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ORIGINAL ARTICLE

An Experience with 31 Cases of Neonatal Appendicitis: A Retrospective Study

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ABSTRACT

Background: Neonatal appendicitis (NA) is rarely diagnosed due to lack of specific symptoms and signs. The aim of this study is to share our experience with NA.

Methods: We performed a retrospective data review from electronic medical records of patients admitted at Children's Hospital of Chongqing Medical University (CHCMU) with the clinical diagnosis of NA from October 2001 to July 2018.

Results: Of 31 neonates, male neonates (n=20) accounted for 64.5%. Abdominal distension and anorexia were the most common clinical features (61.3%, n=19). Neonates with elevated C- reactive protein (CRP) accounted for 92.6% (n=25) where as 51.6% (n=16) had normal white blood cell count (WBC). Of 29 neonates who underwent surgery, 69% (n=20) had perforated appendicitis.

Conclusion: Neonatal appendicitis lacks specific clinical features, and early diagnosis is difficult. Clinicians need to have high index of suspicion when attending neonates with features of abdominal sepsis.

Key words: Acute appendicitis; Neonatal appendicitis; Necrotizing enterocolitis

INTRODUCTION

Acute appendicitis is extremely rare in neonatal age group.[1-3] It accounts for an estimated 0.04–0.2% of childhood appendicitis.[3-11] The Clinical features of NA are very atypical, which leads to misdiagnosis and delayed treatment.[4,6] In addition, perforation of NA is more common, that results in high morbidity and mortality.[2,6–10].

The aim of this study was to assess clinical features, investigations and management of NA.

MATERIALS AND METHODS

We performed a retrospective review of medical record of patients admitted to our hospital with clinical diagnosis of NA from October 2001 to July 2018. A total of 31 patients were found. The data was obtained from electronic medical records of the hospital. All patients with age 0-28 days were included in this study.

This study was approved by the Ethics Committee of Children's Hospital of Chongqing Medical University (CHCMU).

RESULTS

Demography: Of the 31 patients with NA, male predominated with a male to female ration of 1.8:1. More than half of the patients (51.6%) were full term babies. Mean age of presentation was 16 ±10.43 days. Table 1 describes demographic features of study population.

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Clinical Features: These patients presented with various clinical features not specific to any particular diagnosis. The common features were abdominal distension, reluctance to feed, and fever. Table 2 describes clinical features in the study population.

Table 1: Data on 31 cases of Neonatal Appendicitis

Mean age of onset	**16.06 days**	**±10.43**
Mean hospital stay	16.32 days	±6.83
Maturity	n	%
Preterm	12	38.7
Term	16	51.6
Unassigned	3	9.7
Sex	n	%
Male	20	64.5
Female	11	35.5

Table 2: Clinical characteristics of 31 cases of Neonatal Appendicitis.

Clinical Findings (n=31)	**n**	**%**
Fever	10	32.3
Abdominal Distention	19	61.3
Vomiting	13	41.9
Reluctance to feed	19	61.3
Abdominal wall erythema	8	25.8
Blood in stool	6	19.4
Bowel sound change	17	54.8
Abdominal tenderness	16	51.6
Right inguinal area mass	8	25.8

Diagnosis: A number of laboratory (Table 3) and imaging (Table 4) investigations were done to reach a preoperative diagnosis and optimize the baby. NEC was our most common preoperative diagnosis followed by an incarcerated inguinal hernia. NA was suspected in only 4 patients (Table 5).

Management: All patients underwent surgery on emergent basis except 2 who were managed conservatively. At surgery, 20 patients (69%) had perforated appendicitis, 8 (27.6%) had suppurative appendicitis, and 1 had acute appendicitis. In 8 patients (27.6%), the appendicitis was due to incarceration in inguinal hernia (Amyand hernia).

In 10 patients, NEC was suspected as a cause of appendicitis. Postoperatively 10 patients developed septicemia which was managed accordingly. All the patients were discharged in good condition. No death occurred in our series.

Table 3: Laboratory findings of study cases.

White blood cells (n=31)	**n**	**%**
Elevated	12	38.7
Normal	16	51.6
Reduced	3	9.7
CRP (n=27)		
Elevated	25	92.6
Normal	2	7.4
Blood culture isolates (n=15)		
Klebsiella pneumoniae	2	13.3
Escherichia coli	1	6.7
No growth	12	80.0
Intraperitoneal effusion culture(n=22)		
E. coli	5	22.7
Klebsiella pneumoniae.	8	36.4
Enterobacter cloacae	2	9.1
Enterococcus faecium	1	4.5
Pneumococcus	1	4.5
Staphylococcus aureus	1	4.5
Pseudomonas aeruginosa	1	4.5
No growth	3	13.6

Table 4: Imaging outcomes of 31 cases of neonatal appendicitis.

Abdominal ultrasonography (n=23)	**n**	**%**
Intraperitoneal effusion	3	13.0
Right lower quadrant lesion	6	26.1
Incarcerated inguinal hernia	8	34.8
Appendix enlarged perforated and adhered	0	0.00
Others	6	26.1
Abdominal plain film(n=22)		
Pneumoperitoneum	8	36.4
Incomplete intestinal obstruction	4	18.2
Dilated small bowels	4	18.2
Others	6	27.3

Table 5: Initial Diagnoses.

The initial diagnosis	**n**	**%**
Gastrointestinal perforation	1	3.2
Neonatal appendicitis	4	12.9
Ileus	2	6.5
NEC	10	32.3
Sepsis	2	6.5
Inguinal hernia	8	25.8
Others	4	12.9

DISCUSSION

Acute appendicitis is one of the common diseases among children, it is less often considered in the diagnosis of neonatal acute abdomen. Raveenthiran [1,12] analysed the reports published in 1990 and 2014 and found that maximum number of cases

have been reported from India. We have dealt 31 cases of NA from October 2001 to July 2018 in our hospital. It seems that the incidence of NA is significantly increasing. We think that this increase may be related to the improvement in surgical diagnosis and documentation.

Karaman et al,(13] found that the occurrence of NA in males was three times higher than in females. Raveenthiran V, [1] found a slight male preponderance as also observed in our series. Premature neonates believed to be at higher risk for development of NA as reported by Reyes et al[14] and Secco et al[15]. In our study, term neonates were at more risk compared to preterm babies. Similar trend was reported by Raveenthiran V.[1]

NA has no specific clinical features thus and misdiagnosis and mismanagement may be common. This often lead to appendicular perforation resulting in peritonitis and increased mortality.[2,15] In this study, the clinical findings (Table 2) were also nonspecific and consistent with literatures; other commonly occurring clinical features reported in literature are tachycardia, respiratory distress, and scrotal oedema[2,15–17]. NA is usually reported in associated with Hirschsprung's Disease or NEC, and rarely as isolated or as an Amyand hernia.[1,9,11,15,18] Some authors believe that NA may be associated with cystic fibrosis [5]. In this study, 10 patients had NA secondary to NEC; none of our patients had Hirschsprung's Disease (HD) or Cystic Fibrosis (CF).

Most studies have not shown reliable investigations/biomarkers in the diagnosis of NA.[7,10,11,15,18] Plain radiographs, although not diagnostic of appendicitis, are helpful in detecting complications such as perforation.[1]Spiral computed tomography can also be a very useful diagnostic tool;[15-17] however, is less frequently used, which may be due to avoidance of radiation, higher cost, and development of early peritonitis also directs for early surgical intervention. Many authors suggest the use of ultrasound as an initial imaging modality in infants and children undergoing imaging for suspected appendicitis.[19,20]

Early surgical intervention with appendectomy before complications occur is the ideal treatment, but hardly achieved owing to the difficulty in making an early diagnosis in neonates.[13] The incidence of perforation of NA is relatively high[1,3,5–10,13,21]; Karaman et al[13] found that 74% neonates had perforated appendicitis and 26% had non-perforated appendicitis. In our study, perforation occurred in 20 neonates (69%) of which we could not be able to describe whether the diagnosis delay was the risk factor; however, Raveenthiran V, [1] inferred that diagnostic delay did not increase the perforation rate. Conversely, neonates with appendicular perforation were diagnosed and treated earlier than those without it.

Some factors may contribute to high perforation rate, the reasons are thin wall of the appendix, lower physiological reserves, unobvious proliferation of lymphoid follicle, a relatively small underdeveloped and functionally non-existent omentum and small size of the peritoneal cavity which allows a more rapid and diffuse dissemination of infection.[5,6,21,22] These factors may contribute to high neonatal mortality rate due to perforation and peritonitis. In our series, however, all the patients survived.

CONCLUSION

In most cases, preoperative diagnosis of NA is rarely made. Fever, vomiting, abdominal distention, and reluctance to feed are common manifestations but are not specific to neonatal appendicitis. Early diagnosis based on comprehensive analysis of clinical symptoms and imaging is necessary. Delay in diagnosis may result in complications and increase in morbidity as well as mortality, though in our series, we did not have any mortality.

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