

Effects of Two New Risk Factors on Perforated and Non-Perforated Appendicitis

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Abstract: Appendicitis has been a cause of mortality through the history and has still remained as a major problem in spite of advances and improvements of medical sciences. Acute appendicitis is the most frequent cause of acute abdomen for the patients referring to hospitals. Patients will recover after a timely diagnosis and appendectomy. However, absence of timely and proper diagnosis may result harmful complications and even death. This descriptive-analytic retrospective study was carried out with the evaluation of medical records of those went to Shahid Beheshti and Yahyanejad hospitals from 2002-2004. The data was statistically analyzed by using SPSS software and chi-square and fisher's Exact statistical tests. Out of 1190 cases of non-perforated acute appendicitis, 64.3% were in 15-34 years age group, 727 patients were male and remaining were female, 121 patients with perforated appendicitis that had the highest frequency (49.5%) were in the age group 15-34 years (60 patients), 85 patients were male (70.2%). However, the highest perforated to non-perforated appendicitis ratio (21.5%/78.4%) belongs to the age group over 65. About 16.5% patients with perforated appendicitis were urban but 83.4% patients were rural, 74.3% of the 121 cases of perforated appendicitis had occurred within the first half of the year and 25.6% within the second half. This study proved that incidence of perforated appendicitis is more common between rural patients and those who had referred to hospital in the first half of the year. So living in the village and first half of the year are two important risk factors for acute appendicitis.

Key words: Acute appendicitis, perforated appendicitis, non-perforated appendicitis, rural and urban communities, acute abdomen, lumen

INTRODUCTION

Acute appendicitis is the most prevalent cause of surgical acute abdomen. The studies carried out in developed countries revealed that each year, one out of 1000 suffers from acute appendicitis (Jaffe and Berger, 2005). Percentage of occurrence of acute appendicitis is 10 and it affects male more than female. Perforation rate is 50% for the patients under 10 years. It is 10% for those in 10-50 years age group and 30% for those over 50 year (Paulson and Kalady, 2003).

The most important factor contributing to acute appendicitis is obstruction of appendix lumen. Such a condition occurs because of fecalite, hyperplasia, lymphoids and/or foreign objects. Lumen obstruction causes an increase in bacteria growth and continuation of mucosa excretion. This will bring greater growth to bacteria and increase in intraluminal pressure then appendix becomes edematous and ischemic and this results necrosis in appendix and finally it becomes

gangrenous appendicitis. In the absence of a surgical intervention, appendix becomes perforated and the contents will distribute into abdominal cavity and leads to peritonitis (Paulson and Kalady, 2003).

Diagnosing acute appendicitis is based on the complaints of the patient and clinical examination. Laboratory and radiographic findings and sonography help establishment of a diagnosis. Sonography will be a great help where there aren't specific signs and symptoms of appendicitis (Sivit *et al.*, 2001; Bendeck *et al.*, 2002).

Abdominal pain is accompanied by anorexia and nausea. Tenderness and Ribound Tenderness are common findings. Abdominal pain is dominant with perforated appendicitis and temperature rises to 39-40°. The patient will suffer from illness and bad conditions and clinical symptoms will clearly aggravate (Goldman, 1995; Mellinger *et al.*, 2006; Huang, 2006). Anyway it appears that an exact history of the complaints of the patient, an exact observation and proper physical examination will help to a timely diagnosis (Bendeck *et al.*, 2002;

Goldman, 1995). Appendicitis requires surgical intervention. About 15-20% of cases are normal appendicitis. Female cases are more than male. This is because of the presence of fallopian tubes and ovary (Jaffe and Berger, 2005; Goldman, 1995; Prinz *et al.*, 2001). It will be harder to diagnose appendicitis with some patients such as children, pregnant women and older people. Such a delay will be associated with greater affects. The rate of perforation for children is about 18-47% (Kuster, 1997; Fleshman, 1992). About 14% of 581 children under 14 years having undergone surgical operation with a diagnosis of acute appendicitis had complicated appendicitis. Another study was made on 129 children under 14 years with acute appendicitis in two groups A (Diagnosis within 48 h) and B (diagnosis after 48 h), perforation rate within group A was 24% and it was 71% for group B (Cappendik and Hazebroek, 2000).

Another study on 2280 patients having undergone surgical operations for appendicitis revealed perforated appendicitis for 35% of those over 50 years and 13% for younger ages (Kraemer *et al.*, 2000). Conditions such as peritonitis, abdominal abscess and fistula and even mortality are results of absence of a timely diagnosis and delay in surgical intervention (Gordon and Telford, 2002). Explaining the importance of two new risk factors (residence, seasons), which are different from common factors is the aim of this study.

MATERIALS AND METHODS

This descriptive-analytic retrospective study was based on contents of 1311 patients records having undergone appendectomy operations in Shahid Beheshti and Yahyanejad hospital from April 2002-2004. Patients medical records data were recorded on special forms and by using SPSS software and fisher's Exact, χ^2 statistical test were statistically analyzed. Recognizing perforated or non-perforated appendicitis is based on surgeon's observation during surgery.

RESULTS AND DISCUSSION

Studying 1311 patients medical records hospitalized because of acute appendicitis revealed that 1190 patients

(91%) had non-perforated acute appendicitis and 121 cases (9%) had perforated appendicitis (Fig 1).

The highest frequency of non-perforated acute appendicitis was in the 15-34 years age group ($p = 0.001$) and the lowest frequency of occurrence was in the age group over 65 (Table 1).

Table 2 demonstrates frequency distribution and percent of non-perforated and perforated acute appendicitis in terms of gender (Table 2).

Perforated to non-perforated ratio was 21.5-78.4% for the age group over 65 ($p < 0.05$). It was the highest compared to those of other age groups and the lowest ratio was for age group 15-34 years (Table 1).

Frequency distribution of non perforated and perforated appendicitis in terms of residence has been given in Table 3. Perforation rates were higher with rural population ($p = 0.001$). From 580 urban patients 6.2% had perforated appendicitis (Table 3).

About 74.3% of the 121 cases of perforated appendicitis had occurred within the first half of the year and 25.6% of the cases within second half of the year. However, out of 1190 cases of non-perforated appendicitis, 52.6% occurred in the first half and 47.3% in the second half of the year (Table 4). Meanwhile 78.2% of the 85 cases of perforated appendicitis had occurred among rural population in the first half and 21.7% in the second half of the year. The ratio of perforated cases having referred 12-24 h from the beginning of pains were

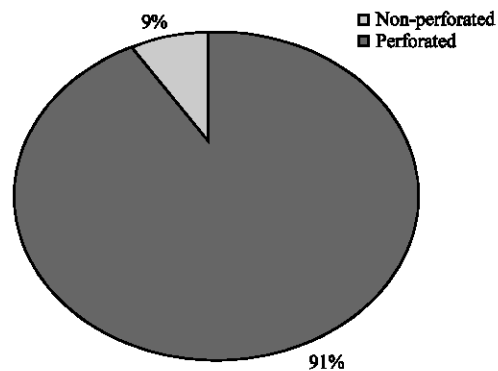


Fig. 1: Frequency distribution of non-perforated and perforated acute appendicitis

Table 1: Frequency distribution and percent of perforated and non-perforated acute appendicitis in terms of age group ($p = 0.001$)

Parameters	Age <14		Age 15-34		Age 35-64		Age 65<	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Perforated	18	10	60	7.26	29	12.08	14	21.53
Non-perforated	162	90	766	92.74	211	87.92	51	78.47
Total	180	100	826	100.00	240	100.00	65	100.00

Table 2: Frequency distribution and percent of non-perforated and perforated acute appendicitis in terms of gender (p = 0.029)

Appendicitis	Non-perforated		Perforated	
	Frequency	%	Frequency	%
Gender				
Male	727	61.09	85	70.24
Female	463	38.90	36	29.75
Total	1190	100.00	121	99.99

Table 3: Frequency distribution and percent of perforated and non-perforated acute appendicitis in terms of residence (p = 0.001)

Appendicitis	Non-perforated		Perforated	
	Frequency	%	Frequency	%
Residence				
Urban community	544	45.71	36	16.52
Rural community	646	54.28	85	83.47
Total	1190	99.99	121	99.99

Table 4: Frequency distribution and percent of non-perforated and perforated appendicitis in terms of seasons of year (p = 0.001)

Appendicitis	Non-perforated		Perforated	
	Frequency	%	Frequency	%
Season				
First half	627	52.68	90	74.38
Second half	563	47.31	31	25.61
Total	1190	99.99	121	99.99

five times more than the cases had referred before 12 h from the beginning of pains. About 30.8% of the 121 cases of perforated appendicitis had taken analgesic or antibiotics before going to the hospital and the operation report reveals that the most prevalent complications having happened after perforation was generalized peritonitis (44.6%).

Abdominal pain and RLQ area tenderness were the clinical symptoms observed with all the patients with no matter perforated or non-perforated appendicitis. Laboratory findings include Leukocytosis (WBC>10000) and left shift were observed with 92% of non-perforated appendicitis and with 95% of those suffering from perforated appendicitis.

A survey of the acute appendicitis medical records in Shahid Beheshti and YahyaNejad hospitals revealed that 1190 out of 1311 cases of appendicitis were non-perforated that included the highest frequency for the 15-34 age group and the lowest with the age group over 65. About 121 cases had perforated appendicitis and this complication significantly (p = 0.001) in male was more than female. Perforated to non-perforated ratio was greater for the age group over 65 years and the children under 14 (p = 0.001) ranked second from this point of view. These findings are similar to those found in scientific literature (Table 2).

The Incidence of high frequency of perforation in children and old people may probably be attributed to the absence of typical clinical symptoms and the presence of

differential diagnosis the underlying diseases in the old people unable in pain localization, shortness of omentum in children and finally because of the fact that people in the old age suffer from pains less than the youth and other reasons resulting delayed diagnosis and perforation as well (Bratton *et al.*, 2000; Bernard *et al.*, 2005).

Residence was also considered in this study. It was divided into two groups rural and urban communities. Frequency distribution of non-perforated acute appendicitis was not largely different in urban communities from that in rural settings. But perforation percent in rural population is more than (p = 0.001) urban population (about 5times) and that is justified by the following (Table 3).

- The distance from village to city, lack of access to vehicles, undesirable road conditions
- Low knowledge of rural population
- Insufficient knowledge of health practitioners in health care centers located in rural places

A survey of different references and literature provided no proper data about the relation between residency and revealing the complications and this is the first study that has considered such a subject.

One of the other results of this study is evaluating the relation between perforated appendicitis and seasons of year and residence. About 78.2% of the 85 cases of perforated appendicitis among rural population had occurred in the first half and 21.78% of the same in the second half of the year (p = 0.001).

Out of 121 cases of perforated appendicitis, 74.3% had happened in the first half and this may be because of agricultural activities in the first half of the year (Table 4).

However, one should consider some cultural factors, knowledge and literacy as well. This subject (residence) was considered for the first time by this study. Commencement of signs and going to hospital was another important factor.

Perforated appendicitis cases having referred to hospital within 12-24 h from commencement of pain were 5 times more than the cases having referred within the first 12 h of the commencement of pain and it appear that early presentation and timely diagnosis at most within the first 12 h from the emergence of signs and symptoms may decrease complications.

A survey of about 5755 cases of appendectomy revealed that perforation was 32%. About 16.5 h had elapsed from the emergence of the symptoms to the examination by a physician and the time elapsed from referring to hospital and surgical operation was a mean of 4.7 h (20). It seems that the high rate of complications

Table 5: Comparing prevalence of perforated appendicitis in Terms of risk factors

Appendicitis perforated	Age		Gender		Taking and analgesic antibiotics	Residence		Season	
	Children	65<	Female	Male		City	Village	Second half	First half
121 patients	10%	21%	29.70%	70.2%	31%	16.50%	83.50%	25.50%	74.50%

occur with those not having had a timely referring and because of taking medications before going to hospital (Redmond *et al.*, 2002).

It was revealed that age, especially small and old ages is one of the risk factors in the appearance of perforated appendicitis. On the other hand men had a greater frequency of perforated appendicitis in all age groups. It appears that male gender is another risk factor for perforated appendicitis. Perforated appendicitis had greater prevalence among men in spite of the fact that differential diagnosis causes a longer time of admission for women compared to men. The average time from admission to surgical operation was 477 min for men and 709 min for women for 196 male and female cases of appendicitis in 12-50 age group. Perforated appendicitis was observed in 38.7% of men and 23.5% of women ($p = 0.002$) (Guss and Richards, 2002).

Although, age, gender and taking analgesic and antibiotics are important risk factors for perforated appendicitis by studying this research some other factors such as residence (83.5% of perforated cases in rural communities) with ($p = 0.001$) and seasons of the year (74.5% of perforated appendicitis in the first half of the year) whit ($p = 0.001$) are important risk factors and their role is even more important than those prevalent risk factors (Table 5).

The following may be considered as risk factors, place of residence, seasons, time elapsed from beginning of symptoms and pain to reference to a physician and administration of analgesic and antibiotic.

CONCLUSION

This study proved that incidence of perforated appendicitis is more common between rural patients and those who had referred to hospital in the first half of the year. So living in the village and first half of the year are two important risk factors for acute appendicitis.

RECOMMENDATIONS

Considering the findings, abdominal pain should be taken as a serious sign with children, old people and pregnant women. Meanwhile, some other factors such as residence, season, taking analgesic and antibiotics should be considered as important elements for perforated appendicitis.

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REFERENCES

- Bendeck, S.E., M.N. Murica, G.J. Berry and R.B. Jr. Jeffrey, 2002. Imaging for suspected appendicitis. *Radiology*, 225: 131-136.
- Bratton, S.L., C.M. Haberkern and J.H. Waldhausen, 2000. Acute appendicitis risks of complication. *Pediatrics*, 106: 75-78.
- Cappendik, V. and F. Hazebroek, 2000. The impact of diagnostic delay on the course of acute appendicitis. *Arch. Dis. Childhood*, 83: 64-66.
- Fleshman, J.W., 1992. The Appendix. In: *Year Book of Gastrointestinalology*, Aliperti, G. and J.W. Fleshman (Eds.). Chery to Smart Co., UK., pp: 92.
- Goldman, L.D., 1995. Acute Appendicitis. In: *Gastro Intestinal Emergencies*, Taylor, M.B. (Ed.). Lippincott, Williams and Wilkins, UK., pp: 426.
- Gordon, L. and J.R. Telford, 2002. Wallace Appendix. In: *Shackelford's Surgery of the Alimentary Tract*, Zuidema, G.D. and C.J. Yeo (Eds.). 5th Edn., W.B. Saunders, Philadelphia, pp: 180.
- Guss, D.A. and C. Richards, 2000. Comparison of men and women presenting to on emergency department with acute appendicitis. *Am. J. Emerg. Med.*, 18: 372-375.
- Huang, E.H., 2006. Complications of Appendectomy and Colon and Rectal Surgery in Complications in Surgery. 4th Edn., Lippincott, Williams and Wilkins, UK., pp: 498-500.
- Jaffe, B.M. and D.H. Berger, 2005. *Schwartz's Principles of Surgery Self-assessment and Board Review*. 8th Edn., MCGraw Hill, New York, USA., pp: 1119-1121.
- Kraemer, M., C. Faranke, C. Ohmann, Q. Yang and Acute Abdominal Pain Study Group, 2000. Acute abdominal pain study group. acute appendicitis in late adulthood. *Langenbeck's Arch. Surg.*, 385: 470-481.
- Kuster, G.G.R., 1997. The Appendix. In: *Bockus Gastro Enterology*, Berk, H.S. (Ed.). 5th Edn., Sounders Co., UK., pp: 1790.
- Mellinger, J.D., V. Bruce and J.R. Macfadyen, 2006. Small Intestine and Appendix in *Essentials of General Surgery*. 4th Edn., Lippincott, Williams and Wilkins, New York, pp: 300-301.

- Paulson, K. and M. Kalady, 2003. Suspected appendicitis. *N. Engl. J. Med.*, 348: 236-242.
- Prinz, R.A. and A. James and I.I. Madora, 2001. Appendicitis and Appendiceal Abscess. In: *Mastery of Surgery*, 4th Edn., Bockel, R.J. and J.E. Fischer (Eds.). Lippincott, Williams and Wilkins, New York, pp: 1460.
- Redmond, J.M., G.W. Smith, C. Wilasrusmee and D.S. Kittur, 2002. Calculation of halftime for perforation. *Am. Surg.*, 68: 593-597.
- Sivit, C.J., M.J. Siegel, K.E. Applegate and K.D. Newman, 2001. When appendicitis is suspected in children. *Radiographics*, 21: 247-262.