

Incidence of complicated acute appendicitis: a single-centre retrospective study

Częstość występowania powikłanej postaci ostrego zapalenia wyrostka robaczkowego – jednośrodkowe badanie retrospektywne

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Słowa kluczowe: zapalenie wyrostka robaczkowego, zapalenie otrzewnej, dziecko, pierwsza pomoc.

Abstract

Introduction: Abdominal pain has been one of the most common reasons patients seek medical care for centuries. Nowadays, together with laboratory diagnostics and imaging, we are able to make an early diagnosis. This leads to the introduction of early adequate treatment.

Aim of the research: To analyse the incidence and causes of complicated acute appendicitis in one medical centre in between 2004 and 2016.

Material and methods: A retrospective study covered the period from December 23, 2004 to November 07, 2016. It included 2048 cases of children between 0 and 18 years of age undergoing surgery for suspected acute appendicitis. Demographic and clinical characteristics as well as length of hospitalisation, antibiotics schemes, and intraoperative diagnosis were reviewed. Complicated acute appendicitis cases were distinguished and compared with the incidence in world literature.

Results: The percentage of complicated acute appendicitis ranged from 39% to 60%. Complicated acute appendicitis occurs much more often in children under 5 years of age.

Conclusions: The delay and failure in diagnosis of acute appendicitis results in higher incidence of complicated acute appendicitis; consequently, there are higher costs of treatment. Improving the awareness of parents and primary care physicians may allow faster diagnosis and treatment of acute appendicitis. It was noted that the reform of the National Emergency Medical Services in Poland contributed to a reduction in the incidence of complicated appendicitis.

Streszczenie

Wprowadzenie: Bóle brzucha to jedna z najczęstszych przyczyn zgłaszania się dzieci do szpitala i do lekarzy pierwszego kontaktu. Dzięki coraz większym możliwościom diagnostycznym możliwe jest postawienie wczesnej diagnozy choroby i włączenie odpowiedniego leczenia.

Cel pracy: Analiza częstości występowania i przyczyn powikłanych postaci zapalenia wyrostka robaczkowego w materiale jednego ośrodka w latach 2004–2016.

Materiał i metody: Badanie retrospektywne objęło okres od 23 grudnia 2004 do 11 lipca 2016 r. i pacjentów operowanych z powodu podejrzenia ostrego zapalenia wyrostka robaczkowego. Do analizy włączono 2048 przypadków dzieci w wieku 0–18 lat. Analizowano wiek, czas hospitalizacji, schematy antybiotykoterapii oraz rozpoznania śródoperacyjne. Wyodrębniono postaci powikłanego ostrego zapalenia wyrostka robaczkowego i porównano częstość występowania z częstością podawaną w piśmiennictwie światowym.

Wyniki: Odsetek powikłanych postaci zapalenia wyrostka robaczkowego wynosi 39–60% w poszczególnych latach między 2005 a 2016 r. U dzieci poniżej 5. roku życia znacznie częściej występują powikłane postaci zapalenia wyrostka robaczkowego.

Wnioski: Dzieci z powikłanymi postaciami ostrego zapalenia wyrostka robaczkowego zgłaszają się zbyt późno do szpitala. Skutkuje to znacznie większą liczbą powikłań około- i pooperacyjnych, dłuższą hospitalizacją i droższym leczeniem w stosunku do pacjentów z wczesną fazą choroby. Zauważono, że stworzenie m.in. Systemu Państwowego Ratownictwa Medycznego przyczyniło się do zmniejszenia częstości występowania powikłanych zapaleń wyrostka robaczkowego. Poprawa świadomości rodziców oraz lekarzy pierwszego kontaktu pozwoli na szybsze rozpoznanie ostrego zapalenia wyrostka robaczkowego, zwłaszcza przypadków powikłanych.

Introduction

The first description of appendix appeared in 1521 by Da Carpi, who described it as an anatomical structure. However, it was not until the end of the nineteenth century that a more detailed description of the pathophysiology of appendicitis was presented [1, 2]. The awareness of its high mortality rate encouraged doctors to undertake active measures to develop methods for the management and treatment of the disease. Only in the twentieth century was a breakthrough in the treatment of acute appendicitis witnessed with the apparition of early diagnosis and subsequent appendectomy. The change of approach in the treatment of the disease led to improved results. The mortality rate began to fall: under 25% in 1915; about 5% in 1950; and currently < 0.01% in developed countries [3]. The reasons for this is earlier surgeries and the benefit of general anaesthesia, the improvement of surgical techniques and antibiotic therapy, the introduction of aseptic and antiseptic principles, and finally better haemostasis during surgeries [4, 5].

Nowadays, together with laboratory diagnostics and imaging, we are able to make an early diagnosis. This leads to the introduction of early adequate treatment and better outcomes [6–10].

The most widely used classification of the disease consists of uncomplicated and complicated forms of appendicitis. To clarify, the disease is defined as uncomplicated if the appendix has less advanced changes without perforation or diffuse peritonitis. This group is usually characterised by shorter hospital stay and fewer complications during treatment. In the case of complicated appendicitis, gangrenous with diffuse peritonitis, perforated appendix, or periappendicular abscess is observed. These clinical forms required longer hospitalisation, more expensive treatments, and more often result in severe post-operative complications [8].

Aim of the research

The main aim of the study is to analyse retrospectively the incidence, causes, and clinical course of complicated acute appendicitis.

Material and methods

A retrospective study included children aged 0–18 years, who were operated due to acute appendicitis be-

tween December 23, 2004 and July 11, 2016. Patients were treated in the Department of Paediatric Surgery, Urology, and Traumatology, Regional Hospital in Kielce, Poland. This study focused on demographic data, length of hospitalisation, antibiotic therapy, and intraoperative diagnosis.

Appendectomy was performed using either a laparoscopic or an open technique, depending on the preference of the surgeon. Higher prevalence of an open approach (58%) was noticed. All removed appendices were routinely submitted for histological evaluation.

In Poland, the most commonly used classification is by the nature of morphological changes in the appendix, which are assessed intraoperatively. Consequently, the following types of appendicitis are distinguished: simple surface, phlegmon and gangrenous appendicitis with possible perforation, and local or diffuse peritonitis.

In the study, as mentioned in the introduction, a grading system was applied to rate appendicitis between uncomplicated and complicated. According to the surgeon's assessment, proper grading was established in each case.

In the case of acute appendicitis, the most common postoperative complications are wound infection and formation of intraperitoneal abscesses. Whereas long-term complications include mechanical obstruction and abscess formation. In the context of this research paper we do not focus on postoperative complications. Further studies will be necessary.

Results

A total of 2048 children who underwent appendectomy were included in the analysed period. Girls accounted for 36.9% while boys accounted for 63.1%. Children were classified into three age groups: the youngest (0–5), middle (6–10 years), and the oldest (11–18 years) (Table 1). The largest group comprised children under the age of 11 years. Their mean age was 10.7 years.

Diagnosis of appendicitis was based on symptoms, physical examination, blood tests, and imaging. The most common reported symptoms were abdominal pain and vomiting. In all children, routine ultrasound of the abdomen was performed by a radiologist together with white cell count and C-reactive protein (CRP) measurement. In uncertain cases ultrasound was repeated or computed tomography (CT) scan was performed (3 patients). The majority (69.4%) of patients were enrolled for surgery within 12 h of admission to the department. The delay in the rest of the cases was due to extended establishment of correct diagnosis, proper preparation of the patient, or availability of the operating theatre. During that time rehydration and antibiotic therapy were provided. Among those patients 18% had complicated appendicitis.

Table 1. Analysis of patients' age

Group	Girls	Boys	Number of patients (%)	Age, mean
Youngest	89	144	233 (11.4)	3.77
Middle	244	435	679 (33.2)	8.17
Oldest	423	712	1135 (55.4)	13.7
Total	756	1291	2047 (100)	10.7

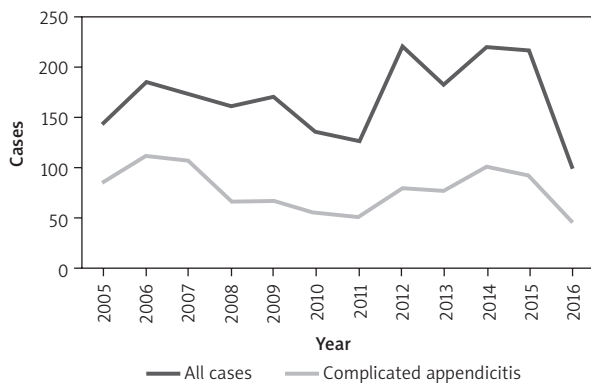


Figure 1. All cases versus complicated acute appendicitis

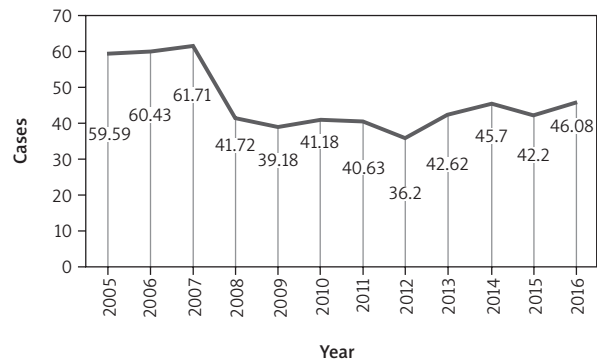


Figure 2. Incidence of complicated acute appendicitis

The average total length of stay was 8.3 days, with 65.3% of patients discharged within 7 days of their admission.

Most of the time children were administered two antibiotics (43.5% of cases). In contrast, one antibiotic was prescribed in 30.7% of cases, and three or more in 26.7%. The most commonly used antibiotics were Metronidazole and Cefuroxime.

Each conclusion of the surgeon’s report was studied, so that appendicitis cases were defined as uncomplicated or complicated. Furthermore, negative appendectomies in the studied period amounted to 0.5%, and no mortal cases were recorded.

The study analysed the incidence of complicated appendicitis over the years (Figures 1, 2). It was then divided into two time periods: 1) 2005–2007 and 2) 2008–2016. As can be seen in the second period under study, the incidence of acute appendicitis increased. Nonetheless the incidence of complicated appendicitis remained at a similar level. Consequently, the average rate of complicated acute appendicitis was 43.95%.

Figure 2 shows the occurrence of complicated acute appendicitis over the years in relation to all cases of acute appendicitis in the study. In first period the incidence of complicated acute appendicitis was around 59–61%, then it dropped to around 39–46% of all cases. In effect, a significant reduction in incidences after 2007 can be noticed.

The analysis of the age of the patients and the occurrence of the complicated appendicitis is shown in Figure 3. The frequency rate of complicated appendicitis was the highest for the youngest children, at 61%. Then middle children were at 46%, whereas older children were at 45%.

Discussion

Acute appendicitis is one of the most common causes of “acute abdomen”. Typically, it manifests with the classic triad of symptoms. It includes abdominal pain, nausea or vomiting, and increased body temperature. In addition to physical examination, ultrasound of the abdomen and blood tests are used to confirm diagnosis. This is particularly important for young and non-cooperating children. Ultrasonography is safe and readily available with high accuracy when used by an experienced radiologist. It is especially useful in children who are more sensitive to radiation. Consequently, it helps differentiate appendicitis from non-surgical reasons of abdominal symptoms [5–7]. In uncertain cases, abdominal CT might be performed.

Lately there have been reports on a satisfactory effect of non-operative management of acute appendicitis [11, 12] although the preferred treatment is still surgery combined with antibiotics [13]. In all cases

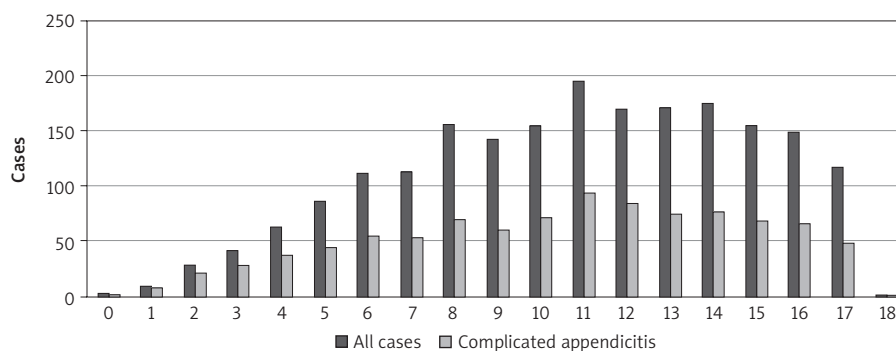


Figure 3. All cases versus complicated acute appendicitis

the priority is to start the chosen treatment as soon as possible. It is known that there is a correlation between the time since the onset of symptoms and the risk factor for an event of complicated appendicitis [14]. However, that does not impact patients who are hospitalised and treated with intravenous hydration and antibiotics [15, 16].

In developed countries 15% to 30% of appendicitis cases are complicated [17, 18]. In contrast, among developing countries, that number rises to 60% with a mortality rate of 1%. Such high incidence is most of all due to insufficient access to medical professionals. There are also high costs of healthcare that must be borne by the patients, not to mention an inefficient system of health management. Other reasons exist. First of all, delays in the diagnostics due to the additional wait before seeking medical attention by patients and their caretakers, as well as the failure to diagnose appendicitis by the primary care physicians, and lastly the delayed referral to paediatric surgery departments [19–21].

In order to provide better access to health care in Poland, 24-hour Medical Service Units and Hospital Emergency Units were created. Thus, after 6.00 p.m. on weekdays and on Saturdays, Sundays, and holidays primary health services are provided by 24-hour Medical Service Units. In effect, patients can receive medical advice round the clock, closer to their homes. Whereas in Hospital Emergency Units, besides medical consultation, some diagnostic tools like ultrasonography, CT, or laboratory tests are available. As a result, we observed a decline in the incidence of complicated acute appendicitis after 2007 in our study [22, 23].

The duration of hospital stay was longer in patients with complicated appendicitis. This prolonged stay was usually due to the need for intravenous antibiotics, fluids, and pain medications or postoperative complications such as postoperative abscesses, wound infections, or mechanical obstruction. In otherwise healthy children after appendicitis we believe it is reasonable to aim for less than a 5-day post-operative stay.

The occurrence of complicated appendicitis is correlated with pre-hospital delay. A long duration of symptoms before admittance to surgical ward has higher risk of worse outcome. Among those children, we observed incidences of being hospitalised in paediatric departments and discharged or transferred with delay.

Furthermore, the incidence is also influenced by age. The youngest children have the highest risk of complicated acute appendicitis. Difficulty in communication, inadequate physical examination, and irritability may cause delay in the diagnosis and proper management. The non-specific clinical presentation in those children attributes to a high misdiagnosis rate [24].

Uncomplicated appendicitis requires less medications and is characterised by a shorter length of stay. There are also fewer postoperative complications. It is also important to consider that there is a much lower cost of treating patients with uncomplicated appendicitis compared to those with complicated appendicitis.

A study of Harbor-UCLA Medical Centre showed that a delay or failure to diagnose appendicitis in children is one of the most common reasons for lawsuits [25, 26].

Conclusions

There are still a lot of cases of complicated acute appendicitis. Increased awareness of parents, access to early diagnosis, and consultations with specialists are crucial. The cost to the healthcare system is substantial.

Conflict of interest

The authors declare no conflict of interest.

References

1. Hamill JK, Hill AG. A history of the treatment of appendicitis in children: lesson learned. *ANZ J Surg* 2016; 86: 762-767.
2. Williams GR. Presidential address: a history of appendicitis. With anecdotes illustrating its importance. *Ann Surg* 1983; 197: 495-506.
3. Turner GG. The mortality of appendicitis. *Br Med J* 1915; 1: 997-998.
4. McLanahan S. Further reductions in the mortality in acute appendicitis in children. *Ann Surg* 1950; 131: 853-864.
5. Gołębiowski A, Smyczek D, Kudela G, Janowicz T, Choiński W, Dymek K, Daniluk Matraś J, Grzechnik T, Wolak P. Postępowanie w ostrym zapaleniu wyrostka robaczkowego u dzieci. *Ógólnopolskie badania ankietowe 2007-2011. Standardy Medyczne. Problemy Chirurgii Dziecięcej* 2013; 3: 7-15.
6. Grata-Borkowska U. Bóle brzucha u dzieci – diagnostyka różnicowa i postępowanie terapeutyczne w POZ. *Lekarz POZ* 2016; 2: 151-155.
7. Caperell K, Pitetty P, Cros K. Race and acute abdominal pain in Pediatric Emergency Department. *Pediatrics* 2013; 131: 1098-1106.
8. Górecki W. Ostre zapalenie wyrostka robaczkowego. In: *Chirurgia Dziecięca. PZWL, Warsaw* 2016; 530-544.
9. Wolak P, Gołąbek T, Obarzanowski M, Chłosta P. A complex case of abdominal pain in a patient with pelviureteric junction obstruction. *Videosurgery Miniinv* 2014; 9: 273-275.
10. Adamczyk-Gruszka O, Gruszka J, Niziurski P. Acute appendicitis in a single and multiple pregnancy – a study of two cases. *Studia Medyczne* 2013; 29: 83-88.
11. Sakorafas GH, Mastoraki A, Lappas C, Sampanis D, Danias N, Smyrniotis V. Conservative treatment of acute appendicitis: heresy or an effective and acceptable alternative to surgery? *Eur J Gastroenterol Hepatol* 2011; 23: 121-127.
12. Fogg LK. Use of antibiotics alone for treatment of uncomplicated acute appendicitis: a systematic review and meta-analysis. *Surgery* 2011; 150: 673-683.
13. Ruffolo C, Fiorot A, Pagura G, Antoniutti M, Massani M, Caratozzolo E, Bonariol L, di Pinto FC, Bassi N. Acute appendi-

- citis: what is the gold standard of treatment? *World J Gastroenterol* 2013; 19: 8799-8807.
14. Bickell NA, Aufses AH, Rojas M, Bodian C. How time affects the risk of rupture in appendicitis. *J Am Coll Surg* 2006; 202: 401-406.
 15. Giraud G, Baracchi F, Pellegrino L, Dal Corso HM, Borghi F. Prompt or delayed appendectomy? Influence of timing of surgery for acute appendicitis. *Surg Today* 2013; 43: 392-396.
 16. Stahlfeld K, Hower J, Homitsky S, Madden J. Is acute appendicitis a surgical emergency? *Am Surg* 2007; 73: 626-629.
 17. Johansen L, Thorup J, Rasmussen L. Prolonged length of stay and many readmissions after appendectomy. *Dan Med Bul* 2011; 58: A4296.
 18. Lee SL, Stark R, Yaghoubian A, Shekherdimian S, Kaji A. Does age affect the outcomes and management of pediatric appendicitis? *J Pediatr Surg* 2011; 46: 2342-2345.
 19. Kong VY, Sartorius B, Clarke DL. Acute appendicitis in the developing world is a morbid disease. *Ann R Coll Surg Engl* 2015; 97: 390-395.
 20. Singh M, Kadian YS, Rattan KN, Jangra B. Complicated appendicitis: analysis of risk factors in children. *Afr J Paediatric Surg* 2014; 11: 109-113.
 21. Głuszek S, Kot M. Posocznica w przebiegu zapalenia wyrostka robaczkowego – rozpoznawanie i leczenie. *Wiad Lek* 1988; 15: 991-996.
 22. Journal of Laws 2004 No. 210, item 2135. ACT of August 27, 2004 on healthcare services financed from public funds.
 23. Journal of Laws 2006 o. 191, item 1410. Act of September 8, 2006 on the National Medical Emergency Service.
 24. Bech-Larsen S, Lalla M, Thorup J. The influence of age, duration of symptoms and duration of operation on outcome after appendicitis in children. *Dan Med J* 2013; 60: A4678.
 25. Sullins V, Lee S. Malpractice in cases of pediatric appendicitis: a 30-year review. *SoSU Committee Reports*; October 11, 2014.
 26. Asad S, Ahmed A, Ahmad S, Ali S, Ahmed S, Ghaffar S, Khattak IU. Causes of delayed presentation of acute appendicitis and its impact on morbidity and mortality. *J Ayub Med Coll Abbottabad* 2015; 27: 620-623.

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