Surg Relat Res* 2020;32:35. <https://doi.org/10.1186/s43019-020-00055-2>.
- [14] Smith EJ, Katakam A, Box HN, Healy WL, Bedair HS, Melnic CM. Staged vs concurrent hardware removal during conversion total knee arthroplasty. *J Arthroplasty* 2020;35:3569–74. <https://doi.org/10.1016/j.arth.2020.06.055>.
- [15] Yun A, Qutami M, Pasko KBD. Salvage of failed femoral neck fracture fixation with conversion total hip arthroplasty using the direct anterior approach. *Hip Pelvis* 2020;32:199–206. <https://doi.org/10.5371/hp.2020.32.4.199>.