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The effect of laparoscopy versus open appendectomy on wound infection in elderly subject: A meta-analysis

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Abstract

Backgrounds

The purpose of the meta-analysis was to evaluate and compare the effect of laparoscopy versus open appendectomy on wound infection in elderly subjects.

Methods

The results of this meta-analysis were analyzed, and the odds ratio (OR) and mean difference (MD) with 95% confidence intervals (CIs) were calculated using dichotomous or contentious random or fixed effect models.

Results

For the current meta-analysis, 6 examinations spanning from 2004 to 2021 were included, encompassing 42675 people; of them, 15486 had a laparoscopy, and 27189 had an open appendectomy.

Laparoscopy had a significantly lower surgical site infection (OR, 0.27; 95% CI, 0.22-0.32, p<0.001) and intra-abdominal abscess (OR, 0.36; 95% CI, 0.31-0.42, p<0.001) compared to open appendectomy in elderly subjects.

Conclusions

The information that was looked at showed that in older people, laparoscopy had a much lower rate of surgical site infections and intra-abdominal abscesses than open appendectomy. However, given the small number of studies included, attention should be given to their values.

Keywords: elderly; surgical site infection; laparoscopy; open appendectomy

Introduction

The most frequent cause of stomach pain and a frequent reason for urgent surgery is appendicitis. Throughout one's lifetime, the probability of having appendicitis is about 7% for women and 9% for men. [1] Population aging has been a major issue in many countries; estimates indicate that by 2050, there will be about 498 million senior people in China (< 65 years). [2] After the population shifts, appendicitis will become more common. [3] Due to greater comorbidities and difficulties in accurately diagnosing the condition, prior research has shown that elderly patients with appendicitis have a higher risk of perforation and consequences. [4] For this reason, treating appendicitis in the senior population requires an accurate diagnosis along with the right technique.[5] Kurt Semm first mentioned laparoscopic appendectomy in 1983. [6] Since then, several studies have compared laparoscopy with open appendectomy. Laparoscopic appendectomy is linked to reduced surgical complications, quicker recovery, and less pain after surgery in adults. On the other hand, there's a lot of disagreement over postoperative intra-abdominal abscess following laparoscopic appendectomy. A cumulative meta-analysis by Ukai et al.[7] found that the higher risk of an intra-abdominal abscess after a laparoscopic appendectomy went away in studies published after 2001. However, a recent Cochrane review found that there is still a higher risk of this happening after a laparoscopic appendectomy. [8-11] There is ongoing discussion on the use of laparoscopic appendectomy in older patients. Previous research revealed that older people could benefit from laparoscopic appendectomy just as much as adults could; however, others claimed that using carbon dioxide to treat pneumoperitoneum increased the risk of cardiovascular comorbidities. To come to a conclusion based on numbers, we looked through several databases for papers that compared laparoscopic and open appendectomy for older patients in this study.

The current study aimed to appraise and compare the effect of laparoscopy versus open appendectomy on wound infection in elderly subjects.

Method

Design of the examination

The meta-analyses were assessed using a predefined procedure and included in the epidemiological declaration. The data was gathered and analyzed by consulting several databases, including OVID, PubMed, the Cochrane Library, Embase, and Google Scholar. These datasets were used to gather analyses that contrasted and assessed the effect of laparoscopy versus open appendectomy on wound infection in elderly subjects.[12]

Data pooling

In appendectomy in elderly subjects, different type of surgeries was found to provide several clinical outcomes. Surgical site infection was the primary outcome of the inclusion parameter in these studies. Language constraints were not taken into consideration while choosing which study to include or screening potential participants.The number of volunteers recruited for the investigations was not limited in any way. Since reviews, editorials, and letters don't offer an opinion, we didn't incorporate them into our synthesis. Figure 1 depicts the full examination identification procedure in its entirety.

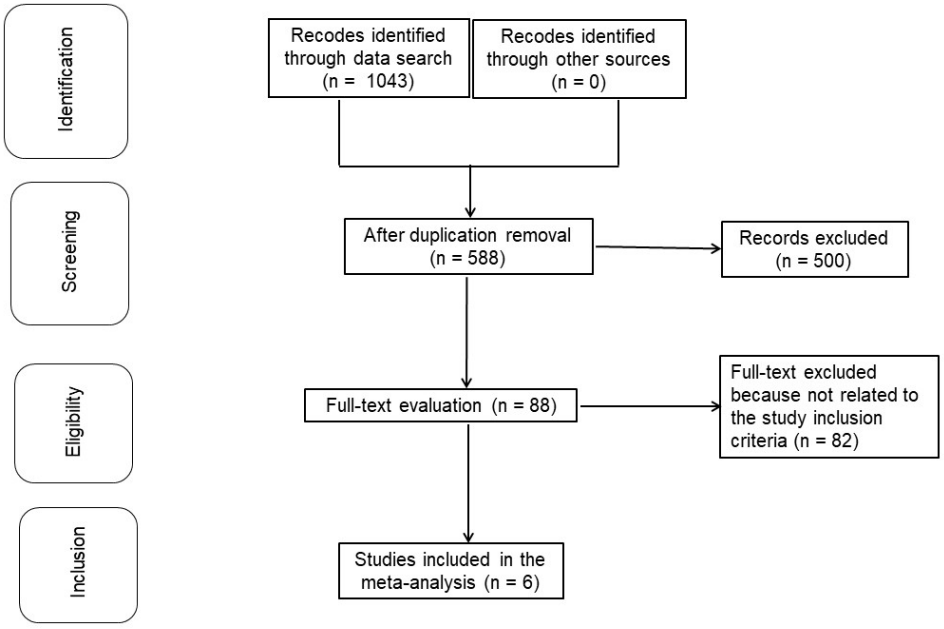

Figure 1. Schematic diagram of the examination procedure

Eligibility of included studies

The effect of laparoscopy or open appendectomy, either beneficial or detrimental, on the clinical results of appendectomy in elderly subjects is being investigated. Papers that addressed how interventions affected the frequency of elderly subjects were the only ones included in the sensitivity analysis. Sensitivity and subclass analyses were carried out by contrasting the interventional groups with the different subtypes.

Inclusion and exclusion criteria

Inclusion criteria:

For a study to be considered for the meta-analysis, it had to meet the following requirements: it had to compare the effect of laparoscopy to open appendectomy on surgical site infections in elderly subjects. To use statistical analysis, the output must contain the expression for the outcome.

Exclusion criteria:

Non-comparative research designs were excluded. Furthermore, there were no letters, books, reviews, or book chapters in the current assessment.

Identification of studies

The PICOS principle was used to develop and specify a protocol of search techniques, [13] which states: P (population) elderly individuals; different type of surgeries was the "intervention" or "exposure"; C (comparison): the comparison between laparoscopy and open appendectomy. O (outcome): surgical site infection; S (design of the examination): the intended assessment was limitless. [14]

Using the keywords and related terms listed in Table 1, we conducted a comprehensive search of the pertinent databases through September 2023. Reviews were conducted on all publications that were part of a reference management program, including abstracts and titles, as well as any research that did not link the type of treatment

to clinical outcomes. In addition, two authors evaluate papers to identify pertinent examinations.

Table 1. Database Search Strategy for inclusion of examinations

Database	Search strategy
Google Scholar	#1 "elderly" OR "laparoscopy" #2 "surgical site infection" OR "open appendectomy" #3 #1 AND #2
Embase	#1 'elderly' /exp OR 'laparoscopy' /exp OR 'open appendectomy' #2 'surgical site infection'/ #3 #1 AND #2
Cochrane library	#1 (elderly):ti,ab,kw (laparoscopy):ti,ab,kw (open appendectomy):ti,ab,kw (Word variations have been searched) #2 (surgical site infection):ti,ab,kw (Word variations have been searched) #3 #1 AND #2
Pubmed	#1 "elderly"[MeSH] OR "laparoscopy"[MeSH] OR "open appendectomy" [All Fields] #2 "surgical site infection"[All Fields] #3 #1 AND #2
OVID	#1 "elderly"[All Fields] OR "laparoscopy" [All Fields] OR "open appendectomy" [All Fields] #2 "surgical site infection"[All Fields] #3 #1 AND #2

Screening of studies

The examination and individual features are presented in a standard format, the last name of the first author, the examination's time and year, the country in which it was conducted, gender, the population type that was recruited for the examination, the total number of individuals, qualitative and quantitative evaluation methods, demographic data, and clinical and treatment characteristics were among the criteria used to reduce the amount of data.[15] Two anonymous authors looked at the possibility of bias in each study as well as the caliber of the methods used in the studies chosen for additional analysis. Two authors objectively examined the techniques used for each examination. [16]

Statistical analysis

In the present meta-analysis, dichotomous or continuous random- or fixed-effect models were used to estimate the odds ratio (OR) and mean difference (MD) with a 95% confidence interval (CI). [13] The I2 index was determined (in percent), and it has a range of 0 to 100. [15] Higher I2 values signify increased heterogeneity, whereas low I2 values signify a lack of heterogeneity. When I2 was 50% or more, the random effect was selected; if I2 was less than 50%, the fixed effect was selected. [17] The first investigation's findings were categorized as part of the subcategory analysis, as was previously described. Publication bias was assessed using Begg's and Egger's tests for quantitative analysis, and it was found to be present if $p>0.05$. The p-values were computed using a two-tailed approach. With Jamovi 2.3, graphs and statistical analyses were produced.

Results

1043 relevant papers were looked at, and 6 studies published between 2004 and 2021 met the criteria to be included in the meta-analysis. [18-23]

Table 2 summarizes the findings of these investigations. 42675 people were elderly, of them 15486 had a laparoscopy, and 27189 had an open appendectomy.

Table 2. Characteristics of studies

Study	Country	Total	Laparoscopy	Open appendectomy
Guller, 2004 [18]	USA	9476	1475	8001
Wu, 2011 [19]	China	150	62	88
Masoomi, 2012 [20]	USA	32680	13765	18915
Yang, 2017 [21]	China	145	80	65
Wu, 2017 [22]	China	115	56	59
Dikicier, 2021 [23]	Turkey	109	48	61
	Total	**42675**	**15486**	**27189**

Laparoscopy had a significantly lower surgical site infection (OR, 0.27; 95% CI, 0.22-0.32, $p<0.001$) with no

heterogeneity (I^2 = 0%) and intra-abdominal abscess (OR, 0.36; 95% CI, 0.31-0.42, p<0.001) with no heterogeneity (I^2 = 0%) compared to open appendectomy in elderly subjects, as revealed in Figures 2 and 3.
The quantitative Egger regression test and the visual interpretation of the effect's forest plot did not reveal any evidence of examination bias (p = 0.88). It was discovered that the majority of relevant examinations had low practical quality and were impartial in their selective reporting.

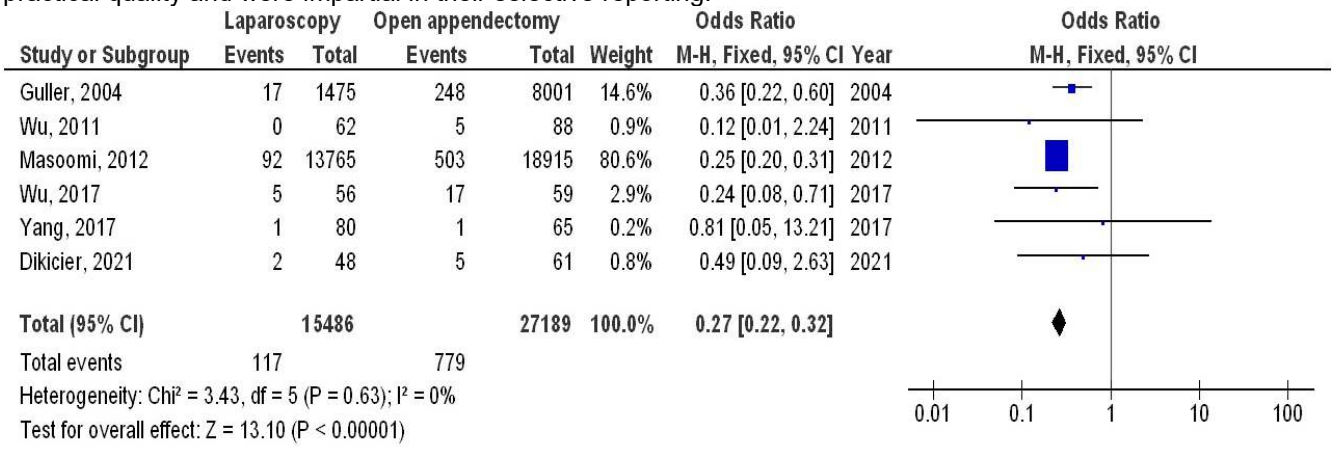

Figure 2. The effect's forest plot of the laparoscopy compared to open appendectomy on surgical site infection in elderly subjects.

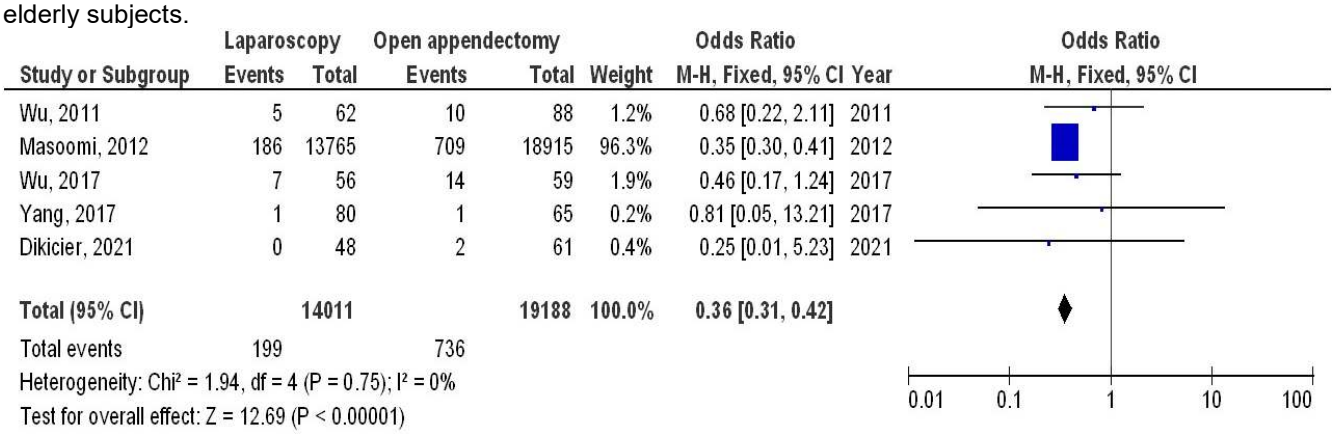

Figure 3. The effect's forest plot of the laparoscopy management compared to open appendectomy on intra-abdominal abscess in elderly subjects.

Discussion

For the current meta-analysis, 6 examinations from 2004 to 2021 were included; of these, 42675 people were elderly, of them, 15486 had laparoscopy, and 27189 had open appendectomy. The sample size was 109–32680 people. [18-23] The data that was looked at showed that laparoscopy had a significantly lower surgical site infection and intra-abdominal abscess compared to open appendectomy in elderly subjects. However, given the included small number of studies, attention should be given to their values.

Due to unusual symptoms and a higher number of comorbidities, elderly patients with appendicitis have a higher perforation rate. [24] Previous research has shown that older patients had greater rates of postoperative mortality and complications than younger people. [25] Based only on the findings of multiple observational studies that lacked quantitative analysis. The guideline consequently assigned this advice a level B grade, which represented moderate clinical certainty and was generalized from consistent levels 2 or 3. [26] Because laparoscopy is less intrusive and requires a quicker recovery than open procedures, it appears to be a safer option. Nonetheless, extant research has also indicated that in instances of complex appendicitis, a more open appendectomy is executed owing to a simpler surgical perspective of the abdominal adhesion and peritonitis. A higher percentage of complex appendicitis may be partially explained by the open appendectomy group's comparatively high postoperative mortality and complication rate. Due to unusual symptoms and generally worse health, the older population also had a greater perforation rate. Approximately one-third of these patients had their appendix misdiagnosed, delaying necessary treatment. [3] Combining preoperative CT with laparoscopy may help lower the rate of incorrect diagnoses and hence prevent perforations. Numerous studies have shown that laparoscopic appendectomy was related to a lower rate of wound infection as compared to open appendectomy. [27] This may be mostly due to the use of a wound-protecting plastic bag during the removal of the inflamed appendix during a laparoscopic appendectomy. [28] Less surgical incisions and more straightforward instances of appendicitis in the group undergoing laparoscopic appendectomy

could potentially explain the reduced wound infection rate associated with this procedure. Simple appendicitis demonstrated the superiority of laparoscopic appendectomy in minimizing wound infection; previous research indicated that general conditions and treatment delays were the main causes of wound infections and intra-abdominal abscesses. [29]

The meta-analysis included the following limitations: There might have been assortment bias because some of the studies that were chosen for the meta-analysis were not included. The removed study, however, did not meet the requirements to be included in the meta-analysis. Furthermore, the data was required to ascertain whether factors such as gender, and ethnicity affected the outcome. The goal of the meta-analysis was to find out how laparoscopy affected the care of elderly subjects who had appendectomy compared to an open appendectomy group. Probably, the use of inaccurate or insufficient data from a previous study exacerbated bias. The main reasons for discrimination were probably the individual's gender, ethnicity, and nutritional state. Unintentional changes in values could arise from incomplete data and unreported investigations.

Conclusions

The data that was looked at showed that laparoscopy had a significantly lower surgical site infection and intra-abdominal abscess compared to open appendectomy in elderly subjects. However, given the included small number of studies, attention should be given to their values.

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