CRD summary
The authors' concluded that most patients experience a subjective improvement following surgical treatment, but studies were generally low quality and heterogeneous. The authors' conclusions reflected the evidence presented, but given limitations and uncertainties in methodologies used throughout the review and poor quality of studies included, these conclusions should be interpreted with caution.

Authors' objectives
To systematically review and evaluate published studies on the efficacy of surgical procedures to treat sialorrhoea in patients.

Searching
MEDLINE was searched between January 1963 and November 2008. Search terms were reported. Bibliographies of retrieved articles were searched for additional material. Articles were restricted to English language.

Study selection
Studies that presented extractable data on success of surgical treatment for patients with sialorrhoea were eligible for inclusion in the review. Eligible studies had sample sizes of greater than five. Studies were excluded if tympanic neurectomy was the sole procedure or there was no extractable data.

The outcome of interest was subjective successful treatment for sialorrhoea.

Most included studies were case series. Caregiver-reported subjective qualitative scales was the most common method used to assess surgical success. The reported mean age and age ranges varied widely between studies (where reported); many studies included children. Surgical procedures were varied and the most common was bilateral submandibular gland duct rerouting.

The authors stated neither how the papers were selected for the review nor how many reviewers performed the selection.

Assessment of study quality
The authors did not state that they assessed validity. Study design was categorised using the Centre for Evidence-Based Medicine (CEBM) guidelines.

Data extraction
Subjective success rate modelled as a binary variable (drooling was better or drooling was much better were classed as success) were extracted and 95% confidence intervals were calculated. Where this scale was not used, stated surgical treatment success rates were used instead.

Two reviewers independently extracted data. Disputes were resolved by a third reviewer.

Methods of synthesis
Random-effects meta-analysis was used to calculate combined surgical success rate (summary estimate) with 95% confidence intervals. Statistical heterogeneity between trials was not tested. Subgroup analysis was used to determine the effect of follow-up duration and time period on success rates.

Results of the review
Fifty studies were included in the meta-analysis (total participants n=1,887, range of study size was five to 181). Forty seven studies were case series (CEBM level four), two were cohort (CEBM level two) and one was prospective (CEBM
Subjective surgical treatment of sialorrhoea was successful in 81.6% of procedures (95% CI 77.5 to 85.7%; 59 study sets). The most successful procedure was bilateral submandibular gland excision with bilateral parotid duct rerouting (87.8%, 95% CI 80.5 to 95.1%).

Subgroup analysis found that overall success rate of studies with more than one year of follow-up was 83.9% (95% CI 78.6 to 89.1%; 42 study sets) compared to 76.6% (95% CI 68.9 to 84.4%; 17 study sets) for less than one year of follow-up. The overall success rate was not significantly different for studies performed before 1990 compared with those after.

Authors' conclusions
Most patients had improved sialorrhoea in response to surgery. Studies that reported surgical outcomes for sialorrhoea management were low quality and heterogeneous.

CRD commentary
The review addressed a clear research question with appropriate inclusion criteria. Limited sources were searched to locate included studies, which meant that relevant studies may have been missed. There were no specific attempts to locate unpublished studies, which introduced potential for publication bias. Only English-language publications were included, which introduced risk of language bias. The authors attempted to minimise bias and error during data extraction; whether similar methods were used when selecting studies for inclusion was unclear. Study quality was not assessed. As studies were case series, strength of the evidence appeared weak. Sufficient study details were given for surgical procedure, outcome measurement used and follow-up duration. More information about participants would have been useful in terms of medical conditions included and which studies assessed only children. There was considerable heterogeneity between studies with regard to source, size of study, severity of sialorrhoea and surgical procedure. Subjective criteria had to be applied to success of procedures. Such factors may have limited the usefulness of combining data by meta-analysis. The authors' conclusions reflected the evidence presented, but given limitations and uncertainties in methodologies used and the poor quality of studies included, these conclusions should be interpreted with caution.

Implications of the review for practice and research
Practice: The authors did not state any implications for practice.

Research: The authors stated that more rigorous directly comparable studies were needed to identify the best surgical procedures for sialorrhoea treatment. More studies that focused on 4-duct ligation with longer follow-up were needed urgently. A directed study to address the question of long-term duct patency and ligation versus rerouting would be worthwhile.

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