Rapid tests for group B Streptococcus colonization in labouring women: a systematic review

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CRD summary
This review found that the only tests with sufficient accuracy to be feasible for testing for group B streptococcus infection in women in labour were polymerase chain reaction and optical immunoassay. The authors' cautious conclusions are likely to be reliable, but should be interpreted with some degree of caution given the limitations of the search and differences between the studies.

Authors' objectives
To evaluate the accuracy of various intrapartum tests for maternal group B streptococcus (GBS) colonisation.

Searching
MEDLINE and the Cochrane Library, including the CENTRAL Register, were searched from inception to 2005. Some details of the search were reported and this included a diagnostic filter. The reference lists of known reviews and primary studies were screened for additional studies. Authors, experts and manufacturers were contacted to identify additional studies. No language restrictions were applied.

Study selection
Study designs of evaluations included in the review
No inclusion criteria relating to the study design were specified. All of the included studies were prospective diagnostic cohort studies.

Specific interventions included in the review
Studies that assessed tests for GBS were eligible for inclusion. The tests assessed in the included studies were: polymerase chain reaction (PCR), optical immunoassay (OIA), DNA hybridisation, enzyme immunoassay (EIA), latex agglutination and Islam starch medium. Most of the studies obtained vaginal swabs without speculum examination. Swabs were taken from different areas in the vagina and from the rectum.

Reference standard test against which the new test was compared
Studies that used laboratory culture as the reference standard were eligible for inclusion. Most of the studies obtained vaginal swabs without speculum examination. The included studies used selective or direct culture as the reference standard.

Participants included in the review
Studies of pregnant women in labour were eligible for inclusion. Some of the included studies were restricted to women in pre-term labour and some included women with or without ruptured membranes or pyrexia. Some studies excluded women who had recently received antibiotics, had received a pelvic examination, had ruptured membranes, had vaginal bleeding, had uninterpretable test results or missing swabs, or women who delivered on arrival at the delivery ward. The prevalence of GBS colonisation varied from 5 to 32%. The studies were carried out in the USA, Canada, Israel and the UK.

Outcomes assessed in the review
No inclusion criteria relating to the outcomes were specified. The primary outcomes reported in the review were the positive and negative likelihood ratios (LR+ and LR-, respectively). Sensitivity and specificity were also reported.

How were decisions on the relevance of primary studies made?
A two-stage process was used to select the studies. One reviewer screened the results of the electronic searches and obtained full articles that were likely to meet the selection criteria. The final selection was based on the assessment of these articles independently by a second reviewer. Two reviewers independently assessed English language studies;
studies reported in other languages were assessed by a reviewer familiar with the language. Any disagreements were resolved through consensus or by referral to a third reviewer.

**Assessment of study quality**

The studies were assessed for methodological quality according to the following criteria: not a case-control design; prospective data collection; consecutive patient enrolment; adequate description of the participants and/or index tests; blinding; full verification of the index tests; use of the same gold standards; a priori estimation of sample size and rationale for sample size; and an investigation of variation according to patient spectrum. Two reviewers independently assessed study quality.

**Data extraction**

Two reviewers independently extracted data on test characteristics (format not specified), including the time taken to perform the tests. For each test, the sensitivity, specificity, LR+ and LR- were calculated, together with their 95% confidence intervals (CIs). If accuracy data were not extractable, authors were contacted for further information.

**Methods of synthesis**

How were the studies combined?

If pooling was considered appropriate, summary LR+ and LR- were calculated using random-effects models. For many tests, pooling was only undertaken in subgroups according to the test subtype and site of swabs. Pooled estimates were also stratified according to the reference standard culture used. Publication bias was assessed using funnel plots based on the diagnostic odds ratio versus the reciprocal of the standard error.

How were differences between studies investigated?

The studies were stratified according to test type. Summary receiver operating characteristic plots and forest plots of LRs were used for a graphical assessment of heterogeneity, while the chi-squared test was used for a statistical assessment of heterogeneity. The correlation between sensitivity and specificity was assessed using Spearman's rank correlation test. Meta-regression was conducted within subgroups of tests when sufficient studies were available. These analyses assessed the effect of study quality (high or low; 3 quality items fulfilled considered to be high quality) on the diagnostic odds ratio.

**Results of the review**

Twenty-three articles reporting 29 different test evaluations were included.

The quality of the included studies was generally poor: only 4 studies recruited mothers consecutively; 4 studies blinded the test from the reference standard; 12 studies used an appropriate reference standard (selective enrichment culture). None of the studies explored spectrum variation. Only 1 study performed a sample size calculation, although 3 studies included more than 1,000 women.

The time taken to perform the test varied according to the test type: PCR 40 to 100 minutes; OIA 30 minutes; DNA hybridisation 60 to 1,440 minutes; EIA 5 to 10 minutes; latex agglutination 70 to 85 minutes; Islam starch medium 120 to 1,400 minutes.

PCR (2 studies, 914 women): the LR+ ranged from 23 to 153 and the LR- from 0.02 to 0.06. The pooled LR+ and pooled LR- were 38.8 (95% CI: 6.1, 248.7) and 0.06 (95% CI: 0.03, 0.11), respectively.

OIA (5 studies, 1,970 women): the LR+ ranged from 7.3 to 34.4 and the LR- from 0.23 to 0.66. The pooled LR+ for the 3 studies that used an appropriate reference standard was 14.7 (95% CI: 10.6, 20.3) and the pooled LR- was 0.47 (95% CI: 0.31, 0.73).

DNA hybridisation (2 studies, 268 women): the LR+ ranged from 29.9 to 97.8 and the LR- from 0.04 to 0.92. Pooled LRs were not reported because of the significant heterogeneity.
EIA (9 studies, 3,569 women): the LR+ ranged from 3.5 to 160.7 and the LR- from 0.31 to 0.89. The pooled LR+ for the 5 studies that used an appropriate reference standard was 36.3 (95% CI: 10.8, 122.0) and the pooled LR- was 0.80 (95% CI: 0.70, 0.92).

Latex agglutination (10 studies, 8,451 women): the LR+ ranged from 2.4 to 358.2 and the LR- from 0.08 to 0.84. The pooled LR+ for the 4 studies that used an appropriate reference standard was 10.4 (95% CI: 3.1, 34.4) and the pooled LR- was 0.38 (95% CI: 0.07, 1.96).

Islam starch medium (2 studies, 519 women): the LR+ ranged from 8.6 to 356.3 and the LR- from 0.04 to 0.58. The pooled LR+ for the 3 studies that used vaginal samples was 28.3 (95% CI: 1.3, 636.5) and the pooled LR- was 0.57 (95% CI: 0.45, 0.72).

The results of the heterogeneity assessment were not reported.

Meta-regression showed that accuracy did not vary according to overall quality or the addition of anorectal swab.

**Authors' conclusions**
The only tests with sufficient accuracy to be feasible for intrapartum testing for GBS and that took a reasonable amount of time to complete were PCR and OIA. OIA appeared less accurate than PCR, but PCR was only evaluated in two relatively small studies.

**CRD commentary**
The review addressed a focused objective that was supported by clearly defined inclusion criteria. The literature search was limited to two electronic databases, although no language restrictions were applied, and it included a diagnostic filter; relevant studies are therefore likely to have been missed. Appropriate steps were taken to minimise bias in the review process. A formal quality assessment was undertaken and the results of this were reported. For the investigation of the effects of quality, an arbitrary threshold was used to define a 'high quality study' and then differences between high- and low-quality studies were assessed using meta-regression. An analysis that incorporated individual quality items would have been more informative.

Full details of the individual studies and their results were reported in tables that also included data on pooled results. This helped with the interpretation of the results. The methods used to pool the studies were adequate, but the discussion of accuracy in the 'Results' section was limited and further assessment of heterogeneity would have improved the reliability of the results of the review. Despite limitations in the search and the failure to adequately investigate heterogeneity, the authors' cautious conclusions are likely to be reliable. However, they should be interpreted with some degree of caution.

**Implications of the review for practice and research**
Practice: The authors stated that any screening recommendations for practice needed re-evaluation.

Research: The authors stated that a robust technology assessment of the accuracy, acceptability and cost-effectiveness of PCR and OIA is required.

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