

## Original Research Article

# Risk factors of acute and perforated appendicitis in a semi-rural population: a retrospective study

Kiran Kumar Paidipelly<sup>1\*</sup>, Sangamitra<sup>2</sup>

<sup>1</sup>Department of Surgery, Mallareddy Medical College for Women, Hyderabad, Telangana, India

<sup>2</sup>Department of Obstetrics and Gynecology, Swaroopa Multispeciality Hospital, Hyderabad, Telangana, India

**Received:** 30 May 2018

**Accepted:** 04 June 2018

### \*Correspondence:

Dr. Kiran Kumar Paidipelly,

E-mail: [dr.kiran1212@gmail.com](mailto:dr.kiran1212@gmail.com)

**Copyright:** © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

## ABSTRACT

**Background:** Acute appendicitis is one of the common conditions observed in the surgery department, which requires an emergency appendectomy with complicated appendicitis including perforated appendicitis is a cause of great concern involving severe morbidity and mortality. To improve our understanding of the sign and symptoms as well as the clinical findings of appendectomy, both in perforated and non-perforated appendicitis, this study was conducted retrospectively on the –patients who attended our hospital.

**Methods:** T The demographic details of 184 the patients in this retrospective study were noted such as age, sex, weight and height, socioeconomic status, the sign and symptoms of the illness at the time of admission, time taken for the surgery to be performed after the admission was noted. All the investigations details such as random blood sugar, complete blood picture, hemoglobin, radiological findings abdominopelvic CT scan where necessary were also noted.

**Results:** Out of the 184 patients admitted to our hospital for appendectomy 22% had perforated appendicitis and 78% had uncomplicated nonperforated appendicitis. The mean age of all the patients in the no perforated group was  $30 \pm 8.3$  and  $33 \pm 10.2$  among the perforated group, with males being more affected than females. The most common symptom among all the patients was migrating pain in the abdomen, followed by anorexia, fever and vomiting. There was a greater time lapse between the onset of symptoms to the admission time in the patients with perforated appendicitis ( $4.9 \pm 1.6$  days), compared to the non-perforated cases ( $2.4 \pm 1.8$  days), with longer hospital stay and raised WBC counts.

**Conclusions:** Proper education regarding the health and well-being of a patient of any age group should properly be given to the patient and their approach to the hospital at the earliest must be reiterated.

**Keywords:** Acute appendicitis, Perforation, Risk factors

## INTRODUCTION

Acute appendicitis is one of the common conditions observed in the surgery department, which requires and emergency appendectomy.<sup>1</sup> The incidence of this condition is estimated to be around 7%. Most of this is seen in children, however the incidence on the elderly population also has seen a rise mainly due to the increase in the life expectancy.<sup>2-8</sup> Although appendicitis is a

common cause for abdominal pain, and measures to treat the condition have been available since a long time, the complicated appendicitis including perforated appendicitis is a cause of great concern involving severe morbidity and mortality.<sup>9</sup>

The cause for perforated appendix has been attributed to the time of onset of the symptoms to the admission to hospital as well as the disease progression. The risk of

perforation increases as the time to hospitalization elapses. Moreover, there are more chances of sepsis, in-hospital complications, in perforated appendicitis when compared to the non-perforated one. There have been a few studies on the change in the incidence trend among both perforated as well as non-perforated appendicitis over time.<sup>10-12</sup> The risk factors for appendicitis have also been attributed to the environmental factors and air pollution, though the actual cause for appendicitis remains elusive.<sup>13</sup>

The risk factors for perforation have been however attributed to diabetes mellitus, symptoms and their duration before surgery, age, various laboratory markers, intra-abdominal pressure, underlying pathology of the inflamed appendix etc. However, the prognosis of appendicitis in younger age group as well as the elderly was similar, though in perforated appendicitis, the situation worsened alarmingly.<sup>1,14-24</sup>

To improve our understanding of the sign and symptoms as well as the clinical findings of appendectomy, both in perforated and non-perforated appendicitis, this study was conducted retrospectively on the patients who attended our hospital.

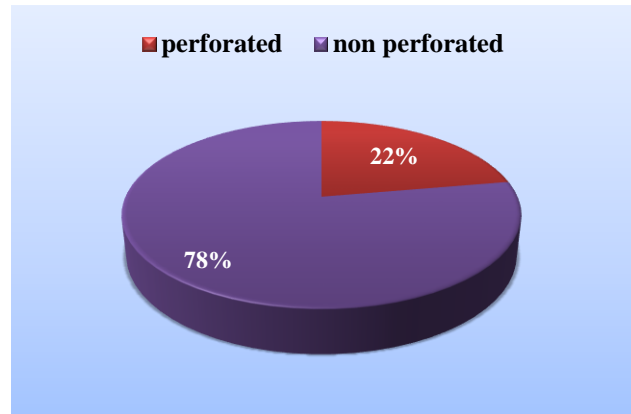
## METHODS

This retrospective study was conducted by the department of surgery at Malla Reddy medical college for women and Swaroopa multi-specialty hospital, Hyderabad, from April 2016 to May 2018. Data of 184 patients who had undergone surgery for appendicitis were included into the study. The details of the patients were obtained from the medical records section of our hospital. During the period of the study, there was no change in the attending surgeons, residents or other staff neither was there any changes in the protocols or procedures, all of which remained considerably consistent. The patients who were admitted to our hospital for appendectomy were divided into 2 groups, group 1- where there were no perforations or complications and group 2 where in the patients had perforated appendix.

The demographic details of all the patients were noted such as age, sex, weight and height, socioeconomic status, etc. Medical history of the patients before their admission was noted with care taken to identify the previous treatment and medications by the earlier attending surgeon. The sign and symptoms of the illness at the time of admission was noted and the time taken for the surgery to be performed after the admission was also previewed. All the investigations such as the blood work up like random blood sugar, complete blood picture, LFT/RFT etc. were noted. The radiological findings such as the x-rays of abdomen as well as the abdominal USG were performed for all the patients and abdominopelvic CT scan were performed when necessary, and the details were noted.

## RESULTS

Out of the 184 patients admitted to our hospital for appendectomy, 41 (22%) had perforated appendicitis and 143(78%) had uncomplicated nonperforated appendicitis (Figure 1).



**Figure 1: Distribution of perforated and nonperforated appendicitis.**

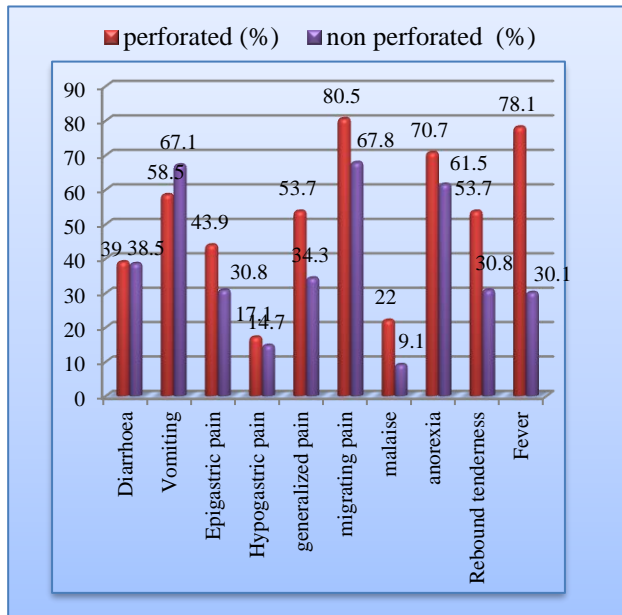
Most of the patients were males in both the groups i.e. non-perforated and perforated groups, each comprising of more than 65% of the cases. Females were 31% and 24% among the non-perforated and perforated cases respectively. The mean age of all the patients in the non-perforated group was  $30 \pm 8.3$  and  $33 \pm 10.2$  among the perforated group, showing no significant difference among the patients in both the groups. There was no significant difference even in the BMI among the 2 groups. However, more than 50% of the patients amongst both the groups seemed to be in the lower economic status, showing poverty to play an essential role in the patients developing appendicitis (Table: 1).

**Table 1: Demographic details of the patients.**

Details	Non-perforated (n=143)	perforated (n=41)
Gender		
Male	98 (68.5%)	31 (75.6%)
Female	45(31.5%)	10(24.4%)
Age in yrs (mean $\pm$ SD)	$30 \pm 8.3$	$33 \pm 10.2$
BMI in kg/m <sup>2</sup> (mean $\pm$ SD)	$24.5 \pm 3.3$	$25.3 \pm 4.1$
Low income	93 (65.1%)	23 (56.1%)

The most common symptom among all the patients was migrating pain in the abdomen with 97 (67.8%) of the non-perforated group and 33(80.5%) in the perforated group, followed by anorexia 88 (61.5%) and 29 (70.7%) in the non-perforated and the perforated group respectively. Fever was more prominent in the perforated group, as seen in 32 (78.1%) of the cases, while vomiting was observed in 96 (67.1%) of the non-perforated and 24

(58.5%) of the perforated group (Figure 2). There was a greater time lapse between the onset of symptoms to the admission time in the patients with perforated appendicitis ( $4.9 \pm 1.6$  days), compared to the non-perforated cases ( $2.4 \pm 1.8$  days).



**Figure 2: Signs and symptoms in the patients with appendicitis.**

The stay in the hospital for these patients was longer, with  $6.1 \pm 2.7$  days compared to  $2.8 \pm 2.2$  days in the non-perforated patients. Increased WBC count was seen in 35 (85.4%) of the perforated cases while it was increased only in 76 (53.1%). In most of the patients, the appendicitis was retro caecal 22 (53.7%) and 94 (65.7%) of the perforated and non-perforated patients respectively. This was followed by free and Retroileal (Table 2).

**Table 2: Clinical findings of patients.**

Clinical findings	Perforated	Non-perforated
Interval between onset of symptoms and admission (in days)	$4.9 \pm 1.6$	$2.4 \pm 1.8$
Stay in hospital (no of days)	$6.1 \pm 2.7$	$2.8 \pm 2.2$
Appendix position		
Pelvic	4 (9.7%)	5 (3.5%)
Retroileal	5 (12.2%)	7 (4.9%)
Retrocaecal	22 (53.7%)	94 (65.7%)
Free	10 (24.4%)	37 (25.9%)
Increased WBC count	35 (85.4%)	76 (53.1%)

## DISCUSSION

Acute appendicitis is one of the common causes for emergency surgery in a hospital set up, although there is

a very high rate of misdiagnosis (15-30%).<sup>25</sup> The rate of perforation of appendix was estimated to be 20-30%, which is found to increase to about 32-72% in the elderly patients. The reason for this was estimated to be due to the late and atypical presentation of the condition in the elderly, which lead to a delay in the diagnosis and the surgical intervention.

It was also attributed to the presence of comorbid diseases in the elderly as well as age-specific physiological changes.<sup>2,3,17,26</sup> In the present study, the mean age was around 30 years. This was similar to other studies.<sup>19,20.</sup>

The overall perforation rate in the present study was 22%, while in a study by Nouri et al, it was 24.3%.<sup>27</sup> There was a preponderance of males in the study compared to the females. Similar results were observed in another study by Drake et al and Naderan et al.<sup>28,29</sup> It was suggested by Naderan et al that one of the explanation for the preponderance of the males could be that the women were directed to a gynecologist due to a common symptom of pain in abdomen for many gynecological problems.

Many of the patients were from the lower background, which was observed in the study by Naderan et al<sup>29</sup>, Ming et al<sup>1</sup>, Tsai et al.<sup>2,29</sup>

It was found that in the adult population of the lower economic strata of patients, there was a greater risk of developing complications rather than in the pediatric as well as the upper strata. This was probably the older people preferred a self-treatment or treatment from a local doctor so as to not be a burden to the family.

Migration of pain was seen as the most common symptom among the patients which was similar to a study by Naderan et al and Iamarino et al.<sup>29,30</sup> Other symptoms also reported by these authors were fever and nausea/vomiting. The serum WBC levels in present study was prominently on the patients with perforated appendix rather than in the non-perforated one.

This was corroborated in other studies and it was observed that earlier, serum WBC counts were used as a marker for the diagnosis of acute appendicitis.<sup>19,20,31,32</sup> Multiple investigators have found an association between markers of limited access to health care and increased risk of perforation, extrapolating that such health care barriers lead to delays in presentation and increased perforation.<sup>28</sup>

Many factors can be responsible for the development of perforation appendicitis among the patients. Some studies have emphasized physical examination and history taking to lead to a probable diagnosis of perforated appendix, the interval of onset of symptoms and admission to the hospital has been stated to be the cause in majority of them.<sup>15,17</sup> However other findings such as variation in

age, preexisting medical conditions, diabetes etc can also have an influence.

## CONCLUSION

Although there are multiple factors which can lead to the incidence of perforation, lack of education in the lower socioeconomic level seems to be a major issue. Proper education regarding the health and well-being of a patient of any age group should properly be given to the patient and their approach to the hospital at the earliest must be reiterated.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the Institutional Ethics Committee*

## REFERENCES

- Ming PC, Yan TY, Tat LH. Risk factors of postoperative infections in adults with complicated appendicitis. *Surg Laparosc Endosc Percutan Tech.* 2009;19:244-8.
- Horattas M, Guyton D, Diane W: A reappraisal of appendicitis in the elderly. *Am J Surg.* 1990;160:291-3.
- Smithy WB, Wexner SD, Daily TH: The diagnosis and treatment of acute appendicitis in the aged. *Dis Colon Rectum.* 1986;29:170-3.
- Franz MG, Norman J, Fabri PJ: Increased morbidity of appendicitis with advancing age. *Am Surg.* 1995;61:40-4.
- Storm-Dickerson TL, Horattas MC: What we have learned over the past 20 years about appendicitis in the elderly?. *Am J Surg.* 2003;185:198-201.
- Lunca S, Bouras G, Romedea NS: Acute appendicitis in the elderly patient: diagnostic problems, prognostic factors and outcomes. *Rom J Gastroenterol.* 2004;13:299-303
- Lee JF, Leow CK, Lau WY: Appendicitis in the elderly. *ANZ J Surg.* 2000;70:593-6.
- Sherlock DJ: Acute appendicitis in the over-sixty age group. *Br J Surg.* 1985;72:245-6.
- Stein GY, Rath-Wolfson L, Zeidman A, Atar E, Marcus O, Joubran S, et al. Sex differences in the epidemiology, seasonal variation, and trends in the management of patients with acute appendicitis. *Langenbecks Arch Surg.* 2012;397:1087-92.
- Andersson R. "Can perforating appendicitis be considered a separate disease entity"? *The European J Surg.* 1999;165(5):481-2.
- Andersson R, Hugander A, Thulin A, Nystrom PO, Olaison G. Indications for operation in suspected appendicitis and incidence of perforation. *BMJ.* 1994;308(6921):107-10.
- Livingston EH, Woodward WA, Sarosi GA, Haley RW. Disconnect between incidence of nonperforated and perforated appendicitis: implications for pathophysiology and management. *Annals Surg.* 2007;245(6):886-92.
- Kaplan GG, Dixon E, Panaccione R, Fong A, Chen L, Szyszkowicz M et al. Effect of ambient air pollution on the incidence of appendicitis. *CMAJ.* 2009;181(9): 591-7.
- Tsai SH, Hsu CW, Chen SC, Lin YY, Chu SJ. Complicated acute appendicitis in diabetic patients. *Am J Surg.* 2008;196:34-9.
- Kokoska ER, Silen ML, Tracy TF, Jr, Dillon PA, Craddock TV, Weber TR. Perforated appendicitis in children: risk factors for the development of complications. *Surg.* 1998;124:619-26
- Bekele A, Mekasha A. Clinical profile and risk factors for perforation of acute appendicitis in children. *East Afr Med J.* 2006;83:434-9.
- Korner H, Sondenaa K, Soreide JA, Andersen E, Nysted A, Lende TH, et al. Incidence of acute nonperforated and perforated appendicitis: age-specific and sex-specific analysis. *World J Surg.* 1997;21:313-7.
- Bratton SL, Haberkern CM, Waldhausen JH. Acute appendicitis risks of complications: age and Medicaid insurance. *Pediatrics.* 2000;106:75-8.
- Moon HM, Park BS, Moon DJ. Diagnostic value of C-reactive protein in complicated appendicitis. *J Korean Soc Coloproctol.* 2011;27:122-6.
- Sand M, Bechara FG, Holland-Letz T, Sand D, Mehnert G, Mann B. Diagnostic value of hyperbilirubinemia as a predictive factor for appendiceal perforation in acute appendicitis. *Am J Surg.* 2009;198:193-8.
- Bingol-Kologlu M, Tanyel FC, Ocal T, Karaagaoglu E, Senocak ME, Buyukpamukcu N. Intraabdominal pressure: a parameter helpful for diagnosing and predicting a complicated course in children with appendicitis. *J Pediatr Surg.* 2000;35:559-63.
- Reid RI, Dobbs BR, Frizelle FA. Risk factors for post-appendectomy intra-abdominal abscess. *Aust N Z J Surg.* 1999;69:373-4.
- Lunca S, Bouras G, Romedea NS: Acute appendicitis in the elderly patient: diagnostic problems, prognostic factors and outcomes. *Rom J Gastroenterol.* 2004;13:299-303
- Sherlock DJ: Acute appendicitis in the over-sixty age group. *Br J Surg.* 1985;72:245-6.
- Pearl RH, Hale DA, Molloy M, Schutt DC, Jaques DP. Pediatric appendectomy. *J Pediatr Surg.* 1995;30:173-81.
- Franz MG, Norman J, Fabri PJ: Increased morbidity of appendicitis with advancing age. *Am Surg.* 1995;61:40-4.
- Nouri S, Kheirkhah D, Soleimani Z. The risk factors for infected and perforated appendicitis. *J Res Med Dental Sci.* 2017;5(1):23-6.
- Drake FT, Mottey NE, Farrokhi ET, Florence MG, Johnson MG, Mock C, Steele SR, Richard C, Thirlby, David R. Flum. Time to Appendectomy and Risk of Perforation in Acute Appendicitis. *JAMA Surg.* 2014;149(8):837-44.

29. Naderan M, Eslami A, Babaki S, Shoar S, Mahmoodzadeh H, Nasiri S, Khorgami Z. Risk factors for the development of complicated appendicitis in adults. *Ulus Cerrahi Derg.* 2016;32:37-42.
30. Iamarino AP, Juliano Y, Rosa O, Novo NF, Favaro Md, Júnior R, Fontenelle MA. Risk factors associated with complications of acute appendicitis. *Revista do Colégio Brasileiro de Cirurgiões.* 2017;44(6):560-6.
31. Alvarado A. A practical score for the early diagnosis of acute appendicitis. *Ann Emerg Med.* 1986;15:557-64.
32. Kaser SA, Fankhauser G, Willi N, Maurer CA. C-reactive protein is superior to bilirubin for anticipation of perforation in acute appendicitis. *Scand J Gastroenterol.* 2010;45:885-92.

**Cite this article as:** Paidipelly KK, Sangamitra, Risk factors of acute and perforated appendicitis in a semi-rural population: a retrospective study. *Int Surg J* 2018;5: 2432-6.