

Clinical Profile of Non-traumatic Acute Abdominal Surgeries in the Pediatric Patients: A Philippine Regional Experience

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Abstract: This 5-year study on pediatric (< 18 years old) non-traumatic abdominal surgeries establishes local demographic and clinical profiles, and correlates these factors for risk of complicated appendicitis (rupture, abscess or phlegmon formation). Patient data on clinico-demographic profiles, type of surgery, and indications for surgery were collected. Chi-Square was done to determine risk of complicated appendicitis in terms age and sex. A total 826 cases were included. The mean age of males was 11.08 years and 12.53 years for females (male:female ratio 1.51). Majority of the cases were acute appendicitis (677 cases or 84.5%). Appendicitis cases were categorically divided into two: uncomplicated (suppurative or congestive) and complicated. Ratio of uncomplicated to complicated is 1.23. The rest of the cases were intestinal obstruction, congenital, intestinal perforation, intestinal bleeding and biliary problems. Most congenital surgeries were for infants (< 2 years), while acquired cases were noted in older patients. No reported infantile appendicitis. The risk of complicated appendicitis during childhood was significantly higher compared to adolescence (OR 1.69, [95% CI 1.17-2.47], $p = 0.005$) and males have a higher risk compared to females. (OR 2.01 [95% CI 1.47-2.75], $p < 0.001$). In conclusion, appendicitis is the most common indication for surgery in children. There is a higher risk for complicated cases among males and those of younger age groups.

Keywords: Appendicitis, Pediatric Surgery, Non-traumatic Abdomen, Intestinal Perforation

1. Introduction

Acute abdominal conditions in infants and adolescents differ from adults in many ways from region to region across the world. In the first few years of life, congenital problems are more commonly encountered. As the child grows, etiologies can vary for each age group (e.g. adolescents are more prone to trauma than smaller children). [1] Age alone can set the focus on pertinent differential diagnoses. In infants and toddlers, congenital anomalies can be considered including malrotation, hernias, Meckel's diverticulum, and intussusception. In the school age child, common causes of abdominal pain include constipation and urinary tract infections. In female adolescents, pelvic inflammatory disease, pregnancy, ruptured ovarian cysts or ovarian torsion are contemplated. [1-3] By determining the case mix pertinent to the locality, physicians and surgeons know what

to expect in terms of case load, establish baseline clinical profiles and similarly provide trends over time. Demographic information provides a better understanding in children with abdominal conditions.

Based on 2020 Philippine Statistics Authority census, Panay has a population of 4,730,668. (www.psa.gov.ph). Iloilo City, the island's most urbanized center, has 457,626 people in which our institution is located. The West Visayas State University Medical Center is the only university based tertiary referral hospital, which receives a substantial number of pediatric cases from all over the region. It has robust training programs in surgery, pediatrics and anesthesiology, capable of handling a variety of pediatric cases and is a source of potential manpower to other healthcare institutions in the nearby regions.

According to the United Nations 2019 report on Human Development Index (HDI), the Philippines ranked 106th out

of 189 countries. [4] We are part of the low HDI, low-income countries. There is much potential for greater health care development in our country today. As pointed out by a multicenter study on mortality and morbidity following emergency abdominal surgery in children among low to mid income countries, adjusted mortality is 7 times greater in low to mid HDI countries compared to high HDI countries. [5] The reasons for this disparity are multifactorial- different etiological conditions, unique ethnic background and limited healthcare resources. Through identification and establishment of local data on different abdominal conditions and further contribution to current literature, we can provide generalities in this population, strategically plan for future trends and analyze subsets pertinent in every region. In addition, appendicitis has been and is still the most common indication for abdominal surgery in children. Selected important clinical factors were also analyzed to correlate risks of complicated appendicitis.

2. Methodology

This is a 5-year cross sectional study on pediatric patients (<18 years old) who underwent surgery for acute abdominal conditions conducted at the West Visayas State University Medical Center (WVSUMC) from January 1, 2015 to December 31, 2019. Data on patients were classified according to clinical groups based on age and abdominal conditions. Patients were divided into three groups based on age: Infants (>2-year-old), Childhood (2-9 years old) and Adolescent (10-18 years old), and according to abdominal conditions: traumatic and non-traumatic conditions.

Data collected included age, sex, operative diagnosis, operative procedure and type of abdominal surgery. Data were kept confidential and ethical approval for the study were secured from the institution's ethical review board. Sources of data were from the in-patient charts, operative records, monthly census records and out-patient records.

2.1. Inclusion Criteria

All pediatric patients (18 years old and below) who underwent abdominal surgery.

2.2. Exclusion Criteria

- a) Patients who were pregnant and underwent surgery for pregnancy related complications.
- b) Patients who were operated for a surgical indication but no intra-operative pathology was found.
- c) Patients who were operated at another institution and was referred to our institution for re-operation.
- d) Incomplete patient charts.

A total 8855 patients were initially considered, 8029 were excluded based on the criteria and 826 were included in the final analysis.

2.3. Data Analysis

Descriptive variables included mean, range and percentage. Different frequencies, mean and proportion

pertinent to each age subgroup were reported. Chi Square Test was used to show association of age and sex to risk of complicated appendicitis. Data were presented in graph and tables.

3. Results

A total 8855 patients were initially considered, 8029 were excluded based on the criteria and 826 were included in the final analysis. In the excluded patients, 8 were found to have no pathology intra-operatively. All of these 8 patients were presumed initially with acute appendicitis.

Table 1. Non traumatic acute abdominal cases done in each pediatric age group from January 1, 2015 to December 2019 at the West Visayas Medical Center State University-Medical Center (WVSU-MC).

Age group	Cases	n	%
Infancy (<2-year-old) Male (\bar{x} - 0.61 years) Female (\bar{x} - 1.03 years)	Congenital	41	
	Imperforate anus	9	
	Hirschsprung's Disease	9	
	Abdominal Wall Defects	7	5.1%
	Intestinal Atresia	4	
	Diaphragmatic Hernia	4	
	Malrotation	1	
	Intestinal obstruction	49	
	Intussusception	25	
	Incarcerated inguinal hernia	22	6.1%
	Adhesions	1	
	Tumor	1	
	Others	2	
	Enterocolitis	1	0.2%
Childhood (2-9 years old) Male (\bar{x} - 7.18 years) Female (\bar{x} - 6.63 years)	Meckel's Diverticula	1	
	Uncomplicated Appendicitis	64	8.0%
	Complicated Appendicitis	77	9.6%
	Intestinal obstruction	22	
	Intussusception	4	
	Incarcerated inguinal hernia	6	2.7%
	Adhesions	11	
	Sigmoid volvulus	1	
	Others	2	
	Enterocolitis	1	0.2%
	Malrotation	1	
	Uncomplicated Appendicitis	312	39.0%
	Complicated Appendicitis	221	27.6%
	Intestinal obstruction	3	
Adolescent (10-18 years old) Male (\bar{x} - 14.64 years) Female (\bar{x} - 16.12 years)	Incarcerated inguinal hernia	1	0.4%
	Adhesions	2	
	Intestinal Perforation	6	
	Infectious colitis	2	0.7%
	Gastrointestinal tuberculosis	1	
	Adhesions	3	
	Others	2	
	Meckel's Diverticula	1	0.2%
	Acute Cholecystitis	1	
	Total		801

In the included 826 cases, the male:female ratio was 1.51. Mean age of male patients was 11.08 years old and mean age of females was 12.53 years old. Distribution according to age groups was presented in Figure 1. Among the total cases, 801 cases (97%) were non trauma and only 25 cases (3%) were trauma cases. Majority of non-trauma cases were acute appendicitis (677 cases, 84.5%). Appendectomy cases were divided into two groups; uncomplicated cases (suppurative or

congestive) and complicated (ruptured appendicitis, abscess or phlegmon formation). The ratio for uncomplicated to complicated cases was 1.23. The rest of the abdominal surgery cases were for intestinal obstruction, congenital,

intestinal perforation, intestinal bleeding and biliary problems. Table 1 summarizes cases done in each particular age group infant (<2 year old), childhood (2-9 years old) and adolescent (10-18 years old).

Table 2. Odds ratio of uncomplicated to complicated appendicitis in relation to age and sex.

	Uncomplicated Appendicitis (n)	Complicated Appendicitis (n)	Odds risk (95% CI)	p-value (χ^2)
Childhood (2-9 year old)	64	77		
Adolescent (10-18 year old)	312	221	1.69 (1.17- 2.47)	0.005* (χ^2 -7.81)
Male	191	199		
Female	189	98	2.01 (1.47-2.75)	<0.001* (χ^2 -19.13)

*significant at p-value ≤ 0.05

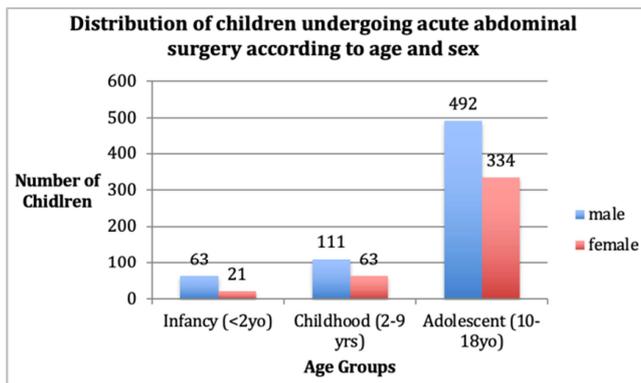


Figure 1. Distribution of children who underwent abdominal surgery according to age group and sex admitted in West Visayas Medical Center State University-Medical Center (WVSU-MC) from January 1, 2015 to December 2019.

In our series, there were 7 female adolescent patients with concomitant gynecologic and obstetric problems who were operated for acute appendicitis (1.3%). There was one case of a 16-week pregnant adolescent operated for appendicitis. There were 2 cases of pelvic inflammatory disease and the rest were found to have concomitant benign ovarian cysts.

Chi square was done to correlate complications as to age and sex. The odds of having complicated cases among childhood appendicitis were significantly higher compared to adolescent appendicitis. (OR 1.69, [95% CI 1.17-2.47]). Whereas the odds of having complicated appendicitis were significantly higher in males compared to females. (OR 2.01 [95% CI 1.47- 2.75]).

4. Discussion

Majority of abdominal surgeries done were for appendicitis while only 15.5% accounted for other causes. As expected, most congenital abdominal surgeries were done for neonates and infants. Surgeries for infants, however, account for only a small fraction of the entire pediatric surgical service (5.1%). Aside from congenital diseases, intestinal obstruction caused by intussusception and incarcerated hernia accounted for a higher percentage of surgeries done in infancy. Acquired conditions such as adhesions, volvulus, enterocolitis, Meckel's Diverticula, cholecystitis and gastrointestinal tuberculosis accounted for the majority of surgeries done in the older

children. However, a relatively low incidence for these indications were observed probably because these diseases were most often initially treated conservatively (ex. adhesions and tuberculosis). The different geographic, ethnical and racial backgrounds in our country can explain the cases we see in our institution. Our case mix closely mirrors that of our colleagues from the United States; a developed country in which a vast majority of non-traumatic abdominal surgeries are done for appendicitis while intestinal obstruction, intestinal perforation and surgeries for congenital anomalies comprise for just a portion of the entire surgical service. [6, 7].

While most causes of acute abdominal pain coming into the emergency room maybe non-surgical; based on our results, the most common cause of an acute surgical abdomen in the pediatric age group is still appendicitis. [8] The higher risk of complicated appendicitis in male than female patients seen in our results can be explained by the higher incidence of appendiceal fecaliths and calculi in females. [9] Current consensus showed that luminal obstruction has an important role in the pathophysiology of appendicitis. [10] Contrary to some opinion of females having a higher rate of misdiagnosis leading to higher rupture rates, our results showed that risk is lower compared to males. Published studies have shown that there were no significant changes in the population incidence of non-incidental appendectomy, overall appendicitis or rate of misdiagnosis in women compared to men. [11].

Our institution uses clinical pathways in the management of appendicitis utilizing clinical presentation and a few blood examinations to come up with the diagnosis. Imaging such as ultrasound (most commonly utilized) or computed tomography (reserved for cases in which ultrasound was inconclusive) is reserved for patients where the diagnosis cannot be established. In proven cases of complicated appendicitis without signs of obstruction, peritonitis and sepsis, the initial approach include drainage and intravenous antibiotics. Otherwise, an operative approach is done in most cases.

As reported elsewhere in the literature, children have a higher incidence of rupture or having complicated cases of appendicitis. Our results confirm to what others have reported. Seeking medical attention for a child with abdominal pain maybe complicated by behavioral, economic, social, and geographical problems. Even in developed countries, where healthcare provision is universal; they note that positive predictors of rupture included lower economic classes, younger age of

diagnosis, and geographical proximity. [12] This supports a multifactorial problem apart from economic factors as to why we observe higher cases of complicated cases of appendicitis in younger children. In the United States, appendicitis rupture rate has been suggested as a national indicator to health access. There is higher rupture rate among different ethnic groups in which racial minorities of Asians, Hispanic and African American have higher appendicular rupture compared to whites. Aside from race, they noted lower income, lower age and absence of private insurance were associated with higher risk. The authors of this report argued that this can be ameliorated by timely access to care. [13] Being in a developing country, most of our patients belong to the mid to lower income class. However, economic status should not hinder access to quality surgical care. It is also logical to use appendiceal rupture rate as an indicator to health accessibility being appendicitis as the most common cause of an acute surgical abdomen.

We have provided a general profile of pediatric surgical patients managed in our institution. While this may or may not be reflective of other institutions, this relatively simple summation of statistics can provide better allocation of health care resources based on present surgical needs in the locality. The ability to prioritize resources to areas of greatest impact is not only reasonable but also practical.

5. Conclusion

Appendicitis is still the most common indication for an acute non traumatic abdominal surgery in the pediatric age group. Among appendicitis cases, uncomplicated are more common than complicated cases with higher risk for complications in males and younger children. Suggestions in using rates of complicated appendicitis to measure health systems accessibility and delivery can be explored specially when applied to vulnerable groups. This concept needs further validation and can be of future clinical research interest. It is also recommended that a future cohort study should be done to focus on risk factors for complicated appendicitis. Studies to investigate other potential risk factors such as distance of patient's home from the hospital, socioeconomic status, and other context-appropriate accessibility-related risk factors should be explored.

Much has been published about clinical demographics on pediatric patients with abdominal conditions and there are regional differences which have resulted to different practices among surgeons tailored to their locality. This article adds to the body evidence on peculiarities of pediatric patients with abdominal conditions in a specific region in the world. Our Philippine experience offers our own demographic data to contribute to global trends in pediatric abdominal conditions. Future researches and comparing regional results from other centers can provide a wider understanding in this specific clinical field in pediatrics.

Competing Interests

The author declare that he has no competing interests.

Authorship

JP Guzman- conceptualization, drafting of proposal, data collection, statistical analysis, manuscript writing, final revision of the manuscript.

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