Laparoscopic appendectomy in children: technically feasible and safe in all stages of acute appendicitis

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
Children needing appendectomy were given laparoscopic appendectomy (LAP), using three step dilators (US Surgical): umbilical, lower quadrant and suprapubic. An Endo-GIA stapler (US Surgical) or Endoloops (Ethicon) were used to ligate and divide the appendix and mesoappendix. Endoloops were used in the smaller children. All patients were given cefoxitin preoperatively, while those who were thought to have a ruptured appendix at the time of surgery were given ampicillin, gentamicin and metronidazole intravenously. The comparator treatment was open appendectomy (OAP). Patients in both treatment groups with a ruptured appendicitis, who presented late with a walled-off periappendiceal abscess, underwent percutaneous drain placement with intravenous antibiotics and had an interval appendectomy (IA) 6 weeks later.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised children requiring appendectomy for presumed appendicitis. No inclusion or exclusion criteria were reported.

Setting
The setting was secondary care. The economic study was carried out in Illinois, USA.

Dates to which data relate

Source of effectiveness data
The effectiveness data were derived from a single study.

Link between effectiveness and cost data
The same patients provided both the cost and effectiveness data. The costing was carried out retrospectively.

Study sample
The authors did not report whether the sample size was determined in the planning phase of the study. They also did not report any retrospective power calculations. It appears that all children undergoing appendectomy between August
1998 and December 2002 have been included. A total of 103 children underwent appendectomy during the study period, of which 10 children underwent IA (8 undergoing LAP and 2 OAP) and were analysed separately. Of the remaining 93 patients, 28 underwent OAP and 65 underwent LAP. The median age of the study population was 10 years.

**Study design**
This was a retrospective cohort study that was conducted in a single centre. The authors examined retrospectively the outcomes of two surgical techniques during a time period when OAP was gradually being phased out (it was not carried out after August 2000) and being replaced by LAP. Three (4.6%) patients of the LAP group with a ruptured appendix were converted to OAP, but they were treated as part of the LAP group. There was no follow-up after hospital discharge.

**Analysis of effectiveness**
The basis of the analysis was intention to treat. The primary health outcomes used were:

- the complication rate,
- the wound infection rate,
- the rate of intra-abdominal abscesses (IAA), and
- the length of hospital stay.

It was reported that both groups of patients were comparable in terms of demographics and socioeconomic indicators, but no evidence of this was reported.

**Effectiveness results**
The rate of complications was 29% in the OAP group and 15% in the LAP group.

The wound infection rate was 21.4% for the OAP patients and 4.6% for the LAP patients.

The IAA rate was 3.6% for the OAP patients and 9.2% for the LAP patients.

Total complications (including wound infections, IAAs and prolonged ileus) were 28.6% for the OAP patients and 15.4% for the LAP patients.

There were no complications in the IA patient group undergoing LAP, whereas one of the 2 IA patients undergoing OAP developed an IAA.

**Clinical conclusions**
The authors concluded that, apart from the IAA rate, LAP appears to be superior to OAP. They expected the IAA rate to improve for LAP, as skills improve with experience.

**Measure of benefits used in the economic analysis**
No summary measure of benefits was produced. In effect, the authors carried out a cost-consequences analysis.

**Direct costs**
No discounting was carried out as the costs were incurred during less than one year. The authors did not break the costs down into their unit costs and quantities, nor did they give the data source for their cost calculations. The costs that were included were for the operating room and postoperative analgesia. The price year was 2003.
Statistical analysis of costs
No statistical analysis of the costs was carried out.

Indirect Costs
No indirect costs were included.

Currency
US dollars ($).

Sensitivity analysis
No sensitivity analysis was carried out.

Estimated benefits used in the economic analysis
See the 'Effectiveness Results' section.

Cost results
Excluding the IA patients, the median costs were $1,858 in the OAP group and $3,718 in the LAP group.

No costs were given for the IA patients.

The costs for the duration of hospital stay, including the cost of treating complications, were included.

Synthesis of costs and benefits
The costs and benefits were not combined as the study was, in effect, a cost-consequences analysis.

Authors' conclusions
The authors acknowledged that laparoscopic appendectomy (LAP) was as effective as open appendectomy (OAP), but was more expensive. However, they argued that this expense is justified as LAP brings benefits that were not calculated in this study but have been found in other studies, such as better cosmetic results, higher patient and parent satisfaction, and an earlier return to normal activity.

CRD COMMENTARY - Selection of comparators
The choice of the comparator, OAP, was justified by it having been current practice in the authors' setting. You should decide if it represents current practice in your own setting.

Validity of estimate of measure of effectiveness
The source of the effectiveness data was a single study. The study design was not ideal for the hypothesis since the patients were not randomly selected to have one of the two kinds of surgery. In addition, it was unclear, apart from the date of the operation, what factors determined which kind of surgery a patient would undergo. There was no sample selection and so the patients should have been representative of patients attending that hospital. It was reported that the patient groups were comparable at analysis, but the evidence to justify this was not given. The analysis of effectiveness was not handled convincingly as there were no statistical tests.

Validity of estimate of measure of benefit
The authors did not derive a summary measure of health benefit. In effect, the study was a cost-consequences analysis.

**Validity of estimate of costs**
The information on the costs appears to have been incomplete as the authors did not include all hospital costs in their calculations, reporting only analgesic costs and operating costs. As the length of stay was longer for LAP patients, including these costs would make the cost differential even higher for these patients. The unit costs were not reported separately from the quantities, which makes generalisability to other settings difficult. Information on the sources of the prices and resource use was not given. In addition, no analysis of the prices was undertaken. These facts will limit the generalisability of the study. The price year was appropriately reported, which will aid any possible inflation exercises. Discounting was irrelevant, as the costs were incurred during less than one year, and was appropriately not performed.

**Other issues**
The authors compared their findings with those from other studies, but did not address the issue of generalisability to other settings. The authors did not present all available information. For example, they did not provide information on the patient groups at baseline, nor did they provide cost data on the patients undergoing IA. The authors’ conclusions do not reflect the scope of the analysis, as the authors referred to results from other studies to in order to derive conclusions on the cost-effectiveness of the interventions. The authors acknowledged that a retrospective study is not ideal. Other limitations should have been stressed. For example, the authors did not comment on the difference in the size of the patient groups, the lack of randomisation and the fact that there were no statistical tests of the results.

**Implications of the study**
The authors concluded that laparoscopy can be recommended for children on effectiveness grounds and that the extra expense is justified. However, as their study has several weaknesses, their conclusion cannot be justified by the evidence they present.

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