

HK61: Can one-stage exchange be performed in patients with culture negative PJI?

Amir Human Hoveidaei, MD, MSc; Martí Bernaus, MD; Daniele De Meo, MD; Li Cao, MD; Wenbo Mu, MD, PhD; Baochao Ji, MD; Mustafa Citak, MD, MBA

Response/Recommendation: Yes. one-stage exchange can be considered a viable option for patients with culture-negative periprosthetic joint infection (CN PJI).

Level of Evidence: Moderate

Delegate Votes:

Rationale

Periprosthetic joint infection (PJI) remains a major challenge in orthopaedic surgery, with two-stage exchange arthroplasty being considered as the “gold standard” for treatment in North America (1, 2). However, one-stage revision has emerged as a viable alternative (3), particularly in culture-positive (CP) cases (4, 5). The role of one-stage revision in culture-negative (CN) PJI, however, remains unclear due to the limited available literature. This systematic review and meta-analysis aimed to evaluate the outcomes of one-stage revision in CN PJI cases compared to CP cases, and to explore its potential as an effective treatment option.

A comprehensive search of Web of Science (WoS) and PubMed databases identified 240 studies for screening. After removing 79 duplicates, 161 studies were screened for eligibility. Of these, 111 studies were excluded as irrelevant, and 50 full-text articles were assessed. Ultimately, 6 studies met the inclusion criteria and 5 studies were included in the final analysis (**Table 1**). Data was extracted to compare reinfection and aseptic revision rates in CN versus CP one-stage revisions.

Five studies comparing one-stage revision in CN versus CP PJI cases, with follow-up periods ranging from 2.1 to 7 years, reported a pooled odds ratio (OR) of 0.733 for reinfection (95% CI: 0.324–1.659, $P = 0.4559$, $I^2=0\%$) (**Figure 1**). A random-effects model analyzing aseptic failure rates across three studies yielded an OR of 1.959 (95% CI: 0.391–9.815, $P = 0.4136$, $I^2=0\%$) (**Figure 2**). These findings indicate no statistically significant differences in reinfection or aseptic failure rates between the two groups, suggesting comparable outcomes.

The available data suggests that one-stage revision in CN PJI cases yields outcomes comparable to CP cases, challenging the notion that culture negativity should be a contraindication for one-stage revision (6). The available evidence highlights the potential benefits of one-stage revision, including reduced morbidity, shorter treatment duration, lower healthcare costs, and improved patient convenience compared to the traditional two-stage approach (7). However, the limited number of studies and small sample sizes underscore the need for further high-quality research to establish definitive guidelines and determine the optimal treatment strategy for CN PJI.

In conclusion, our systematic review and meta-analysis of available studies demonstrated no statistically significant differences in reinfection or aseptic failure rates between culture-negative and culture-positive cases undergoing one-stage revision.

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Figures

Table 1 Characteristics of studies included in the meta-analysis

Author (year)	Country	PJI Definition Criteria	Patients in each group	Age (mean; total)	Sex (total)	BMI (mean; total)	Affected Joint	Follow-up Time (mean; total)	Failure Definition	Comorbidities	Other Complications
Ji et al. (8) 2023	China	Musculoskeletal Infection Society Criteria	105 (CP), 27 (CN)	68.6 years	34 m, 98 f	26.3 kg/m²	TKA	51.6 months	Recurrence of infection in the same knee and mechanical failure unrelated to PJI or sepsis as endpoints.	HTN (57 total), DM (30 total), Others (14 total)	4 aseptic osteolysis cases, 3 flexion instability cases, 2 arthrofibrosis cases, 2 hematomas, 6 venous thrombosis cases, 3 femoral stem tip pain (all total population).
Razii et al. (9) 2021	UK	ICM 2013	68 (CP), 16 (CN)	68 years	53 m, 31 f	NR	TKA	7 years	Recurrence of infection as confirmed by clinical findings, culture results, and reoperation.	NR	NR
Karczewski et al. (10) 2023	Germany	EBJIS 2021	20 (CP), 10 (CN)	70 years	13 m, 17 f	NR	THA	2.1 years	Reinfection based on Delphi Consensus criteria: infection signs, surgical intervention, or death due to PJI.	NR	1 quadriceps paralysis, 1 femoral nerve palsy, 1 dislocation requiring reoperation.
Zanna et al. (11) 2023	Germany	ICM 2018	22 (only CN)	73.2 ± 9.8 years	16 m, 6 f	29.5 ± 4.9 kg/m²	TKA and THA	3.6 ± 2.6 years	Recurrence of infection or mechanical failure requiring surgical intervention; aseptic loosening defined separately.	ASA > 3 reported	NR
Ji et al. (12) 2020	China	MSIS 2011	192 (CP), 51 (CN)	59.3 years (CN), 63.6 years (CP)	20 m, 31 f (CN); 85 m, 107 f (CP)	24.5 ± 5.8 kg/m² (CN), 25.3 ± 4.4 kg/m² (CP)	TKA and THA	53.2 months (CN); 59.3 months (CP)	Recurrence of infection or mechanical failure requiring surgical intervention; aseptic loosening defined separately.	HTN, DM	2 cases of renal impairment (CN), 3 cases of hip dislocation (CP).
Xu et al. (13) 2022	China	MSIS	One-Stage: 7 (CP), 6 (CN)	63.6	37 m, 40 f	23.8 kg/m²	TKA and THA	29.2 months	Recurrence of infection or need for additional surgical intervention for failure	HTN: 14; DM: 4	Myelosuppression: 5; Renal damage: 4; Liver damage: 1
PJI (Prosthetic Joint Infection), CN (Culture-Negative), CP (Culture-Positive), MSIS (Musculoskeletal Infection Society), ICM (International Consensus Meeting), EBJIS (European Bone and Joint Infection Society), THA (Total Hip Arthroplasty), TKA (Total Knee Arthroplasty), ASA (American Society of Anesthesiologists), HTN (Hypertension), DM (Diabetes Mellitus), FU (Follow-Up), NR (Not Reported), and DAIR (Debridement).											

Table 2 Included studies and number of included patients

Author (year)	One-stage CN	One-stage CP
Ji et al. (8) 2023	25 Success, 2 reinfection, 0 mechanical failure	95 Success, 7 reinfection, 3 mechanical failure.
Razii et al. (9) 2021	16 Success, 0 reinfections, 0 mechanical failures	53 Success, 8 reinfections (9.5%), 7 mechanical failures.
Karczewski et al. (10) 2023	9 Success, 0 reinfections, 1 mechanical failure	17 Success, 1 reinfection, 2 mechanical failures.
Zanna et al. (11) 2023	22 total, 2 reinfections, 1 mechanical failure	NA
Ji et al. (12) 2020	46 Success, 5 reinfections	181 Success, 11 reinfections
Xu et al. (13) 2022	4 Success, 2 Reinfections	7 Success, 0 Reinfection

CN (Culture-Negative), CP (Culture-Positive)

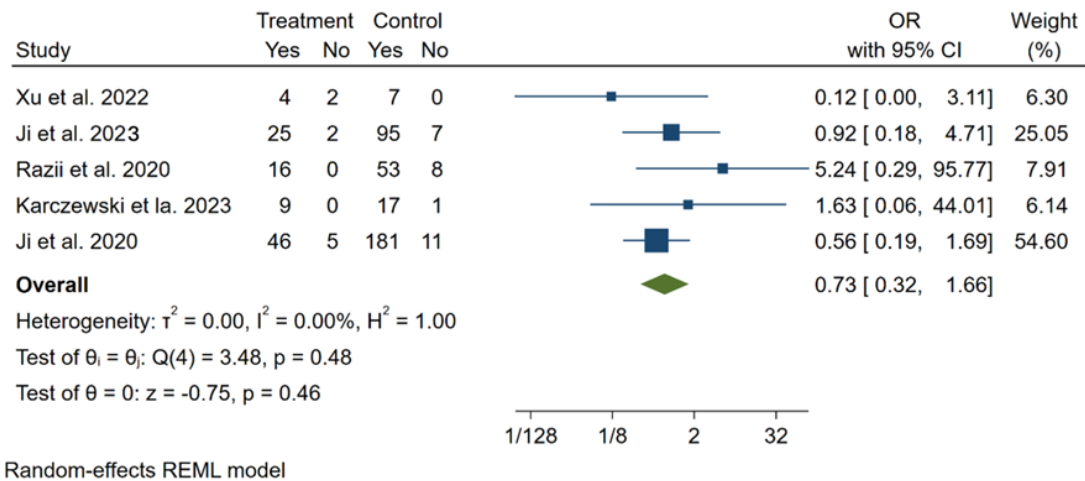


Figure 1. Reinfection

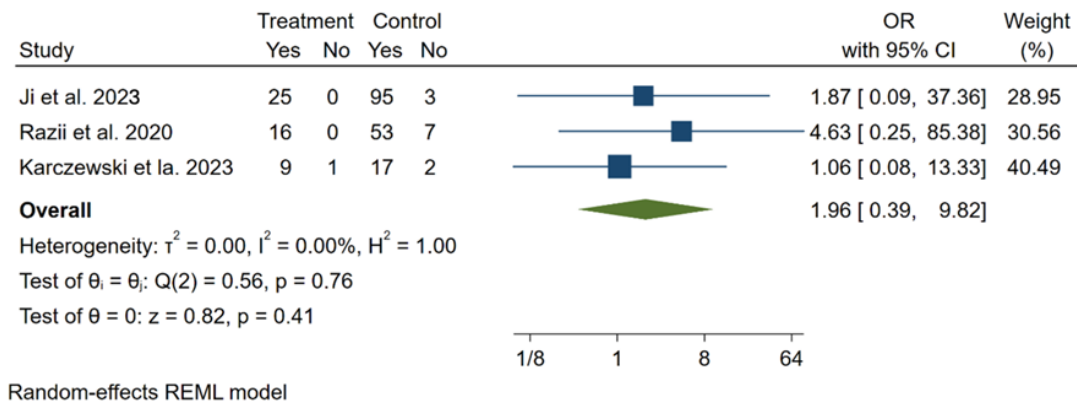


Figure 2. Aseptic Failure