Metaanalysis of urine screening tests for determining the risk of urinary tract infection in children

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Authors' objectives
To summarise the literature and perform a meta-analysis of studies on urine screening tests for urinary tract infection (UTI) in children; to assess the validity and applicability of the included studies; and to identify the test or combination of tests that best predicts the presence or absence of UTI in children.

Searching
MEDLINE was searched from 1966 to January 2001, and LILACS from 1982 to 1998. The keywords were listed. The reference lists of primary retrieved articles and review articles were checked, along with the authors' personal collection of papers. Experts in the field were also contacted.

Study selection

Study designs of evaluations included in the review
Diagnostic cohort studies. To be included, index tests and standard tests had to be systematically performed in all patients with the sampling technique specified. The included studies were all prospective. Review papers and letters to the editor were excluded. The studies had to report sufficient information to judge methodological quality.

Specific interventions included in the review
The following tests, alone or in combination: leucocyturia (or pyuria) in uncentrifuged urine; bacteria and/or leucocytes in uncentrifuged, stained or unstained urine; and dipstick tests (leucocyte esterase and nitrite, alone or in combinations). For studies to be included, the tests had to be performed with medical supervision at a hospital or at an out-patient clinic. Studies performed at home without medical supervision were not eligible. Studies had to report the sampling technique to be included.

Reference standard test against which the new test was compared
The reference test was quantitative urine culture.

Participants included in the review
The participants were children aged from 0 to 18 years.

Outcomes assessed in the review
To be included, the studies had to state prevalence, sensitivity, specificity and predictive values, or present data in such a way that the calculation of this information was feasible.

How were decisions on the relevance of primary studies made?
The abstracts of identified papers were read by two reviewers independently. Those deemed to be relevant were retrieved as full papers, which were read independently by the same two reviewers. Any disagreements were resolved by consensus.

Assessment of study quality
A modified 14-point scale was used to assess validity (see Other Publications of Related Interest no.1). The criteria included: statement of test assessment technique; statement of test positivity criterion; all patients or random sample; reference and index test data collected independently; consecutive or nonconsecutive patients; prospective or retrospective study; symptoms; description of cohort; population-based or self-referred cohorts; age; gender; comorbidity; setting; year of study; previous antimicrobial therapy reported; mixed agent infections or contamination. The validity assessment was performed by two reviewers independently. The final score for each article was reached by consensus.
Data extraction

The data were extracted by one reviewer and checked by a second. Any discrepancies were resolved by consensus. The data extracted included: prevalence of UTI; sensitivity, specificity and predictive values of index tests; sample size; test used; age; urine sampling technique; whether the urine was centrifuged and/or Gram stained; the specific definitions of the urine culture standard test; and clinical data. Samples obtained from suprapubic aspiration and bladder catheterisation were grouped as ‘sterile’ and all others as ‘nonsterile’.

True-positive rates and false-positive rates were calculated. When different cut-offs were reported, sensitivity, specificity and predictive values were calculated separately for each cut-off. When a single study reported data for specific age groups, each one was considered separately.

Methods of synthesis

How were the studies combined?

Summary receiver operating characteristic (ROC) curves were generated following ad hoc methodologies (see Other Publications of Related Interest nos.2-4).

How were differences between studies investigated?

A stepwise multiple regression analysis was conducted to take into account the potential influence of the following variables: sampling technique (sterile or not), age group (0 to 6 months, up to 4 years, 5 to 10 years, or 11 to 18 years) and whether the urine sample assessed was centrifuged.

Results of the review

Forty-eight studies (92,766 samples) were included: 31 used consecutive patients and 17 used nonconsecutive patients.

The validity scores ranged from 6 to 16 (maximum score not stated). The index test and the standard were independently measured in all patients, and the clinical spectrum of patients was wide in almost all of the studies.

The primary studies revealed heterogeneity in terms of, among others, the age groups, sampling technique, whether the urine samples were centrifuged and Gram stained, definition of standard according to sampling technique used, positivity threshold values and clinical features. Most of the studies included uncentrifuged, unstained urine samples.

Pyuria and bacteriuria were reported, respectively, as the number of leukocytes and number of bacteria per high-power field (hpf). The bivariate summary ROC curves showed that pyuria of at least 10/hpf and bacteriuria of any/hpf (P10 and B), and bacteriuria of at least 10/hpf (B10) had the best diagnostic performances. The other tests were of intermediate or low performance.

After the final model of multivariate analysis was run, P10 and B remained the best combination, being better than when urine was collected through suprapubic aspiration or catheter, irrespective of age group and whether the urine was centrifuged or not. P10 was consistently the test with the lowest performance for all age groups.

The validity assessment score was tested in a separate stepwise regression (appears to be post-hoc) along with all the other individual variables. It was not found to have a significant influence on the diagnostic performance of the index tests.

The results of the dipstick tests were not reported.

Authors’ conclusions

Pyuria of at least 10/hpf (or 10/microlitre) and bacteriuria-any are best suited for assessing the risk of UTI in children.

CRD commentary

This appeared to be a well-conducted review, although some aspects were not clear, probably due to language
difficulties. The inclusion criteria were explicitly stated, the literature search seems to have been comprehensive, a thorough validity assessment was undertaken and included in the analysis of results, and details of the included studies were provided. Very little attention was given to the dipstick test results. Details of the multivariate regression analyses were poorly reported. If all studies were included for all tests, there is the possibility that the data were counted twice, which would lead to bias in the results of the review. The authors’ conclusions seem to follow from the results presented.

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

Research: The authors state that studies assessing combinations of rapid dipstick tests, such as leucocyte esterase and nitrite, in the diagnosis of UTI in children should be performed.

Bibliographic details

PubMedID
11791090

Other publications of related interest

Indexing Status
Subject indexing assigned by NLM

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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.