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Original research

# Laparoscopic appendicectomy in obese is associated with improvements in clinical outcome: Systematic review

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## HIGHLIGHTS

- There is no difference in the outcomes between the obese and non-obese patients undergoing laparoscopic appendicectomy (LA).
- LA in obese patients is associated with significantly reduced mortality, shorter operating times and reduced length of stay.
- LA appears to be a safer alternative to open surgery in obese adult patients.

## ARTICLE INFO

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## ABSTRACT

**Background**: Obese patients with general surgical emergencies provide unique challenges to the emergency surgical teams. Acute appendicitis is the most common adult acute surgical emergency encountered in practice. This systematic review evaluates the role of laparoscopic appendicectomy in obese by comparing the outcomes of laparoscopic appendicectomy in obese versus non-obese and the laparoscopic versus open appendicectomy in obese patients. **Methods**: Relevant comparative studies were identified from the Cochrane Central Register of Controlled Trials, MEDLINE, Embase and PubMed (1990–2013). Primary outcomes evaluated were mortality, overall morbidity and duration of surgery. Secondary outcomes evaluated were superficial (superficial wound infection) and deep surgical site infection (intra-abdominal abscesses), conversion to open surgery, and cost of the procedure. **Results**: Seven retrospective cohort studies and one prospective randomized controlled trial met the inclusion criteria. There was no statistically significant difference in the primary and secondary outcomes between the obese and non-obese patients undergoing laparoscopic appendicectomy. Laparoscopic appendicectomy in obese patients is associated with reduced mortality (risk ratio [RR]: 0.19 (95% CI 0.12–0.30), reduced overall morbidity (RR: 0.49 (95% CI: 0.47–0.51)), reduced superficial wound infections (RR: 0.27 (95% CI 0.21–0.35)), shorter operating times and post-operative length of hospital stay, compared to open appendicectomy. Methodological quality of the included studies is low. **Conclusion**: Laparoscopic appendicectomy appears to be a safer alternative approach to open surgery in obese adult patents. There is no significant difference in the outcomes between the obese and non-obese patients undergoing laparoscopic appendicectomy.



## 1. Introduction

Over the past decade, two new cohorts of patients are increasingly encountered and considered for surgical evaluation on an emergency surgical take by a general surgeon. While octogenarians represent one cohort, obese patients are in the other group. In England, the number of obese has doubled in the last twenty-five years and it is predicted that 60% of the adult men and 50% of the adult women and 25% of the children will be obese by 2050 [1].

It is estimated that the provision of emergency surgical care comprises 40–50% of the workload of most surgical specialities. In England and Wales, over 14,000 admissions per year to intensive care units are made from general surgical emergency admissions [2]. Mortality rates are near 25% and it is estimated that around 80% of surgical mortality arises from unplanned/emergency surgical

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intervention [3].

Abdominal surgery in obese patients provides unique anaesthetic and surgical challenges. In addition to the obesity associated co morbidities, important pre-operative factors such as delay in the clinical diagnosis due to the apparent absence of clinical signs, limited availability of the more commonly required diagnostic abdominal computed tomogram; intra-operative factors such as difficult venous access, airway and ventilation issues, difficult access during surgery and the need for post-operative specialized nursing and medical care, tends to make the obese population a challenging surgical patient group. Although these issues are usually well addressed in most elective bariatric units, this is often not the case in common emergency general surgical units.

In general, obese patients compared to non-obese counterparts are noted to sustain a significantly higher risk of postoperative complications such as myocardial infarction, wound infection, nerve injury, and urinary infection [4]. Obesity has been shown to have a negative impact on outcomes after colorectal and oesophageal surgery, associated with longer operative times and increased post-operative morbidity [5–8].

There are currently no comparative studies to assess the role of laparoscopic surgery in general surgical emergencies. Two published meta-analyses compared laparoscopic and open techniques of appendicectomy in obese patients and demonstrated no significant difference in postoperative complications [9,10]. However, these studies included patients who are overweight [11,12] as well as studies evaluating the outcomes in paediatric population [13]. Moreover, there are additional large comparative studies [14–17] and an RCT [18] published since the previous meta-analyses [9,10], which suggest the requirement for further meta-analysis. The current systematic review and meta-analysis is performed to compare the difference in the outcomes of laparoscopic and open surgery in obese patients undergoing appendicectomy.

## 2. Methods

Methodology was developed from the standard guidelines outlined in the Cochrane Handbook for Systematic Reviews of Interventions (version 5.2.0) and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement.

### 2.1. Search strategy and study selection

A detailed electronic search was carried out from the following databases:

Cochrane Central Register of Controlled Trials, MEDLINE, Embase and PubMed. The search was performed using the Medical Subject Headings (MeSH):
"Obesity", "appendicectomy", combined with Boolean operator "AND".
No language limitation was applied to the search. All studies published from 1990 to 2013 were considered. Abstracts of potentially relevant publications based on the titles were read and comparative studies of *obese versus non-obese emergency surgery and open versus laparoscopic emergency surgery in obese* were retrieved. A review of all the comparative studies was performed. A hand search of the references of all comparative studies retrieved was undertaken for any further potential studies, however, no additional studies were identified.

### 2.2. Inclusion and exclusion criteria

#### 2.2.1Inclusion criteria:

All the randomized controlled trials (RCTs) or comparative studies were included. Studies including patients with body mass index (BMI) $\geq$ 30 and patients aged 12 years or older were included. Where a study has included overweight and obese patients, only obese patients (BMI $\geq$ 30) from that particular study were included in the comparative analysis.

#### 2.2.2Exclusion criteria:

Case reports were excluded.

### 2.3. Data extraction

Two reviewers extracted all data independently using a data extraction form. The information extracted from each study was (where available): year of publication, study design, inclusion criteria, exclusion criteria, number of participants in each group, types of surgery, and the complication rates such as mortality, superficial wound infection, intra-abdominal abscess (IAA), pneumonia, deep vein thrombosis, pulmonary embolism, post-operative ileus, post-operative bowel obstruction, injury to surrounding structures, duration of surgery, length of hospital stay (LOS), return to operating room, incisional/port-site hernia, conversion to an open operation, and the cost of procedure. Authors of included studies were contacted for any unclear or missing information.

Primary outcomes evaluated were mortality, overall morbidity and duration of surgery. Secondary outcomes evaluated were superficial (superficial wound infection) and deep surgical site infection rates (intra-abdominal abscesses), conversion to open surgery, and cost of the procedure.

### 2.4. Assessment of risk of bias

Two raters independently assessed the methodological quality of the included RCTs using the Cochrane Collaboration's tool for assessing risk of bias [19]. This included random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, assessment of incomplete data outcome, selective reporting and other source bias.

### 2.5. Statistical analysis

Meta-analysis was performed using the software RevMan 5.2 provided by the Cochrane Collaboration. All the assessed outcomes were dichotomous variables. Statistical analysis was performed using risk ratio (RR) as the summary statistic with corresponding 95 per cent confidence interval (CI). Meta-analysis using fixed-effect model and random-effects model was performed for each outcome and the analysis compared. When there was no discrepancy between the two analyses, the fixed-effect model was used. When there was a discrepancy, both models were presented. $P < 0.05$ was considered statistically significant.

Statistical heterogeneity was calculated using the $\chi^2$ test, where significance was set at $P < 0.10$ and was quantified by measuring $I^2$. An $I^2$ value above 50 per cent indicated significant statistical heterogeneity. The random-effects model was employed when there was significant heterogeneity.

## 3. Results

We identified a total of 273 references through electronic searches. We excluded 260 clearly irrelevant articles through reading abstracts. Thirteen articles were scrutinized, of which,