



Research

Acute Appendicitis in Istanbul: An 8-year Retrospective Cohort Study

İstanbul'da Akut Apandisit İnsidansı: 8 Yıllık Retrospektif Kohort Çalışması

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ABSTRACT

Objective: Acute appendicitis (AA) is the most common cause of acute abdominal and emergency surgery worldwide. Over the past decades, the incidence of AA has been increasing, and with minimally invasive technology, treatment modalities are changing. This study aimed to examine the incidence of AA in Istanbul, Turkey over the years and seasons and investigate the rates of open and laparoscopic appendectomy (LA).

Methods: This retrospective cohort study reviewed the archives of the Turkish Association of Trauma and Emergency Surgery between January 2012 and December 2019. Data from 11 tertiary hospitals with heavy patient flow from Istanbul were included. Descriptive statistics and univariate analysis of variance tests were performed. Statistical significance was defined as p-values of <0.05.

Results: A total of 39,932 AA cases were evaluated. The cumulative incidence of AA in Istanbul was 123/100,000 between 2012 and 2019, with increasing incidence over the years (p=0.01). LA rates have increased, and 68.5% of the cases were laparoscopically managed in 2019. AA rates were slightly higher in spring than in other seasons (p>0.05).

Conclusion: The incidence rate of AA and its laparoscopic management are significantly increasing in Istanbul.

Keywords: Acute appendicitis, epidemiology, incidence, incidence rate, laparoscopic appendectomy

ÖZ

Amaç: Akut apandisit (AA), tüm dünyada en sık görülen akut karın ve acil cerrahi nedenidir. Son yıllarda, AA insidansı artmakta ve gelişen minimal invaziv teknolojiyle birlikte tedavi şekli değişmektedir. Bu çalışmada, İstanbul'daki AA olgularının yıllara ve mevsimlere göre insidansını belirlemeyi, ve açık ve laparoskopik apandektomi (LA) oranlarını incelemeyi amaçladık.

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Gereç ve Yöntem: Bu retrospektif çalışmada, Ulusal Travma ve Acil Cerrahi Derneği'nin arşivinde yer alan Ocak 2012-Aralık 2019 tarihleri arasındaki veriler incelendi. İstanbul'un en fazla hasta yoğunluğuna sahip 11 üçüncü basamak hastane çalışmaya dahil edildi. Tanımlayıcı istatistik testleri ve tek değişkenli varyans analizi (UNIANOVA) uygulandı. İstatistiksel anlamlılık $p < 0,05$ olarak kabul edildi.

Bulgular: Bu çalışmada 39.932 AA olgusu değerlendirildi. İstanbul'da 2012-2019 yılları arasında AA'nın kümülatif insidansı 123/100.000 idi ve AA'nın insidans hızı yıllar içinde artış gösterdi ($p=0,01$). LA oranı artmaktadır ve bu oran 2019 yılında %68,5'e ulaşmıştır. AA'nın görüme oranı ilkbaharda diğer mevsimlere göre hafif yüksektir ($p > 0,05$).

Sonuç: İstanbul'da AA insidans hızı ve LA uygulanma sıklığı artmaktadır.

Anahtar Kelimeler: Akut apandisit, epidemiyoloji, insidans, insidans hızı, laparoskopik apendektomi

INTRODUCTION

Acute appendicitis (AA) is the most common cause of acute abdominal and emergency surgery worldwide, and the lifetime risk of developing AA is 8.6% in males and 6.9% in females (1). The global incidence of AA is 100-206 per 100,000 person-years annually and increasing, especially in newly industrialized populations (2).

AA develops more frequently in the second and third decades of life, and better socioeconomic status is associated with its lower incidence rates (3). AA can occur throughout the year. No consensus was achieved on the seasonal variation of AA; however, the majority of the epidemiological studies reported that the seasons with their highest and lowest incidence are summer and winter, respectively (4-7).

Minimally invasive AA management was first described and performed in the early 80s and gained popularity over the decades (8,9). With increasing experience, laparoscopic appendectomy (LA) has significantly lowered morbidity and complication rates (9).

To the best of our knowledge, this is the first epidemiologic study that examined AA in Istanbul, which is the most densely populated city in Turkey. This study aimed to determine the incidence and incidence rate of AA in Istanbul over the years and seasons and investigate the rates of LA.

METHODS

Participants and Data Collection

This retrospective cohort study reviewed the archive of the Turkish Association of Trauma and Emergency Surgery, and the data of the Monthly Marmara Region Trauma and Emergency Surgery Meetings between January 2012 and December 2019 were enrolled. Data from 11 tertiary hospitals with heavy patient flow from Istanbul was evaluated for selection and patients older than 18 years who underwent surgery for AA were included. The number of AA cases and surgical approaches were identified.

Ethical Considerations

This study was approved by the Ethics Committee of Istanbul Medeniyet University Göztepe Training and

Research Hospital Clinical Research (decision no: 2019/0308, date: 18.09.2019), and permissions were received from the included hospitals in the study.

Statistical Analysis

International Business Machines Statistical Package for the Social Sciences version 20 (IBM Corp., Armonk, NY, USA) was used for statistical analyses. Missing data were managed using the mean imputation method. Incidence, incidence rate, and percentage calculations were performed. For incidence rate calculations, census data of the districts of the hospitals were reached in the determined time interval. The Shapiro-Wilk test was performed to test normality. Univariate analysis of variance was accordingly implemented. A two-tailed p-value of < 0.05 was considered statistically significant.

RESULTS

A total of 39,932 AA cases were evaluated. In 2012-2019, the average incidence rate of AA was 123 per 100,000 person-years, which was significantly increasing ($p=0.01$) (Figure 1, 2). The total LA rate was 43.77%, and the rate increased from 31.8% up to 68.5% in 8 years (Figure 3).

The incidence of AA was the highest in spring and the lowest in winter (Table 1). However, no significant association was detected between the incidence and seasons ($p > 0.05$). Of the total cases, 1.8% ($n=712$) were perforated AA, which tended to decrease (Figure 4). The highest incidence of perforated AA was seen during winter and lowest in the fall, though this was statistically insignificant ($p > 0.05$).

Table 1. Seasonal distribution of AA and perforated AA in Istanbul

	AA [n (%)]	Perforated AA [n (%)]	p
Spring	10,327 (25.9%)	166 (23.3%)	> 0.05
Summer	10,066 (25.2%)	166 (23.3%)	> 0.05
Fall	10,050 (25.2%)	163 (22.9%)	> 0.05
Winter	9,489 (23.8%)	217 (30.5%)	> 0.05
Total	39,932 (100.0%)	712 (100.0%)	> 0.05

AA: Acute appendicitis

DISCUSSION

The present study, with its large sample size, comprehensively overviews the AA incidence and LA rates in Istanbul for 8 years. In Istanbul, the cumulative incidence rate of AA in Istanbul is 123/100,000 in 2012-2019 and the incidence rate increased over the years. The presence of a gap in the literature on population-based studies in our country prohibits the conclusion of epidemiological assumptions for AA incidence in Turkey. A study that included 1,871 AA cases in Kars (an eastern city of Turkey) between 2004 and 2007 revealed that the average incidence rate of AA was 150/100,000 (10). Ferris et al. (2) conducted the largest meta-analysis for global incidence of AA between 1950 and 2015. The incidence of AA has been remaining constant in North America and Europe during the 21st century, while the rate is increasing in the Middle East, Asia, and South America. In the study, the pooled incidence was 160/100,000 in Turkey.

LA rates are significantly rising in Istanbul. The average was 43.77% between 2012 and 2019. The rate increased from 31.81% in 2012 to 68.51% in 2019. A comprehensive study that examined the 66,990 AA cases in New York between 2009 and 2014 revealed a 77.7% LA rate (11). Another study

from Ireland that included 23,684 appendectomies between 2014 and 2017 revealed a 77.6% LA rate (12). After gaining experience on laparoscopic procedures with improved infrastructures, increased LA rates may be predicted for the future.

The majority of studies revealed that the highest and lowest incidence of AA is in summer and winter, respectively (4-7). Environmental factors, such as gastrointestinal infections, air pollution exposure, excess alcohol consumption, and a high carbohydrate diet with low fibers may lead to AA in summer (13). Our study revealed the highest incidence rate of AA in spring, unlike most studies that reported summer with the highest incidence. During summer, majority of the residents leave Istanbul for their home cities or vacation, which may be the reason for the decreased rates of AA in these months. The incidence rate of perforated AA varies between 8.3% and 46% in the literature, and the perforated AA incidence has not been precisely linked to seasonal variations (5,6,14). Reinisch et al. (15) reported the association between non-ambient temperature and complicated AA. Our study revealed a 1.8% perforated AA rate, and cases mostly occurred in winter; however, no significant association was found between the seasons and perforated AA incidence ($p>0.05$).

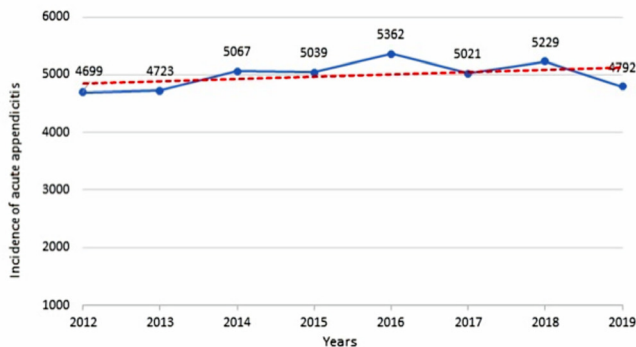


Figure 1. Incidence of acute appendicitis cases in Istanbul between 2012 and 2019

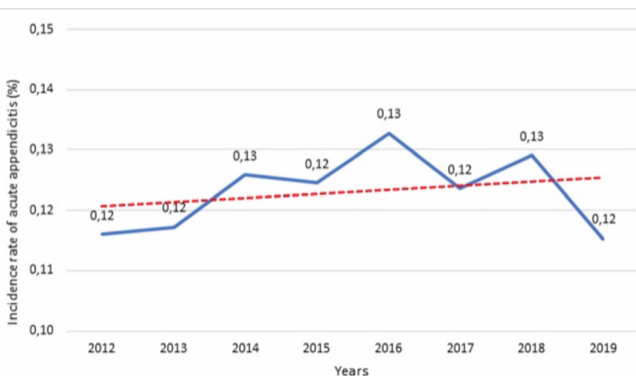


Figure 2. The incidence rate of acute appendicitis cases in Istanbul between 2012 and 2019

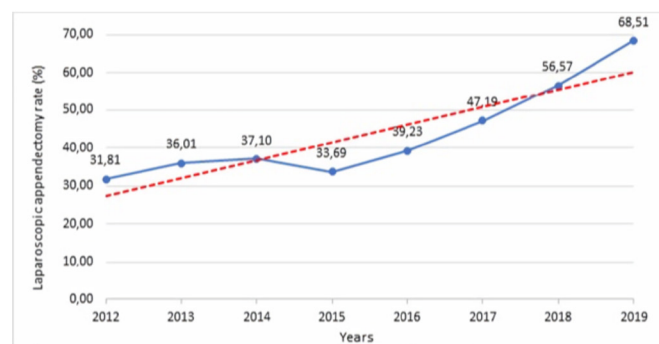


Figure 3. Laparoscopic appendectomy rate in Istanbul between 2012 and 2019

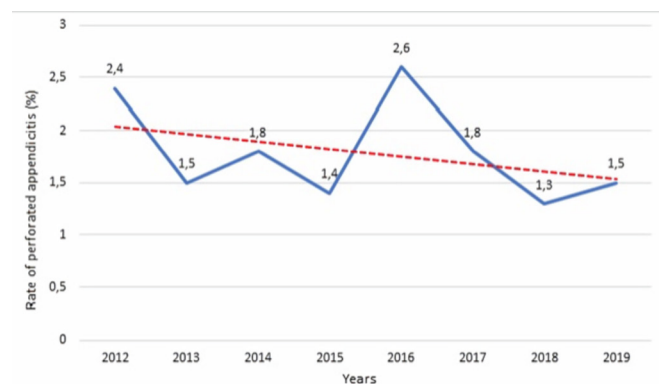


Figure 4. Rate of perforated appendicitis in Istanbul between 2012 and 2019

The limitation of our study includes the missing demographic data of patients in the medical records obtained from the archives. The strengths of our study include its multi-centric and population-based design with a large sample study.

CONCLUSION

Our study is the first and most comprehensive epidemiologic study on AA in Istanbul. The incidence rate of AA in Istanbul is compatible with the western regions of the globe. Rapidly increasing rates of LA revealed improvements in the treatment modalities and experiences.

ETHICS

Ethics Committee Approval: This study was approved by the Ethics Committee of Istanbul Medeniyet University Goztepe Training and Research Hospital Clinical Research (decision no: 2019/0308, date: 18.09.2019), and permissions were received from the included hospitals in the study.

Informed Consent: Retrospective study.

Authorship Contributions

Surgical and Medikal Practices: Ü.N.K., B.N.K., H.A., N.Ç., A.S., C.E., H.F.K., A.A., İ.Ş.S., F.E., B.G., Fa.E., A.F.K.G., O.Ş., O.A., Concept: Ü.N.K., B.N.K., N.Ç., Design: Ü.N.K., B.N.K., N.Ç., Data Collection or Processing: Ü.N.K., B.N.K., H.A., N.Ç., A.S., C.E., H.F.K., A.A., İ.Ş.S., F.E., B.G., Fa.E., A.F.K.G., O.Ş., O.A., Analysis or Interpretation: Ü.N.K., B.N.K., N.Ç., Literature Search: Ü.N.K., B.N.K., H.A., N.Ç., Writing: Ü.N.K., B.N.K., H.A., N.Ç., A.S., C.E., H.F.K., A.A., İ.Ş.S., F.E., B.G., Fa.E., A.F.K.G., O.Ş., O.A.

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