An economic evaluation of sonographic examination of children with suspected appendicitis
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Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

Health technology
Sonographic examination of children with suspected appendicitis.

Type of intervention
Diagnosis and treatment.

Economic study type
Cost-effectiveness analysis.

Study population
Children with suspected appendicitis.

Setting
The study setting was the hospital. The economic study was conducted in the USA.

Dates to which data relate
Effectiveness and resource use data were collected from studies published between 1986 and 1998. Cost data were taken from a study covering the period May 1994 to March 1997. The price year was not reported.

Source of effectiveness data
Effectiveness data were derived from a literature review and expert opinion.

Modelling
A decision analytic model was used to determine the cost-effectiveness of the diagnosis and treatment options.

Outcomes assessed in the review
The review assessed the incidence of true appendicitis, positive predictive value (PPV), negative predictive value (NPV), and the sensitivity and specificity of ultrasonography.

Study designs and other criteria for inclusion in the review
English language reports of clinical trials of the evaluation ultrasonography in the diagnosis of appendicitis in the pediatric population.

Sources searched to identify primary studies
MEDLINE was searched from 1986 to 1998.

Criteria used to ensure the validity of primary studies
The criteria used were not reported.

Methods used to judge relevance and validity, and for extracting data
Summary statistics from individual studies were used.

Number of primary studies included
At least 6 studies were included.

Methods of combining primary studies
Primary studies were combined using narrative method and meta-analysis.

Investigation of differences between primary studies
Not stated.

Results of the review
In the acute abdomen population, the prevalence of appendicitis was 83%. The sensitivity and specificity of ultrasound scan were 81% and 86%. The positive predictive value (PPV) and negative predictive value (NPV) of ultrasonography were 0.96 and 0.50. In the equivalent examination population, the prevalence of appendicitis was 28.4%. The sensitivity and specificity of ultrasound scan were 93% and 93% and the PPV and NPV were 0.84 and 0.97 respectively.

Methods used to derive estimates of effectiveness
The estimates of effectiveness were also based on the opinions of the authors and experts.

Estimates of effectiveness and key assumptions
50% of misdiagnosed patients discharged without ultrasound would return with ruptured appendices. 100% of those discharged after a false-negative ultrasound would return with ruptured appendices.

Measure of benefits used in the economic analysis
The incidence of true appendicitis, PPV, NPV, sensitivity and specificity of ultrasonography were used as the measures of benefit.

Direct costs
Direct costs were not discounted given the short time frame of the study (less than 1 year). Quantities and costs were reported separately. Direct costs included the costs of appendicitis, laparotomy, observation, and ultrasound examination. The quantity/cost boundary adopted was that of the health service. The estimation of quantities and costs was based on actual data. Costs were based on billing practices within the University of Michigan. The price year was not reported.

Statistical analysis of costs
No statistical analysis of costs was reported.
Indirect Costs
Indirect costs were not included.

Currency
US dollars ($).

Sensitivity analysis
One-way and two-way sensitivity analyses were conducted on the sensitivity and specificity of an ultrasound scan, the charge for an ultrasound scan, and the rate of rupture at re-presentation.

Estimated benefits used in the economic analysis
In the acute abdomen population, the prevalence of appendicitis was 83%. The sensitivity and specificity of ultrasound scan were 81% and 86%. The PPV and NPV of ultrasonography were 0.96 and 0.50. In the equivalent examination population, the prevalence of appendicitis was 28.4%. The sensitivity and specificity of ultrasound scan were 93% and 93% and the PPV and NPV were 0.84 and 0.97.

Cost results
In the acute abdomen population, the routine use of ultrasonography resulted in an additional cost of $234 per patient when compared with immediate operation. If patients were inappropriately discharged after all negative studies, on average the cost of managing a case of appendicitis would be increased by $1.114. In the equivocal examination model, the management with ultrasound scans and subsequent discharge resulted in expected savings of $373 per patient when compared with immediate discharge and $260 per patient when compared to admission and observation. If patients with negative scan findings were admitted subsequently, the ultrasound scan added $245 to the cost per patient when compared with admission and observation only. This analysis was sensitive to variation in the percentage of patients who returned with ruptured appendicitis after immediate discharge.

Synthesis of costs and benefits
Costs and benefits were not combined into cost-effectiveness ratios.

Authors' conclusions
The use of ultrasonography can be recommended for children with suspected appendicitis and equivocal examinations who are discharged from the emergency room after a negative examination result.

CRD COMMENTARY - Selection of comparators
A justification was given for the comparators used, namely currently employed diagnosis and treatment strategies. You, as a user of the database, should decide if these health technologies are relevant to your setting.

Validity of estimate of measure of benefit
The authors undertook a search of Medline to identify studies for input parameters for the model, but do not report the search terms used. More information about the design of the review could have been reported. The estimation of benefits was obtained directly from the effectiveness analysis. The results were derived using appropriate modelling methods in the absence of clinical trial data.

Validity of estimate of costs
All relevant direct cost categories were included. Physicians' fees, however, were not considered. Sensitivity analyses were conducted on costs and quantities. Quantities and costs were reported separately. However, some limitations exist
in that the price year was not reported and charges were used to proxy prices. These features tend to limit the
generalisability of the cost results.

Other issues
The authors did make appropriate comparisons of their findings with those from other studies and the issue of
generalisability to other settings was addressed. The authors did not present their results selectively. The study
considered children with suspected appendicitis and this was reflected in the authors' conclusions. In terms of
limitations, the authors acknowledged that there was no clear definition of the constellation of symptoms that
distinguished patients with equivocal examination findings from those with acute abdomens. The conclusions of the
study were also contingent on the relative cost data comprising the three treatment options. The costs used in the study
were institution specific. Finally, ultrasound scans are operator dependent.

Implications of the study
Ultrasonography is not cost-effective in the patient with an acute abdomen and a high likelihood of having appendicitis.
Future investigations need to be carried out to evaluate the relative cost-effectiveness of CT and ultrasonography in the
diagnosis of this condition. Further cost analyses should also consider the cost of non-medical expenses as well as
patient perceptions and satisfaction.

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