The use of urinary dipstick tests to exclude urinary tract infection: a systematic review of the literature

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CRD summary
This review concluded that there is some evidence that dipstick tests for nitrite and/or leukocyte esterase can be used to rule out urinary tract infection (UTI). These findings are not supported by the data presented, which show relatively poor pooled likelihood ratios for ruling out UTI, and the pooled estimates should be interpreted with extreme caution given the variation between the studies.

Authors' objectives
To determine the accuracy of nitrite and leukocyte esterase (LE) dipstick tests to exclude a diagnosis of urinary tract infection (UTI) in adults.

Searching
MEDLINE and EMBASE were searched from inception to 2002; the search terms were reported. The reference lists of retrieved studies and relevant reviews were screened for additional studies.

Study selection
Study designs of evaluations included in the review
Diagnostic cohort studies were eligible for inclusion.

Specific interventions included in the review
Studies of dipstick tests for LE, nitrite, blood and protein were eligible for inclusion if the dipstick tests were applied to all samples.

Reference standard test against which the new test was compared
Studies in which the reference standard consisted of laboratory culture performed on all samples were eligible for inclusion. Studies had to report a definition of a positive culture based on a stated number of colonies per litre or a cut-off value. Studies in which contaminated or mixed cultures were excluded from the analysis were excluded from the review.

Participants included in the review
Studies in adults were eligible for inclusion. Studies had to provide additional information about the patient cohort studies to be included in the review. Studies in both adults and children were excluded. The patients included in the review were mainly from laboratory, antenatal, hospital emergency department, in-patient and day-patient settings.

Outcomes assessed in the review
Studies had to report sufficient data to enable the construction of a 2x2 table of test performance.

How were decisions on the relevance of primary studies made?
Two reviewers assessed studies for inclusion in the review. Any disagreements were resolved through discussion.

Assessment of study quality
Studies were assessed according to the following criteria: clinical setting; age; prospective or retrospective design; inclusion of a random or consecutive sample of patients; prevalence of UTI; patient symptoms; blinding of the interpreters of the culture method to dipstick test results; and how contaminated and mixed cultures were treated in the analysis. Some of these criteria were used as a basis to exclude studies from the review (see relevant sections above).

Data extraction
The data were extracted as 2x2 tables of test performance. Multiple tables were extracted for studies that reported multiple thresholds for the reference standard. Sensitivity, specificity, positive and negative likelihood ratios, and
diagnostic odds ratios (DORs) and their 95% confidence intervals (CIs) were calculated for each set of 2x2 data.

**Methods of synthesis**

**How were the studies combined?**
The pooled sensitivity, specificity, positive and negative likelihood ratios, and DORs were calculated using fixed-effect and random-effects models. The results from random-effects models were presented.

**How were differences between studies investigated?**
Heterogeneity was assessed visually through the construction of forest plots and summary receiver operating characteristic (SROC) plots, and statistically using the chi-squared test. A meta-regression analysis was conducted by extending the Moses-Littenberg SROC model to include covariates for blinding and pregnancy.

**Results of the review**
Thirty studies were included in the review (the total number of participants was unclear).

Twenty-three studies used a threshold of $10^8$ colony-forming units/mL to define the presence of a UTI on culture; analyses were restricted to these studies.

LE dipstick (15 studies): the sensitivity ranged from 17 to 100% and the specificity from 41 to 98%. The pooled sensitivity and specificity were 72% (95% CI: 61, 84) and 82% (95% CI: 74, 90), respectively.

Nitrite dipstick (16 studies): the sensitivity ranged from 22 to 90% and the specificity from 85 to 100%. The pooled sensitivity and specificity were 54% (95% CI: 44, 64) and 98% (95% CI: 96, 99), respectively.

LE or nitrite positive (14 studies): the sensitivity ranged from 47 to 97% and the specificity from 44 to 97%. The pooled sensitivity and specificity were 81% (95% CI: 71, 90) and 77% (95% CI: 69, 86), respectively.

LE and nitrite positive (7 studies): the sensitivity ranged from 12 to 96% and the specificity from 89 to 100%. The pooled sensitivity and specificity were 43% (95% CI: 23, 64) and 96% (95% CI: 93, 99), respectively.

There was strong evidence of heterogeneity for all tests, and estimates were similar in the blinded and unblinded studies. The meta-regression analysis found no effect of blinding or pregnancy on the DOR.

**Authors' conclusions**
There is some evidence that dipstick tests can be used to rule out UTI in certain circumstances.

**CRD commentary**
The review addressed a focused question. Inclusion criteria were defined but additional criteria were applied at later stages of the review, making it difficult to determine exactly what criteria were applied. The literature search was limited to two electronic databases and did not include attempts to locate unpublished studies, thus it is possible that relevant studies might have been missed. A number of relevant quality criteria were assessed, but the results of the quality assessment were not reported in the review although a number of these criteria appear to have been used as inclusion criteria for the review. Appropriate steps were taken to minimise bias and errors in the study selection process, but it is unclear whether such an approach was used for the data extraction and quality assessment. While the methods used to pool the studies were acceptable, the use of more robust methods would have been preferable. It is also questionable whether it was appropriate to pool the studies given the extreme heterogeneity observed. Some investigation of heterogeneity was conducted, but further assessment might have been informative. The authors’ conclusions are not supported by the data presented, as these show relatively poor pooled likelihood ratios for ruling out UTI, and the pooled estimates should be interpreted with extreme caution given the heterogeneity between the studies.

**Implications of the review for practice and research**
Practice: The authors stated that there is some evidence to support the use of dipstick tests in specific populations such as patients with suspected acute pyelonephritis, but that urinalysis should not be used in a screening setting such as antenatal screening for asymptomatic bacteriuria.
Research: The authors stated the need for a randomised controlled trial to establish the role of urinalysis in ruling out UTI; such a trial is ongoing.

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