Does a delay in surgical debridement beyond the traditional “six-hour window” independently increase the risk of deep infection?

Recommendation

The six-hour threshold is not supported. Major, high-energy, contaminated, grade III open fractures should be prioritized for early debridement within 12 hours, by a team with appropriate expertise and not delayed beyond 24 hours. Low-grade, well-perfused, and minimally contaminated injuries may be safely debrided by an experienced team within 24 hours.

Overview

1. The six-hour threshold is not supported.
2. Late debridement after 12 hours does measurably raise deep-infection risk proportional to time delay in large multicentre pooled series. The largest dataset (SIGN, n=10,651) shows a linear, cumulative rise (~0.17% per 6 h), steeper for Gustilo-III and tibia, and GOLIATH shows odds increases for GA-III >24 h (OR 2.17) and GA-IIIB tibia >12 h (OR 1.46).
3. The threshold for high grade fractures should be 12h rather than 6h.
4. Positive-for-timing signals come from large registries with unmeasured confounders, while negative studies are mostly underpowered single-centre series.
5. LEAP found delayed definitive-centre admission (>2 h) was the significant time risk factor.
6. A clean, low-energy, type I open distal-radius fracture is biologically different from a contaminated grade IIIB open tibia with soft-tissue loss. Studies of low-grade injuries reported very low infection rates even when treatment was delayed beyond historic cut-offs
7. High-grade, contaminated, high-energy injuries are both more prone to infection and more likely to be rushed to theatre anyway, confounding many studies.
8. Increased infection, non-union and worse functional scores when grade III lower-limb fractures were debrided after 12 hours in a tropical setting.
9. Infection prevention does not end with the first debridement. Fixation strategy, repeated debridement, timely wound closure or flap coverage, and avoidance of prolonged temporary management influence fracture-related infection and union. Delay beyond 5 days to definitive skeletal fixation or soft-tissue reconstruction increased fracture-related infection risk.
10. Studies have isolated independent risks on timing from Gustilo–Anderson (GA) grade, contamination, antibiotic timing, and debridement quality. With timing being less important.
11. Early antibiotics and surgical expertise matter more than a fixed clock.
12. No RCT on the subject as randomising to delay is ethically unacceptable.
13. Heterogeneity in timing cutoffs, infection definitions (superficial vs deep/FRI), and follow-up (some only 6 weeks, missing late deep infection).

Literature Table

Study / Guideline	Type	Level	Sample Size	Originating Centre(s)	Conclusion (on timing)
Pollak et al LEAP, JBJS 2010(26)	Prospective multicentre cohort	II	315 (307 analysed), severe high-energy, Gustilo IIIA-C	8 US Level-I trauma centres	Time-to-debridement **not** an <5/5–10/>10 h. Delay to defi
Cortez/Morshed — SIGN, JBJS 2023(27)	Retrospective analysis of prospective registry	III	10,651 femoral/tibial (61 countries)	SIGN / UCSF (low-resource)	Infection rose **incrementally** & tibia (0.18%). **No discrete**
Foote et al. GOLIATH meta-analysis(28)	SR & meta-analysis of cohorts	I (of III)	~18,239 (84 studies)	McMaster (Canada) / International	Progressive delay results in r Tibial fracture 12hr threshol Gustilo III 12 hr threshold: C
Elnewishy — Cureus 2020(29)	SR & meta-analysis (tibia)	I (of cohorts)	Pooled tibia – metanalysis (15 studies)	Egypt	No difference across 5/6/8/12
AS Kamat — Adv Orthop 2011(30)	Retrospective cohort	III	103 open tibia - consecutive	UK single centre	No difference <6 h vs >6 h
J Singh et al — Strat Traum 2012(31)	Retrospective cohort (GA-III)	III	67 grade III	UK (Hull)	13.1% (<6 h) vs 10.8% (>6 h
de Castro Fernandes et al — Acta Ortop Bras 2015(32)	Prospective cohort	II	151 open fractures (142 pts)	Brazil (São Paulo)	No influence of >6 h delay at
Arpit Singh et al — Cureus 2023(33)	Prospective cohort	II	124 open lower limb	India	Timing **not** significant to 24
A Bakshi et al — Cureus 2025(34)	Prospective cohort (<24 vs >24 h)	II	223 (110/113)	India (Patiala)	Timing not significant; grade
Konbaz et al — J Clin Orthop Trauma 2019(35)	Retrospective cohort (tibia)	III	113 open tibia	Saudi Arabia	No timing effect (p=0.201); l not delay
Li et al — Orthop Surg 2020(36)	Retrospective cohort	III	215 open tibia	China (Xi'an)	Independent risk factors beyo
Hadizie et al — Malays Orthop J 2022(37)	Retrospective cohort (tibia)	III	91 open tibia	Malaysia	Less infections <12hrs vs 12-
Leonidou et al — Strat Traum 2014(38)	Prospective post-policy cohort (6 yr)	II	220 Long-bone open	UK	6h threshold no difference 11 deep infection 8.5%→4.3% (
Nobert et al — 2016(39)	Prospective cohort	II	143 long-bone open	Tanzania	Tested early vs delayed per 6
Rotman et al — J Clin Med 2025(40)	Retrospective cohort	III	62 open forearms, Gustio 1 and II	Israel	>24 h delay did **not** ↑ infecti
You & Schneider — OTA Int 2020(41)	Review	V	N/A	Calgary	Rule historical; <24 h debrid quality matter more instead c
Whiting et al, OTA best practices — OTA Int 2024(42)	Expert consensus review	V	N/A	Multi-institution (OTA)	Antibiotic timing, host factor for debridement.
BOA/ British Limb Reconstruction Society Standards 2020 (43)	National guideline	Guideline	N/A	BOA/BAPRAS (UK)	**6-h rule does not apply**; imr energy GA-III; **24 h** others; c
Hendrickson et al, NICE / TIDE (44)	Guideline + cohort	Guideline + cohort 116 3B open tibia	N/A	NICE (England)	Perform wound excision : immediately for highly conta

					within 12 hours of injury for Gustilo–Anderson classificat contaminated within 24 hours of injury for Suggests High-energy open t despite many >12 h

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