Systematic review and meta-analysis of nephrostomy placement versus tubeless percutaneous nephrolithotomy

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CRD summary
The review found that tubeless percutaneous nephrolithotomy (kidney stone removal) was a safe and effective procedure with a comparable stone clearance rate to conventional percutaneous nephrolithotomy. The authors’ conclusions reflected the evidence presented but, given potential bias in the review process and limitations in the quality of the included trials, they should be considered tentative.

Authors' objectives
To compare the effectiveness and safety of tubeless with conventional percutaneous nephrolithotomy.

Searching
PubMed, EMBASE, LILACS and the Cochrane Library were searched for relevant studies in Western languages up to January 2010; search terms were reported. Reference lists of related studies were searched.

Study selection
Eligible studies were randomised controlled trials (RCTs) that compared tubeless versus conventional percutaneous nephrolithotomy with nephrostomy tube in adults with kidney stone(s) and an indication for conventional percutaneous nephrolithotomy.

Outcomes included stone-free rates, pain assessment, analgesic medication necessity, operative time, hospitalisation time, blood loss, and complications.

Patients in the included trials had a mild to moderate stone burden; in most trials, patients with intraoperative complications were excluded. All reported surgeries were performed with the patient in prone position. The time of stent removal varied from one to six weeks and time of nephrostomy tube removal varied from one to three days. None of the trials used a sealant agent in the percutaneous tract. Most trials used the double-J stent during performance of tubeless percutaneous nephrolithotomy; one trial used an external urethral catheter; one trial did not describe the method used. There was a wide range of stone-free definitions; these included abdominal radiography, abdominal radiography and sonography and computed tomography. Imaging was undertaken either during hospitalisation or 90 days after surgery. Included trials were performed in India, Turkey, the USA and the UK; they were published between 2001 and 2009.

Two reviewers independently selected studies for the review, with final selection achieved through consensus.

Assessment of study quality
The quality of the included trials was assessed using criteria that included sequence generation, allocation concealment, blinding, whether an intention-to-treat analysis was performed, and source of funding.

The authors did not state how many reviewers performed the quality assessment of studies.

Data extraction
Peto odds ratios (ORs), with 95% confidence intervals (CIs), were calculated for dichotomous outcomes; mean differences (MDs) were calculated for continuous outcomes, with their 95% confidence intervals.

Two reviewers independently extracted data, but it was not stated how disagreements were resolved.

Methods of synthesis
A fixed-effect model was used to combine trials and calculate odds ratios and weighted mean differences (WMDs), with associated 95% confidence intervals. Assessment of pain by visual analogue scales (VAS) and postoperative analgesic requirements were too heterogeneous for pooling, so results were presented narratively in tables.
Heterogeneity was assessed by the $\chi^2$ test and quantified by $I^2$. $I^2$ over 50% was considered evidence of considerable heterogeneity. When significant heterogeneity was identified, either a separate analysis (using a random-effects model) was performed or trials were not pooled in meta-analyses.

Sensitivity analyses were undertaken using quality assessments to test the stability of the main findings.

**Results of the review**

Ten RCTs were included in the review (n=621 patients). None of the trials were blinded or performed intention-to-treat analyses. Allocation concealment was adequate in two trials; completeness of follow-up was reported in five trials (where reported).

There was no evidence of a difference in the stone-free rates, operative time, blood transfusion rates, haemoglobin drop and postoperative fever between percutaneous nephrolithotomy interventions. Heterogeneity was identified in the operative time and haemoglobin drop analyses, but exclusion of trials that appeared to be contributing to the heterogeneity did not markedly change the results.

Tubeless percutaneous nephrolithotomy was associated with less bleeding and haematuria (OR 0.31, 95% CI 0.10 to 0.95; eight RCTs), less urine leakage (OR 0.13, 95% CI 0.04 to 0.38; RCT studies) and reduced length of hospital stay (MD -1.11 days, 95% CI -1.55 to -0.68; seven RCTs). Substantial heterogeneity was identified for length of hospital stay; exclusion of three trials that appeared to be contributing to the heterogeneity did not change the direction or significance of the results. Four of six trials reported significantly less pain on the VAS scale. Six of eight RCTs reported significantly reduced postoperative analgesic requirements for tubeless versus conventional percutaneous nephrolithotomy.

**Authors’ conclusions**

Tubeless percutaneous nephrolithotomy was a safe and effective procedure, with a stone clearance rate comparable to that of conventional percutaneous nephrolithotomy. Tubeless percutaneous nephrolithotomy was associated with a shorter hospital stay, less postoperative urinary leakage, pain reduction and minimisation of analgesic requirements.

**CRD commentary**

The review addressed a clear research question. Inclusion criteria appeared appropriate. A number of relevant sources were searched with restriction to Western languages, so language bias could not be ruled out. No explicit attempts were made to find unpublished studies or to formally assess publication bias, so publication bias could not be excluded. Appropriate methods were used for the selection of studies and data extraction, but the authors did not report how many authors performed quality assessment, so reviewer bias and error was possible in this process.

The included trials were small and mostly of poor quality. Synthesis of trials was appropriate. Where possible and where substantial heterogeneity was identified, attempts were made to explain the heterogeneity and exclude heterogeneous trials from the meta-analyses. For some outcomes, trials were not pooled and results were appropriately presented in narrative format.

The authors’ conclusions reflect the evidence presented but, given potential bias in the review process and limitations in the quality of the included trials, these conclusions should be considered tentative.

**Implications of the review for practice and research**

**Practice:** The authors stated that tubeless percutaneous nephrolithotomy was a safe and effective procedure for patients with mild to moderate stone burden who are undergoing an uneventful percutaneous nephrolithotomy.

**Research:** The authors stated that future research should be protocol driven, with a more uniform report of outcomes to help clinical decision making.

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Record Status
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.