

قال الله تعالى: {اقرأ باسمِ رَبِّكَ الَّذِي خَلَقَ (1) خَلَقَ الْإِنْسَانَ مِنْ عَلَقٍ (2) اقْرَأْ وَرَبُّكَ الْأَكْرَمُ (3) الَّذِي عَلَّمَ بِالْقَلَمِ (4) عَلَّمَ الْإِنْسَانَ مَا لَمْ يَعْلَمْ }

صدق الله العلي العظيم

(سورة العلق)



MANAGEMENT OF PERFORATED APPENDICITIS IN CHILDREN BELOW 12 YEARS OLD

Supervised by Dr. Ahmed Zubar Zain

Done by Farah Ihsan Ali

Class of 2018-2019

CONTENTS:

<u>subject</u>	<u>page</u>
<u>Acknowledgment</u>	<u>2</u>
<u>Abstract</u>	<u>3</u>
<u>Introduction</u>	<u>4</u>
<u>Anatomy</u>	<u>6</u>
<u>Physiology</u>	<u>7</u>
<u>Acute appeditis</u>	<u>7</u>
<u>Lab investigation</u>	<u>9</u>
<u>Management</u>	<u>12</u>
<u>Results</u>	<u>15</u>
<u>Discussion</u>	<u>17</u>
<u>Conclusion</u>	<u>19</u>
<u>Recommendation</u>	<u>20</u>
<u>Refrences</u>	<u>21</u>

Acknowledgment

This study was supported [by Al-Imamain Al-Kadhmiya Teaching Hospital] .

First I thank Allah the one who help me in my life .

I thank [Dr.AhmedZubar] for assistance with this study for comments that greatly improved the manuscript.I would also like to show our gratitude to the (Surgical department) for sharing their pearls of wisdom with us during the course of this study, I am also immensely grateful to (my family) for their comments on an earlier version of the manuscript.

Abstract

Background:

Perforated appendicitis is a common surgical emergency that requires almost immediate management within the first few hours.

Patients and methods:

A prospective study for thirteen patients admitted to Al-Imamain Al-Kadhimain teaching hospital who complain of acute abdomen. Data collected during time period from 28th of December to the 3rd of March .Proper history and physical examination was done for all the thirteen cases.

Aim of study:

Management of perforated appendicitis in age group up to 12 years old.

INTRODUCTION

Appendiceal disease is a frequent reason for emergency hospital admission, and appendectomy is one of the most common emergency procedures performed in contemporary medicine. Despite the prevalent role this organ plays in healthcare today, the human appendix was not noted until 1492. Leonardo da Vinci depicted the appendix in his anatomic drawings, but these were not published until the eighteenth century. In 1889, Charles McBurney published his landmark paper in the *New York State Medical Journal* describing the indications for early laparotomy for the treatment of appendicitis.¹

The first known appendectomy was performed in 1736 by Claudius Amyand in London.

1- Appendicitis is one of the most common surgical emergencies in contemporary medicine, with a yearly incidence rate of about 100 per 100,000 inhabitants. Lifetime risk for appendicitis is 8.6% for males and 6.7% for females, with the highest incidence in the second decade of life.

2- The natural history of appendicitis is unclear, but it appears that progression to perforation is not predictable and that spontaneous resolution is common, suggesting that nonperforated and perforated appendicitis may, in fact, be different diseases.

3- Right lower quadrant pain, gastrointestinal symptoms starting after the onset of pain, and a systemic inflammatory response with leukocytosis and neutrophilia, increased C-reactive protein concentration, and fever are considered diagnostic of appendicitis. The Appendicitis Inflammatory Response Score or Alvarado score can help improve diagnostic accuracy.

5- The role of nonoperative treatment for uncomplicated appendicitis remains controversial. Currently, appendectomy remains the standard of care. Laparoscopic appendectomy has a slight benefit over open appendectomy.

6- Perforated or complicated appendicitis is more common in the very young (age 5 years) and very old (age 65 years).

7- Complicated appendicitis without signs of sepsis or generalized peritonitis may benefit from nonoperative management.

The role of incidental appendectomy is limited to patients at high risk for misdiagnosis of appendicitis (malrotation, patients unable to respond or react normally), patients at high risk for complications with appendicitis (children ready to undergo chemotherapy), and patients with limited access to modern healthcare.

ANATOMY

The average length of the appendix is 6 to 9 cm; however, it can vary in length from <1 to >30 cm.

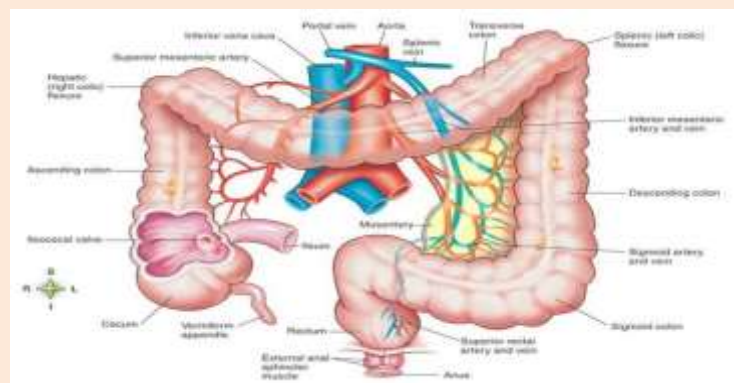
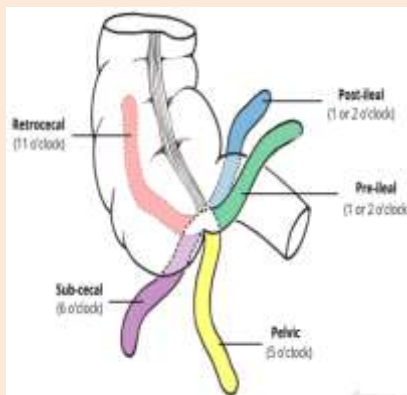
The outer diameter varies between 3 and 8 mm, whereas the luminal diameter varies between 1 and 3 mm.

The appendix receives its arterial supply from the appendicular branch of the ileocolic artery. This artery originates posterior to the terminal ileum, entering the mesoappendix close to the base of the appendix.

The lymphatic drainage of the appendix flows into lymph nodes that lie along the ileocolic artery. Innervation of the appendix is derived from sympathetic elements contributed by the superior mesenteric plexus (T10-L1) and afferents from the parasympathetic elements via the vagus nerves.

The histologic features of the appendix are contained within the three following layers: the outer serosa, which is an extension of the peritoneum; the muscularis layer, which is not well defined and may be absent in certain locations; and finally, the submucosa and mucosa. Lymphoid aggregates occur in the submucosal layer and may extend into the muscularis mucosa. Lymphatic channels are prominent in regions underlying these lymphoid aggregates. The mucosa is like that of the large intestine, except for the density of the lymphoid follicles. The crypts are irregularly sized and shaped, in contrast to the more uniform appearance of the crypts in the colon.

Neuroendocrine complexes composed of ganglion cells, Schwann cells, neural fibers, and neurosecretory cells are positioned just below the crypts.



Figure(1) :varius position of appendix

PHYSIOLOGY

For many years, the appendix was erroneously believed to be a vestigial organ with no known function. It is now well recognized that the appendix is an immunologic organ that actively participates in the secretion of immunoglobulins, particularly immunoglobulin A.

The appendix may function as a reservoir to recolonize the colon with healthy bacteria.

ACUTE APPENDICITIS

ETIOLOGY:

The etiology and pathogenesis of appendicitis are not completely understood. Obstruction of the lumen due to fecaliths or hypertrophy of lymphoid tissue is proposed as the main etiologic factor in acute appendicitis.

The frequency of obstruction rises with the severity of the inflammatory process. Fecaliths and calculi are found in 40% of cases of simple acute appendicitis, in 65% of cases of gangrenous appendicitis without rupture, and in nearly 90% of cases of gangrenous appendicitis with rupture.

Traditionally, the belief has been that there is a predictable sequence of events leading to eventual appendiceal rupture.

The proximal obstruction of the appendiceal lumen produces a closed-loop obstruction, and continuing normal secretion by the appendiceal mucosa rapidly produces distension. Distension of the appendix stimulates the nerve endings of visceral afferent stretch fibers, producing vague, dull, diffuse pain in the mid-abdomen or lower epigastrium. Distension increases from continued mucosal secretion and from rapid multiplication of the resident bacteria of the appendix. This causes reflex nausea and vomiting, and the visceral pain increases. As pressure in the organ increases, venous pressure is exceeded. Capillaries and venules are occluded but arterial inflow continues, resulting in engorgement and vascular congestion. The inflammatory process soon involves the serosa of the appendix and in turn the parietal peritoneum. This produces the characteristic shift in pain to the right lower quadrant.

CLINICAL PRESENTATION:

The inflammatory process in the appendix presents as pain, which initially is of a diffuse visceral type and later becomes more localized as the peritoneal lining gets irritated (Table 30-1).³³ Symptoms. Appendicitis usually starts with periumbilical and diffuse pain that eventually localizes to the right lower quadrant (sensitivity, 81%; specificity, 53%). Although right lower quadrant pain is one of the most sensitive signs of appendicitis, pain in an atypical location or minimal pain will often be the initial presentation. Variations in the anatomic location of the appendix may account for the differing presentations of the somatic phase of pain.

Appendicitis is also associated with gastrointestinal symptoms like nausea (sensitivity, 58%; specificity, 36%), vomiting (sensitivity, 51%; specificity, 45%), and anorexia (sensitivity, 68%; specificity, 36%). Gastrointestinal symptoms that develop before the onset of pain suggest a different etiology such as gastroenteritis.

Diarrhea may occur in association with perforation, especially in children.

Signs. Early in presentation, vital signs may be minimally altered. The body temperature and pulse rate may be normal or slightly elevated. Changes of greater magnitude may indicate that a complication has occurred or that another diagnosis should be considered.

Physical findings are determined by the presence of peritoneal irritation and are influenced by whether the organ has already ruptured when the patient is first examined. Patients with appendicitis usually move slowly and prefer to lie supine due to the peritoneal irritation. On abdominal palpation, there is tenderness with a maximum at or near McBurney's point

On deep palpation, one can often feel a muscular resistance (guarding) in the right iliac fossa, which may be more evident when compared to the left side.

When the pressure of the examining hand is quickly relieved, the patient feels a sudden pain, the so-called rebound tenderness. Indirect tenderness (Rovsing's sign) and indirect rebound tenderness (i.e., pain in the right lower quadrant when the left lower quadrant is palpated) are strong indicators of peritoneal irritation. Rebound tenderness can be very sharp and uncomfortable for the patient. It is therefore recommended to start with testing for indirect rebound tenderness and direct percussion tenderness. Pain with extension of the right leg (psoas sign) indicates a focus of irritation in the proximity of the right psoas muscle.

Similarly, stretching of the obturator internus through internal rotation of a flexed thigh (obturator sign) suggests inflammation near the muscle.

Laboratory Findings:

Laboratory examinations are therefore an important part of the diagnosis. Mild leukocytosis is often present in patients with acute, uncomplicated appendicitis and is usually accompanied by a polymorphonuclear prominence. It is unusual for the white blood cell count to be $\geq 18,000$ cells/mm³ in uncomplicated appendicitis. Counts above this level raise the possibility of a perforated appendix with or without an abscess. An increased C-reactive protein (CRP) concentration is a strong indicator of appendicitis, especially for complicated appendicitis. White blood cell counts can be low due to lymphopenia or septic reaction, but in this situation, the proportion of neutrophils is usually very high. Therefore, all inflammatory variables should be viewed together. Appendicitis is very unlikely if the white blood cell count, proportion of neutrophils, and CRP are all normal. Urinalysis can be useful to rule out the urinary tract as the source of infection. 2`

Symptoms	Score
Migratory right iliac fossa pain	1
Anorexia	1
Nausea/Vomiting	1
Signs	
Tenderness in right iliac fossa	2
Rebound tenderness	1
Elevated temperature	1
Laboratory Findings	
Leucocytosis	2
Shift to the left of neutrophils	1
Total score	10

TABLE(1),ALVARADO SCORE

Score	Significance
1-4	Unlikely to be acute appendicitis
5-6	Possible diagnosis of acute appendicitis
7-8	Acute appendicitis present
9-10	Definite acute appendicitis requiring surgery

TABLE(2),SIGNIFICANCE OF ALVARADO SCORE

Imaging Studies

Plain films of the abdomen can show the presence of a fecalith and fecal loading in the cecum associated with appendicitis but are rarely helpful in diagnosing acute appendicitis; however, they may be of benefit in ruling out other pathology.

A chest radiograph is helpful to rule out referred pain from a right lower lobe pneumonic process. If the appendix fills on barium enema, appendicitis is unlikely; however, this test is not indicated in the acute setting. Ultrasonography and computed tomography (CT) scan are the most commonly used imaging tests in patients with abdominal pain, particularly in evaluation of possible appendicitis.

Thickening of the appendiceal wall in ultrasonography and the presence of periappendiceal fluid are highly suggestive of appendicitis.

Demonstration of an easily compressible appendix measuring <5 mm in diameter excludes the diagnosis of appendicitis. The sonographic diagnosis of acute appendicitis has a reported sensitivity of 55% to 96% and a specificity of 85% to 98%.



Figure(2): ultrasound image of right iliac fossa,
Show thickening of appendix

Differential Diagnosis

Pediatric Patient. Acute mesenteric adenitis is the disease most often confused with acute appendicitis in children. Almost invariably, an upper respiratory tract infection is present or has recently subsided. The pain usually is diffuse, and tenderness is not as sharply localized as in appendicitis. Voluntary guarding is sometimes present, but true rigidity is rare. Generalized lymphadenopathy may be noted. Laboratory procedures are of little help in arriving at the correct diagnosis, although a relative lymphocytosis, when present, suggests mesenteric adenitis.

Observation for several hours is appropriate if the diagnosis of mesenteric adenitis is suspected, as it is a self-limited disease.

Management

Uncomplicated Appendicitis

Operative versus Nonoperative Management of Uncomplicated Appendicitis In patients with uncomplicated appendicitis, surgical treatment has been the standard of treatment since McBurney reported his experiences. The concept of nonoperative treatment for uncomplicated appendicitis developed from two lines of observations. First, for patients in an environment where surgical treatment is not available (e.g., submarines, expeditions in remote areas), treatment with antibiotics alone was noted to be effective. Second, many patients with signs and symptoms consistent with appendicitis who did not pursue medical treatment would occasionally have spontaneous resolution of their illness.

Urgent versus Emergent Appendectomy for Uncomplicated Appendicitis

Traditionally, appendicitis has been considered a surgical emergency. Once diagnosed, a patient was emergently taken to the operating room for surgical treatment. However, delays in diagnosis, lack of access to available operating suites, and nonoperative management of appendicitis have challenged the notion that uncomplicated appendicitis is a surgical emergency.

Three retrospective studies have evaluated the role of emergent or urgent surgery for uncomplicated appendicitis; the emergent group had a time from presentation to the operating room of <12 hours, whereas the urgent group had a time from presentation to the operating room of 12 to 24 hours.

Complicated Appendicitis

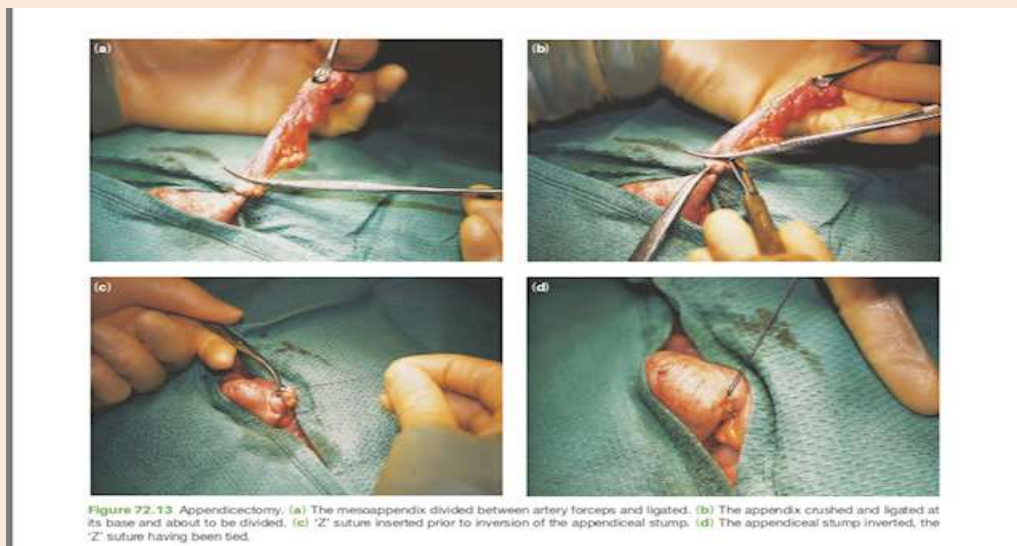
Complicated appendicitis typically refers to perforated appendicitis commonly associated with an abscess or phlegmon. The yearly incidence rate of perforated appendicitis is about 2 per 10,000 persons. Children less than 5 years of age and patients more than 65 years of age have the highest rates of perforation (45% and 51%, respectively). The proportion of perforation increases with increasing duration of symptoms.

Rupture should be suspected in the presence of generalized peritonitis and a strong inflammatory response. In many cases, rupture is contained and patients display localized peritonitis.

OPERATIVE INTERVENTIONS FOR THE APPENDIX

Open Appendectomy

Typically performed with a patient under general anesthesia, For early non perforated appendicitis, a right lower quadrant incision at McBurney's point (one-third of the distance from the anterior superior iliac spine to the umbilicus) is commonly used. If perforated appendicitis is suspected or the diagnosis is in doubt, a lower mid line laparotomy can be considered.



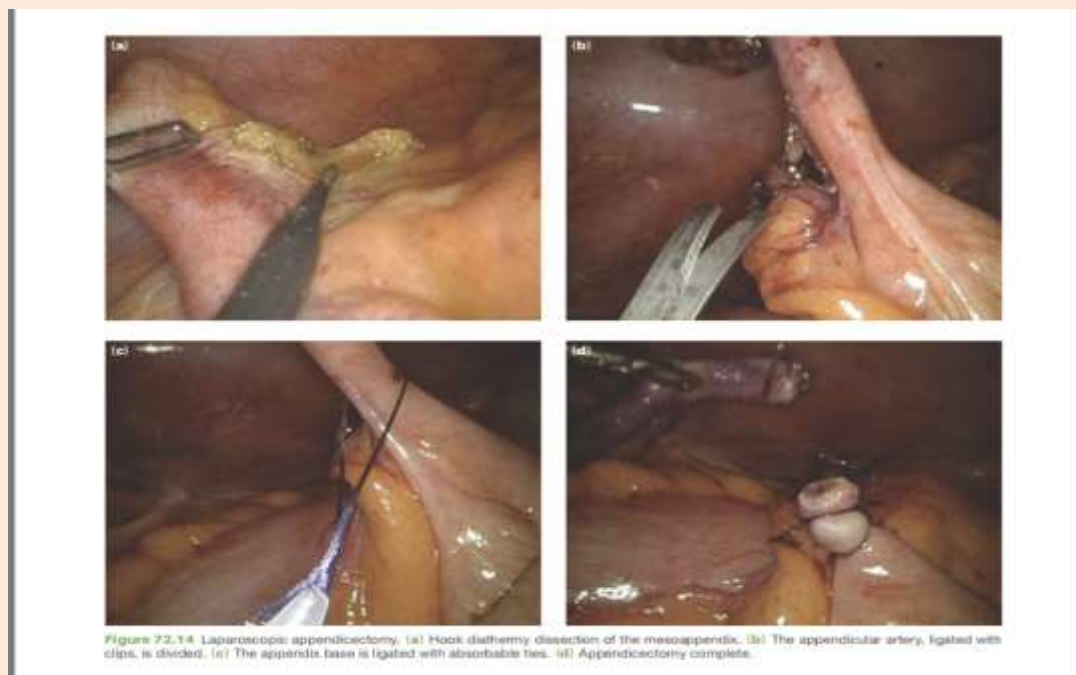
Figure(3): show open appendeectomy

Laparoscopic Appendectomy

The first reported laparoscopic appendectomy was performed in 1983 by Semm; Laparoscopic appendectomy is associated with fewer incisional surgical site infections compared to open appendectomy.

However, laparoscopic appendectomy may be associated with increased risk of intra-abdominal abscess compared to open appendectomy. There is less pain, shorter length of stay, and quicker return to normal activity with laparoscopic appendectomy when compared to open appendectomy.

Laparoscopic appendectomy is associated with increased operative duration and increased operating room costs.⁵



Figure(4): show laproscopic appendectomy

RESULTS

The total cases collected "13"cases, the results were according to age up to 12 years old and the most common age group was 3-6 years old , and according to sex male was more incidence69.2% than female30.7% , most of cases were stay in hospital about 3-5 days , duration of illness was 1-4 days and usage of drain done in 9 of patients after operation.

all cases had free fluid collection and thickening in the wall of appendix in ultra sound findings.

About 69.2% WBC count more than 20000 cells/micro.l , and about 15.3% of post operative complication is wound infection during my research intetval .

The most common presentation was pain in right iliac fossa100% associated with fever 69.20% ,anorexia69.20% and vomiting84.60% .

Rebound , psoas, rovsing, cough impulse and pointing signs were positive in most of cases .

Gender	Number	Percentage
Male	9	69.2%
Female	4	30.7%

Table (3) Sample size and gender distribution

Age	Counts	Percentage
1-3 YO	0	0
3-6 YO	5	38.4 %
6-9 YO	4	30.7 %
9-12 YO	4	30.7 %

Table (4):Age distribution of perforated appendix

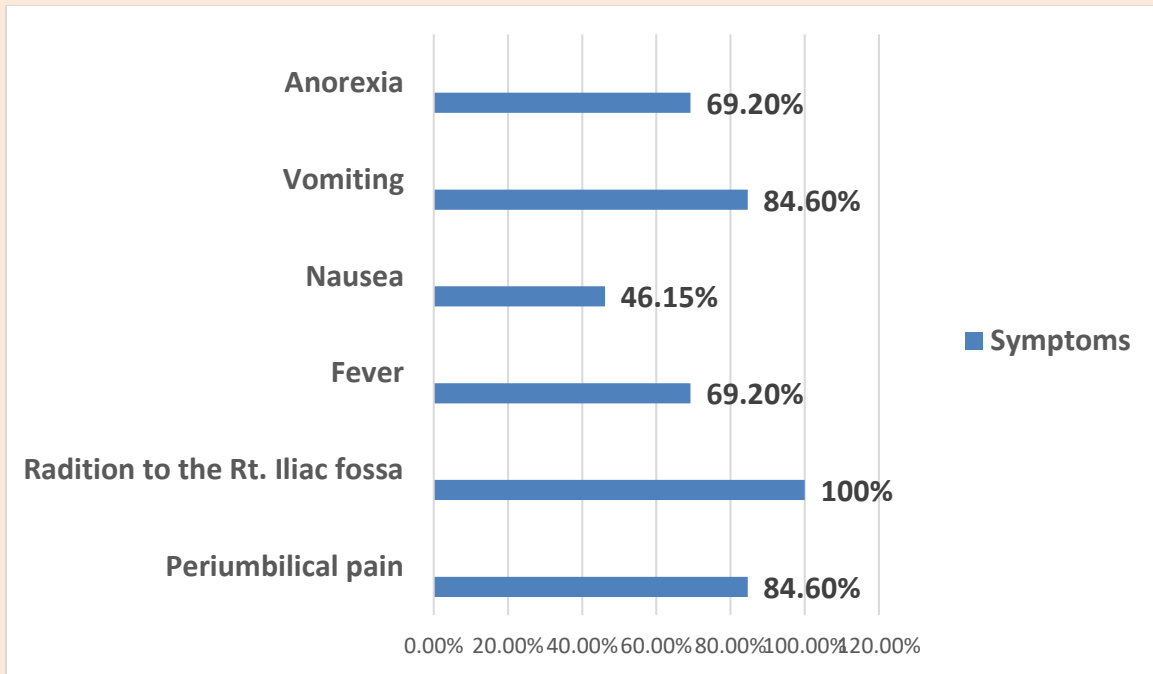


Figure (5): Symptoms percentage of perforated appendix

WBC Counts	11000-15000	0	0
	15000-20000	4	30.7 %
	More than 20000	9	69.2 %

Table (5): WBC counts of the patient sample

Post operative complications		Percentage
Paralytic ileus	1	7.6 %
Wound infection	2	15.3 %
Seroma	1	7.6 %

Table (6) :Post operative complications

Discussion

Acute appendicitis is the most common surgical abdominal emergency in the pediatric population.

The goal of our study was to identify the presenting symptoms and signs and examine their subsequent management.

By this study in thirteen cases collected from (Al-Imamain Al-Kadhamian Teaching Hospital)

was found that highest risk for perforation is in the age group 3-6 years old and male had high incidence than female for perforation.

The most common presentation is right lower abdominal pain, fever, nausea, vomiting.

Investigation shows WBC count in most cases more than 15000 cells/mm³ and ultrasound findings showed thickened in the wall of appendix and free fluid collection and required early appendectomy.

Duration of illness was 1-4 days and hospital stay about 3-5 days.

Post operative complications were wound infection (2), paralytic ileus (1), and seroma (1) respectively.

When we compared our study to the study of Colvin, et al; that shows the patients with age group less than 3 years old have low incidence to develop perforated appendix.

The perforation rate was highest in youngest patients especially in age group 3-5 years old.

Patients presented with maximal right lower quadrant tenderness, nausea, and pain with percussion, and coughing.

Also presented with vomiting, fever and diarrhea.

Elevated WBC count especially neutrophil counts are sensitive indicators of appendicitis.

Psoas, obturator and Rovsing signs were infrequent but very specific for appendicitis. ³

And Study of Javed Alloo et al; show appendicitis is the most surgical abdominal emergency in pediatric population, but rarely considered in children less than 3 years of age.

The most common presentation in 27 children have vomiting(27)
,fever(23),pain(21),anorexia(15) and diarrhea(11).

The average duration of symptoms is 3 days, with 4 or more days in 9 children .

Perforated appendicitis was found in all 27 cases. An appendectomy was performed to 25 cases and RLQ drain was placed in 18 cases .

16 of patients had 22 complications , which included 6 wound infections ,4 abscesses, 4 wound dehisces,4 pneumonias and one enterocutaneous fistula.

Perforated appendicitis was found in less than 3 years of age , resulting in very high morbidity , although it is uncommon in this age group .`4`

Conclusion

- The highest incidence of perforation in our study in age between 3 to 6 years old.
- Male is most common affected than female.
- The most common presentation is right lower quadrant pain and fever.
- Surgical appendectomy should be done as early as possible because high risk of peritonitis .
- The most common complication is wound infection after appendectomy .

Recommendation

- We must raise the suspicion of acute appendicitis in any child with abdominal pain .
- Early diagnosis and surgical treatment of acute appendicitis must be our goal in order to prevent complication .
- Proper post operative management and follow up must be done to prevent post operative complication .

References

1` Mike K. Liang, Roland E. Andersson, Bernard M. Jaffe, and

David H. Berger ,schwartzs principles of surgery 10th edition published in 2015 , p. 1241-1248.

2` Alan Norrish & Chris Lavy; Bailey and Loves 27th edition published in 2018 by CRC press ,p.1326

3` Colvin, Joshua M. MD*; Bachur, Richard MD†; Kharbanda, AnupamMD‡Pediatric Emergency Care: December 2007 Department of Pediatrics, Morgan Stanley Children's Hospital, Columbia University, New York, NY; †Department of Pediatrics and Division of Pediatric Emergency Medicine, Children's Hospital, Harvard Medical School, Boston, MA; and ‡Department of Pediatrics and Division of Pediatric Emergency Medicine, Morgan Stanley Children's Hospital, Columbia University, New York, NY.

4` Javed Alloo,Theodore Gerstle,Joel Shilyansky,Sigmund H. Ein,January 2004.

1.The Family Practice Teaching Unit, The Scarborough Hospital* , Toronto, Ontario, Canada.

2.Division of General Surgery, The Hospital for Sick Children & Department of Surgery, University of Toronto, Toronto, Ontario, Canada.

3.Division of General Surgery, Rm. 1526, The Hospital for Sick Children, 555 University Avenue, Toronto, ON, Canada M5G 1X8.

5` Alan Norrish & Chris Lavy; Bailey and Loves 27th edition published in 2018 by CRC press ,p.1310

