



## Negative appendectomy rate during 5 years in Modarres Hospital of Tehran, Iran, and correlation with imaging

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### Abstract

**Introduction:** Appendicitis is the most common emergency surgical admission regardless of the age group. In case of delay in diagnosis, serious complications may occur, needing immediate actions. Complications of acute appendicitis like perforation, peritonitis, and sepsis are to justify massive negative appendectomies. In this study, it has been tried to collect data about negative appendectomy during last 5 years in Modarres hospital, Shahid Beheshti University of Medical sciences, Tehran, Iran, based on demographics and correlation with diagnostic studies before operation. This study is important in terms of economy and health care aspects.

**Methods:** Data were collected about all patients appendectomized during 5 years between 2012 and 2017 at Modarres hospital. There were 1454 records, of which 108 records were excluded from the study due to the lack of enough data, interval appendectomy, and clean appendectomy. Finally, end 1346 appendectomies were assessed.

**Results:** There were 275 (20.4%) and 1071 (79.6%) negative appendectomy and suppurative appendicitis, respectively. Preoperative ultrasonography (US) was performed on 753 (56.0%) patients, of which 472 (62.7%) and 281 (37.3%) cases were coordinated with and different from pathologic records, respectively. Preoperative computed tomography (CT) scan was performed for 316 (23.5%) patients, which matched and differed pathologic records in 280 (88.6%) and 36 (11.4%) cases, respectively.

**Conclusion:** Diagnosis of appendicitis should still mainly be based on history, and clinical and laboratory data.

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### Introduction

Appendicitis is most common emergency surgical admission regardless of the age group.<sup>1</sup> In case of latency in diagnosis, serious complications may occur, hence prompt action is required. Complications of acute appendicitis including perforation, peritonitis, and sepsis are to justify massive negative appendectomies.<sup>2</sup> Moreover, this rush causes negative appendectomy several times. Negative appendectomy is associated with a prolonged hospital stay, morbidity,

mortality, and increased costs. Over 250000 appendectomies for presumed appendicitis are performed in the United States annually, with approximately 15% demonstrating no evidence of appendicitis, a condition often referred to as a “negative” appendectomy.<sup>3</sup> Negative appendectomy rates (NARs) have remained as a quality marker and imaging modalities have tried to keep the NAR at a minimum level with the rates ranging from 12 to 18 %.<sup>1</sup> In this study, it has been tried to collect data on negative appendectomy during last 5 years in Modarres hospital,

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Shahid Beheshti University of Medical sciences, Tehran, Iran, based on demographics and correlation with diagnostic studies prior to operation. This study is important in terms of economy and health care aspects.

### Methods

Patients were enrolled in the study using census method. Data were taken using patient's hospital records that have been appendectomized during 5 years between 2012 and 2017 at Modarres hospital. All demographic data including age, sex, physical examination finding, information on clinical status, operative findings, pathology, and imaging features were taken from the documented records. There were 1454 records, of which 108 records were excluded from the study due to the lack of enough data, interval appendectomy, and clean appendectomy. Finally, end 1346 appendectomies were assessed. Inclusion criteria were all patients with appendicitis operated during the 5 years. 976 and 370 patients were men and women, respectively. Sonography and abdominopelvic computed tomography (CT) scan were performed on 753 and 316 patients, respectively. Absence of appendicitis in pathology report regarded negative appendectomy.

### Results

In the present study, 1346 appendectomies were assessed; of this amount, 275 (20.4%) and 1071 (79.6%) cases were negative appendectomy and suppurative appendicitis, respectively. 976 (72.5%) and 370 (27.5%) of the subjects were men and women, respectively. Of 976 men, 815 (83.0%) and 161 (17.0%) cases experienced suppurative appendicitis and negative appendectomy, respectively. In addition, 256 (69.0%) and 114 (31.0%) cases of the 370 women experienced suppurative appendicitis and negative appendectomy, respectively. Moreover, 141 (10.5%), 446 (33.0%), 314 (23.3%), 276 (20.5%), 118 (8.8%), and 51 (3.9%) of the patients were under 10, between 10 to 20, between 20 to 30,

between 30 to 40, between 40 to 50, and more than 50 years old, respectively.

Preoperative ultrasonography (US) was performed on 753 (56.0%) patients, of which 472 (62.7%) and 281 (37.3%) cases were coordinated with and different from pathologic records, respectively. In addition, preoperative CT scan was performed for 316 (23.5%) patients, which matched and differed pathologic records in 280 (88.6%) and 36 (11.4%) cases, respectively.

### Discussion

In the present study, overall negative appendectomy was about 20.0% (31.0% and 17.0% among women and men, respectively) that was more than the international accepted rate. Although higher rate among women is natural, and due to similar diseases that mimic appendicitis, higher overall rate may be due to lower usage of pre-operative CT scan. In a study by Raja et al., it was shown that from 1990 to 2007, the NAR decreased significantly from 23.0% to 1.7% and the proportion of patients undergoing appendectomy who underwent preoperative CT increased significantly from 1.0% to 97.5%.<sup>4</sup>

The other study by Bachur et al. showed the effect of diagnostic imaging on NAR variation by age and gender. Diagnostic imaging for boys older than 5 years with presumed appendicitis has no relevant effect on NAR.<sup>5</sup> In the study by Applegate et al., comparison of children who underwent no preoperative imaging and those who underwent US, indicated that children who underwent CT scan had a significantly lower NAR without a significantly higher perforation rate.<sup>6</sup>

Seetahal et al. showed that between 1998 and 2007, there were 475651 cases of appendectomy that were isolated. Of these, 56252 (11.83%) were negative appendectomies. There was a steady decrease in the NARs from 14.70% in 1998 to 8.47% in 2007. Women and men accounted for 71.6% and 28.4% of cases of negative appendectomy, respectively. Ovarian cyst was the most common diagnosis mistaken for

appendicitis among younger women, whereas malignant disease of the ovary was the most common condition mistaken for appendiceal disease among women aging 45 and older. The most common misdiagnosis among men was diverticulitis of the colon.<sup>7</sup>

Although in some studies, preoperative US and CT scan lower rates of negative appendectomy were reported, the results of the studies by Papes et al.<sup>8</sup> and Schok et al.<sup>9</sup> formed the opinion that diagnosis of appendicitis should still mainly be based on history, and clinical and laboratory data.<sup>8</sup> The study by Webb et al. has shown that NAR was decreased for adult patients who underwent preoperative CT scan compared with patients with the lack of preoperative imaging. Although most prior studies have suggested that CT is effective only in decreasing the NAR among women, they found that men benefit from CT as well.<sup>2</sup>

In the present study, CT scan had positive predictive value about 89.0% that is consistent with other studies. Preoperative US has been performed among 56.0% of the cases and its positive predictive value is 63.0%, which is less than normal rate; this may be due to performing US by residents in the educational center at emergency condition in the present study.

Drake and Flum found that CT scan had 83.8% sensitivity and 83.8% positive predictive value for appendicitis diagnosis. US performed inferiorly to CT scan (35.5%

and 81.3% positive predictive value and sensitivity, respectively).<sup>10</sup>

### Conclusion

Diagnosis of appendicitis should still mainly be based on history, and clinical and laboratory data, however CT scan can help in decreasing of NAR, hence rational use of it is recommended.

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### Authors' Contribution

Dr Nasser Malekpour Alamdari: Operating surgeon, supervision of the project

Sara Besharat: Corresponding author, performing sonography and CT scan reports

Terife Bakhshi: Collecting data and analysis.

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### Conflict of Interest

Authors have no conflict of interest.

### Ethical Approval

This study is a case review without any intervention.

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