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Occurrence and treatment of pediatric appendicitis in Finland 2004-2014



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ABSTRACT

Background: We aimed to investigate the trends in occurrence and the treatment approaches of appendicitis in Finnish children.

Material and methods: All patients aged <16 y hospitalized for appendicitis in Finland in 2004-2014 were included. Data were retrospectively collected from the Finnish Care Register for Health Care and Statistics Finland.

Results: Altogether 8494 children were hospitalized for appendicitis, with standardized incidence rate of 80.7 (95% confidence interval 79.0-82.0)/100,000 person years. The incidence rate of appendicitis decreased by 3.3% per year during the study period. Appendicitis was more common with increasing age, in boys compared to girls at 8 to 15 y of age, and during the summer compared to the other seasons. Most children (83.2%) were treated with conventional open appendectomy, but laparoscopic appendectomies were slowly increasing during the study period. The length of hospital stay (LOS) was shorter in boys than girls, in those treated laparoscopically, and in those with uncomplicated appendicitis. There was no significant seasonal variation in the LOS. However, the LOS decreased during the study period.

Conclusions: The incidence of pediatric appendicitis is decreasing, and there is a decreasing trend in LOS. While still relatively rare in the Finnish pediatric surgical centers, the use of laparoscopic appendectomy is increasing.

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Introduction

Appendicitis is a common cause of hospitalization and surgery in children. The incidence of appendicitis has previously been shown to be higher in males in comparison to females^{1,2}

and during the summer months.¹⁻⁴ Complicated appendicitis has also been shown to be more common during unusually warm or cold weather conditions.⁵

The incidence of appendicitis in the general population has been reported to decline in the western countries during the

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second half of the 20th century.^{6,7} However, reports are contradictory since the 1990's. While the decline of appendicitis in the general population has been reported to continue in Finland and Ontario,^{2,8} the incidence has increased in the general population in the United States.^{3,9} On the other hand, the occurrence of appendicitis in 10-19-year olds simultaneously decreased by 4.6% in the United States,⁹ and the rate of pediatric appendectomies remained relatively stable in Ontario.¹⁰

Reports on the recent changes in the treatment strategies of pediatric appendicitis are scarce. Rapid increase in the use of laparoscopic approach in pediatric appendectomy has been reported in a Taiwanese national cohort, a Californian statewide cohort, and 12 regional hospitals in Southern California.¹¹⁻¹³ Some reports have indicated laparoscopic appendectomy in children to be associated with shorter length of stay compared to open appendectomy,¹⁴ while others have not.¹⁵⁻¹⁷ Although not yet routinely used in pediatric population, recent small studies have shown antibiotic treatment to be an option in uncomplicated acute appendicitis in children¹⁸⁻²⁰ and randomized multicenter studies have been started.

The aim of this study was (1) to investigate the occurrence, seasonality, and trends of pediatric appendicitis and (2) to find out factors associated with length of hospital stay (LOS).

Material and methods

Study patients and data collection

Patients aged less than 16 y admitted into pediatric, pediatric surgical, surgical, intensive care, or medical wards with appendicitis (International Statistical Classification of Diseases and Related Health Problems, 10th Revision codes K35x as primary discharge diagnosis) from January 2004 through December 2014 for the first time were studied. Data were retrospectively collected from all hospitals treating pediatric appendicitis in mainland Finland using the Finnish Care Register for Health Care. The Care Register for Health Care is a nationwide, obligatory and automatically collected hospital discharge database. Corresponding population data were obtained from Statistics Finland. Simple appendicitis was defined as International Statistical Classification of Diseases and Related Health Problems, 10th Revision code K35.9 (appendicitis without perforation, abscess, or peritonitis) and complicated appendicitis as K35.0 (appendicitis with peritonitis) or K35.1 (appendicitis with periappendicular abscess). Appendectomy procedures and their type (open versus laparoscopic appendectomy) were identified based on recorded Nordic Classification of Surgical Procedures codes. Seasons were divided as spring (March-May), summer (June-August), fall (September-November) and winter (December-February). The study was approved by the National Institute for Health and Welfare of Finland (permissions no: THL/143/5.05.00/2015).

Statistical analysis

Count data were analyzed using negative binomial regression modeling. Incidence was modeled with logarithm of population as an offset parameter. In analysis of seasonal number of admissions, differences in number of days between seasons

were accounted for by using the logarithm of day number as an offset parameter in regression model. Linear regression was utilized for analyzing predictors of duration of hospital stay (beginning days, standardized and logarithmically transformed due to skewness). Results are given as incidence rate ratios or rate ratios. Statistical significance was inferred at $P < 0.05$. The SAS system version 9.4 (SAS Institute Inc, Cary, NC) was used for statistical analyses.

Results

Altogether 8494 children were hospitalized due to acute appendicitis or periappendicular abscess during 2004 to 2014. Out of these children, 7310 (86.1%) had acute appendicitis without peritonitis and 653 (7.7%) had acute appendicitis with peritonitis, and 531 (6.3%) had periappendicular abscess; 4899 (57.7%) were boys and 3595 (42.3%) girls. Mean age of admission was 11.2 y (standard deviation [SD] 3.0 y). There was no significant difference in the mean age between girls (mean 11.2 y [SD 3.1]) and boys (11.3 [2.9]) ($P = 0.174$). None of the children died during the studied hospital stay.

The standardized incidence rate of appendicitis was 80.7 (95% confidence interval 79.0-82.5)/100,000 person years in the total study population, 91.2 (88.7-93.8) in boys, and 69.8 (67.5-72.1) in girls. Corresponding crude rates were 80.9 (79.2-82.6) overall, 91.2 (88.8-93.9) in boys, and 70.0 (67.7-72.3) in girls. The incidence of appendicitis decreased during the study years ($P < 0.0001$, Fig. 1). Overall, the incidence rate decreased by estimated 3.3% (2.2%-4.3%, $P < 0.0001$) per year during the study period. There was no difference in the decreasing incidence trend between genders ($P = 0.7391$).

The incidence rate of appendicitis increased with increasing age in both genders (Fig. 2). Age-distribution of appendicitis differed by gender (interaction $P = 0.0315$) and thus, the results are stratified to age groups. Appendicitis was significantly more common in boys than girls among children aged ≥ 8 y (Table 1).

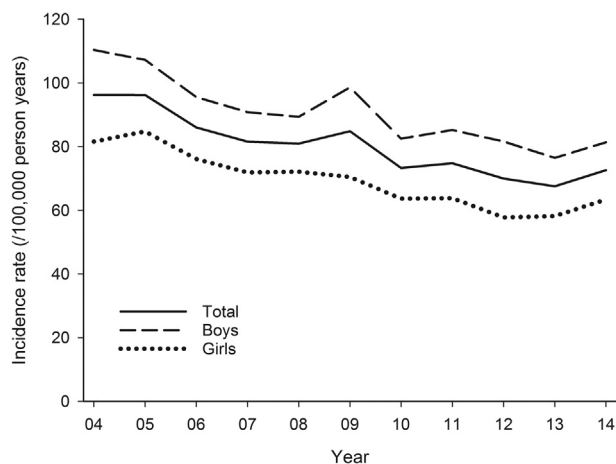


Fig. 1 – Standardized incidence rate of primary admissions for pediatric appendicitis in Finland 2004-2014. Incidence overall (solid line), among boys (dashed line), and among girls (dotted line).

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