

Incidence and Natural History of Polar Gaps Following Cementless Total Hip Arthroplasty

Northern Health

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RESEARCH WEEK
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Background

- In patients who have undergone Total Hip Arthroplasty (THA), early postoperative radiographs often show a focal bone-implant gap at the dome of a cementless cup: the polar or apical gap.
- The incidence of polar gaps and whether it reflects incomplete seating, or predisposes the cup to loosening, is unclear. Establishing such clinical correlations is vital for optimising postoperative surveillance in these patients.

Aims

- Primary:** Pooled incidence of early polar gaps in THA patients
- Secondary:** Natural history, and association of polar gaps with loosening, revision and clinical outcomes
- Exploratory:** Incidence of polar gaps based on implant and fixation factors

Methods

- PRISMA 2020 systematic review: MEDLINE and Embase to April 2026, plus citation searching
- Primary cementless THA, any indication
- Random-effects meta-analysis of proportions (logit), plus expanded-definition sensitivity analysis
- Natural history and clinical outcomes: narrative synthesis

Incidence

36

studies

6,769

hips

22

cohorts

16.7%

Pooled incidence

95% CI 12.4–22.8

3,405 hips; $I^2 = 94.1\%$

≈ **1 in 6 hips** show an early polar gap. Expanded definition: **22.0%** (95% CI 16.0–28.4; 6,201 hips)

Implant & Fixation Factors

Screw fixation

No screws

$p = 0.037$

Screws

16.4%

8.1%

Cup surface

Tantalum

$p = 0.78$

15.6%

Conventional Ti

16.8%

3D-printed Ti

21.4%

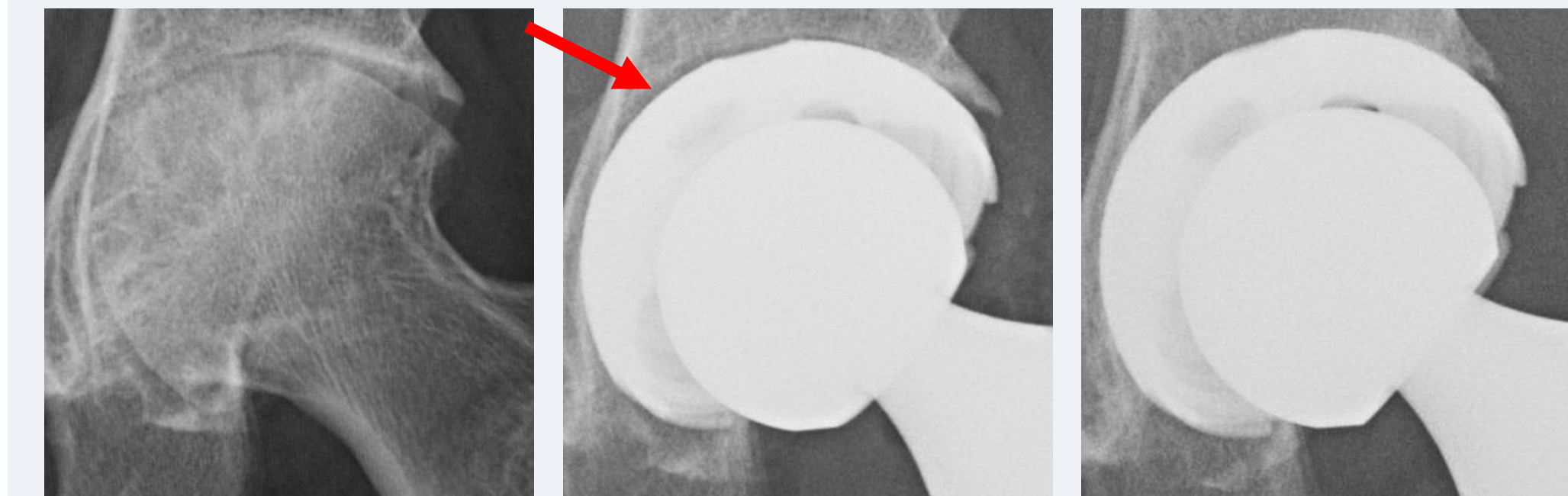
0% 25% 50%

Dashed line: overall 16.7%. Expanded definition:

screw effect attenuated ($p = 0.12$); surface difference significant ($p = 0.037$), highest with 3D-printed Ti (32.3%)

Cohort-level comparisons: screws may mark reaming strategy rather than prevent gaps

Natural History



Pre-op

Post-op

12 months

Northern Health case: resolved at 12 months

- 31 studies: most gaps resolved spontaneously, usually within 6-12 months
- Persistent gaps were typically unchanged or smaller; progression was rare

Clinical Significance

- Revision** (4 studies): 3 for loosening, only 1 with a gap; 3 for osteolysis, all after the gap resolved
- Function and pain** (5 studies): no difference by gap status
- Limitation:** few events; observational data

Conclusion

Polar gaps affect ~1 in 6 hips and most resolve. Isolated polar gaps should not be read as predicting implant failure.