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## Frequency of Wound Infection in Iranian Patients with Simple Appendicitis: A systematic review and meta-analysis

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### Abstract

**Objective:** The aim of this study was to evaluate the Frequency of Wound Infection in Iranian Patients with Simple Appendicitis.

**Methods:** The searches were conducted by two independent researchers in the international (PubMed, Web of Science, Scopus, and Google Scholar) and national databases (Magiran and SID) to find the relevant studies published in English and Persian languages since the creation of the databases until September 2017 (without time limitations). The keywords used in the search strategy were “Laparoscopic Appendectomy, Open Appendectomy, infection, wound, frequency, Acute Appendicitis”, and “Iran”, which were combined using the AND, OR, and NOT operators. a meta-analysis was conducted in STATA14 statistical software.

**Results:** According to the results from the random effects model, the total frequency of wound infection among the 1715 simple appendicitis cases was 2.4% (95% confidence interval [CI]: 1.6, 3.1, I<sup>2</sup>=68.8).

**Discussion:** It is recommended to conduct new studies with an interventional approach toward pre-surgical preoperative risk factors and investigate the effect of these interventions on the incidence of surgical wounds. Thus, it is required to provide conditions and data that can identify the essential strategies of infection prevention and control and investigate their effect; these measures will result in the reduction of patients' pain and their hospital costs.

**Keywords:** Laparoscopic Appendectomy, Open Appendectomy, infection, wound, frequency, Acute Appendicitis, Iran.

### Introduction

Nosocomial infection is an infection that neither manifest itself at the onset of the patient's hospitalization nor has an incubation period; it is created during the patient's hospitalization or after his discharge(1). Annually, millions of dollars are spent on the diagnosis, treatment, and compensation for nosocomial infections(2). Moreover, other costs are required to be added to the aforementioned costs including absence from work, reduced ability and efficiency, occupying

hospital beds, losses imposed on other patients, etc(3). Nosocomial infection is one of the main causes of mortality all over the world (4). Nosocomial infection is likely to affect any given organ of the patient's body (5). However, the most common types of nosocomial infections include urinary tract infection, respiratory tract infection, surgical site infection, and sharp instruments-transmitted infections (AIDS and hepatitis) (6). Surgical site infection can be seen in 0.5-10 percent of the patients (7). The most common factors of surgical site infection are

gram-positive cocci and gram-negative bacilli (8). *Staphylococcus aureus* is the most common type of gram-positive coccus that can be abundantly found in patient's skin and is likely to be transmitted to patients (especially the surgical site) through the hands of the hospital staff (9). From among gram-negative bacilli, one can mention *E.coli*, Klebsiella, and Pseudomonas. Appendicitis is the most common cause of acute abdominal pain that requires a surgery (10). Most of the serious and early complications of appendectomy are infectious including abdominal abscess and wound infection (11). In reference books, the incidence rates of wound infection and abdominal abscess in uncomplicated appendicitis have been reported to be 5% and 1% respectively (12). However, these statistics vary in different studies. The prevalence of nosocomial infection is 5-25 percent in the world (13). This implies that even in the most-equipped centers, it is easy to find such cases and the prevalence rate is not zero. Thus, it is essential that every center have information needed in this regard and attempt to reduce the infection rate. the aim of this study was to evaluate the Frequency of Wound Infection in Iranian Patients with Simple Appendicitis

## Materials and Methods

### Inclusion Criteria (Eligibility Criteria)

The methods used in this systematic review were developed in accordance with the PRISMA checklist instructions. Cross-sectional, case control, and cohort studies were included in this research, and the case series, letter to editors, case reports, clinical trials, study protocols, systematic reviews, and narrative reviews were excluded. Output: The main goal was to find the prevalence, and the output was collected as it was reported. Sampling techniques and sample size: all observational studies were excluded in the systematic review regardless of their design. The minimum sample size was greater than or equal to 25 (patients).

### Search Strategy

The searches were conducted by two independent researchers in the international (PubMed, Web of Science, Scopus, and Google Scholar) and

national databases (Magiran and SID) to find the relevant studies published in English and Persian languages since the creation of the databases until September 2017 (without time limitations). To ensure the literature saturation, the list of the included research references or the relevant reviews found by searching was studied. The special search strategies were created using the Health Sciences Librarian website with specialization in systematic review searches using the MESH phrases and open phrases in accordance with the PRESS standards . After finalizing the MEDLINE strategy, the results were compared to search the other databases. Similarly, PROSPERO was searched to find the recent or ongoing systematic reviews. The keywords used in the search strategy were "Laparoscopic Appendectomy, Open Appendectomy, infection, wound, frequency, Acute Appendicitis ", and "Iran", which were combined using the AND, OR, and NOT operators.

### Study Selection and Data Extraction

Two researchers independently analyzed the titles and abstracts of the articles with regard to the research eligibility criteria. After omitting the redundant studies, the full texts of the studies were assessed against the eligibility criteria and the information on the authors was collected when required. General information (the corresponding author, province, and year of publication), the study information (the sampling technique, questionnaire design, information collection method, research conditions, sample size, and risk of bias), and the output scales (life quality) were collected.

### Quality Assessment

The scale developed by Hoy et al. was used to assess the quality of the methodology and the risk of bias for each observational study. This 10-item scale is used to assess the quality of the studies with respect to their external validity (items 1 to 4 assess the target population, sampling framework, and minimum participation bias) and internal validity (items 5 to 9 assess the data collection method, problem statement, research scale, and

data collection instruments while item 10 assesses the bias of data analysis). The risk of bias was measured independently by two researchers, and the differences were solved by reaching a consensus.

### Data Aggregation

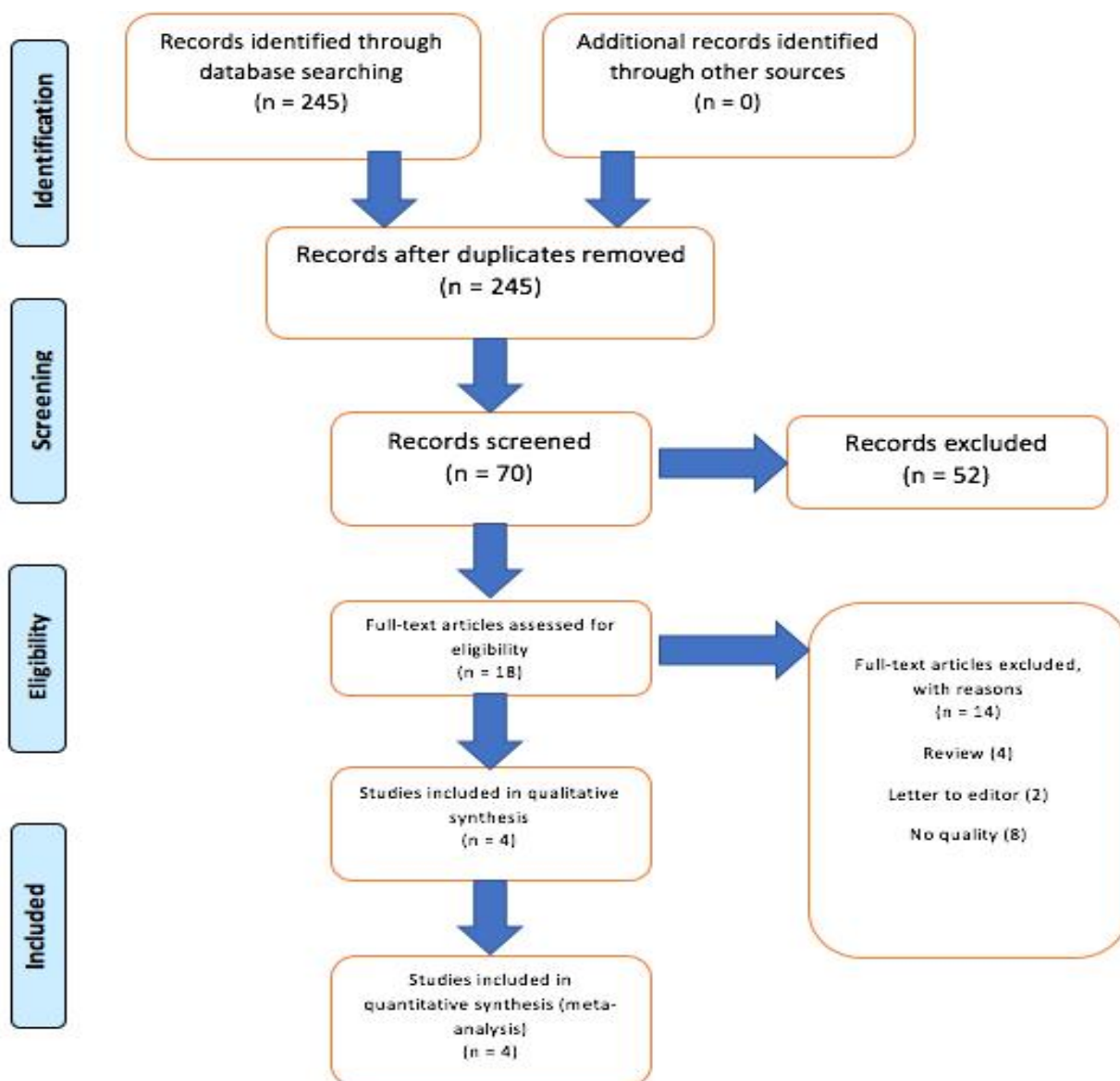
All of the eligible studies were included in the data aggregation following a systematic review and the data was integrated using a forest plot. The random effects model was assessed based on the overall life quality of the participants. The heterogeneity of the preliminary studies was tested using the  $I^2$  test. Besides, the subgroups were analyzed to determine the heterogeneity based on the gender and age of the respondents.

Finally, a meta-analysis was conducted in STATA14 statistical software.

### Results

#### Study Selection

A total of 245 articles were extracted through our preliminary searches in different databases. Of the 175 non-redundant studies identified by analyzing the titles and abstracts, 52 studies were ruled out due to irrelevant titles. Of the existing 18 studies, 4 studies met the inclusion criteria, and of the 14 excluded studies, 4 were review articles, 2 were letter to editor, and 8 did not meet the minimum inclusion criteria (Fig. 1).



**Research Specifications**

A total of 1715 patients suffering from abdominal pain were studied. The age of the participants varied between 14 and 50 years. Of the 4 studies, 3 presented cross-sectional data, and one study was a longitudinal survey. A total of 4 studies

from 4 provinces meeting the inclusion criteria were reviewed. Studies were from Kashan, Mashhad, Hamadan, and Golpayegan, respectively. The most common sampling techniques were also simple sampling (n=3). More than 50% of the studies had low risk of bias. (Table 1).

**Table 1: studies included in the systematic review**

Author	Year	Sample size	Province	Frequency	Risk of bias
Ghorbanpour	2008	35	Hamadan	0.14/3	Low
Jafari	2005	100	Kashan	0.06	Low
Riyahin	2011	980	Golpayegan	0.01/9	Low
Mehrabi	2010	600	Mashhad	0.03/7	Low

**Meta-Analysis of Frequency of Wound Infection in Patients with Simple appendicitis**

According to the results from the random effects model, the total frequency of wound infection

among the 1715 simple appendicitis cases was 2.4% (95% confidence interval [CI]: 1.6, 3.1, I<sup>2</sup>=68.8).

**Table 2: Frequency of Wound Infection in Patients with Simple appendicitis**

ID	First Author	Year	Province	ES	95%CI for ES		%weight
					Low	Up	
1	Ghorbanpour	2008	Hamadan	0.143	0.027	0.259	0.42
2	Jafari	2005	Kashan	0.060	0.014	0.106	2.64
3	Riyahin	2011	Golpayegan	0.019	0.011	0.027	80.16
4	Mehrabi	2010	Mashhad	0.037	0.019	0.055	16.77
Sub-total Random pooled ES	-----	-----	-----	0.024	0.016	0.031	100

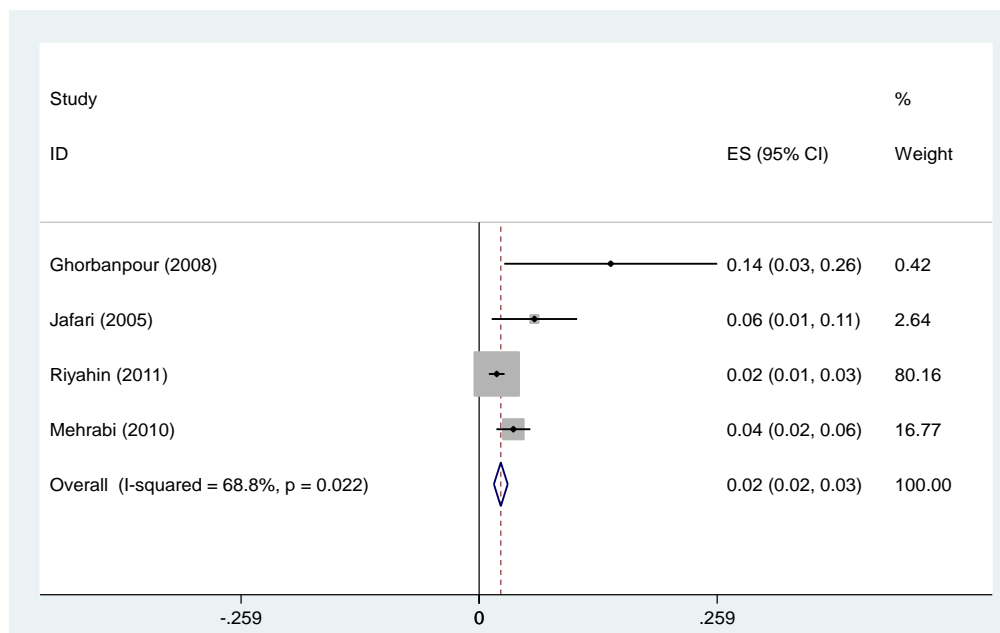


Fig. 2 : The Frequency of Wound Infection in Iranian Patients with Simple appendicitis and its 95% interval for the studied cases according to the year and the city where the study was conducted based on the model of the random effects model. The midpoint of each section of the line estimates the % value and the length of the lines showing the 95% confidence interval in each study. The oval sign shows Frequency of Wound Infection in Iranian Patients with Simple appendicitis for all studies.

## Discussion

According to the results from the random effects model, the total frequency of wound infection among the 1715 simple appendicitis cases was 2.4% (95% confidence interval [CI]: 1.6, 3.1,  $I^2=68.8$ ). The surgical techniques have remarkably developed in recent years. Moreover, the pathogenesis of surgical wounds infections have been identified and prophylactic antibiotics have been widely used by patients. However, the surgical site infection account for 24% of nosocomial infection with the incidence rate of 2-5 percent. The surgical site infection is the second most important nosocomial infection. The surgical site infection brings about increased discomfort for patients as well as increased mortality rate (14).

The risk factors of surgical wounds infection are divided into three main categories including host factors, environmental factors, and factors of pathogenic organisms.

The surgical wound infection is the second important cause of common nosocomial infection in hospitalized patients(15).

In dealing with nosocomial infection, the first step is creating an efficient healthcare system. In this regard, determining the goals of this system is of fundamental significance for the success of the system. The most important goal of the system is reducing surgical site infection resulting in reduced mortality rate, the patients' reduced discomfort, and improved care status. For achieving such a goal, it is primarily required to determine the endemic or basic surgical site infection. Determining the basic infection help epidemiologists determine and control the changes in the basic infection and the factors affecting it through conducting a regular control over the infections statistics (16).

Numerous risk factors are likely to make the surgical site more susceptible to infection. From among these factors, some are independent including underlying diseases, surgery duration, wound classification, and wound contamination. Non-independent risk factors include old age, malignancy, malnutrition, immunity weakness, smoking, and infection in another organ.

It is recommended to conduct new studies with an interventional approach toward pre-surgical preoperative risk factors and investigate the effect of these interventions on the incidence of surgical wounds. Thus, it is required to provide conditions and data that can identify the essential strategies of infection prevention and control and investigate their effect; these measures will result in the reduction of patients' pain and their hospital costs.

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