

Relationship between increasing ALVARADO Score and Severity of Acute Appendicitis

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ABSTRACT

Aim: To determine whether an increasing ALVARADO score was related to the severity of acute appendicitis, as reported in per-operative findings.

Methods: This cross-sectional analytical study was conducted in Surgical Unit-1, Jinnah Hospital, Lahore, taking record of patients from July 2013 to December 2013. ALVARADO score was calculated from patient records. Severity was categorized as normal, inflamed, gangrenous and perforated and noted from operation notes. Mean ALVARADO score for each category of inflammation were then compared using anova t-test, keeping $p < 0.05$ to be statistically significant.

Results: The mean age was 21.5 ± 13.4 years and 104 (59.8 %) male and 70 (40.2%) female patients. The mean ALVARADO score of patients having normal appendix was 4.5, 6 for Inflamed, 7.5 for gangrenous and 8 for perforated. Comparison of means revealed a p value 0.001.

Conclusion: There is a direct relationship between increasing ALVARADO score and severity of appendicitis.

Key words: Acute Appendicitis, ALVARADO score.

INTRODUCTION

Acute Appendicitis is the most common surgical emergency¹. Its signs and symptoms were first described in 1886 by Fitz². Since then a variety of scoring systems exist, which aid to diagnose the acute appendicitis, e.g. Madan score, Ohmann score, ALVARADO score, AIR score, RIPASA score etc^{3,4}. All of them use clinical examination and some other diagnostic tests to diagnose this acute emergency. More scoring systems continue to evolve in the background of a situation where this condition continues to be a diagnostic dilemma although today many high tech diagnostic tools are available to aid diagnosis^{5,6,7}. Among them ALVARADO score has been clinically tested and verified to stratify patients according to risk of having acute appendicitis⁸. This score only stratifies the patient according to risk but doesn't predict about the severity of acute appendicitis as compared to the per-operative findings and histopathological findings. In 1880, Robert Lawson Tait performed the first appendectomy for appendicitis in England⁹. Since then appendectomy is the treatment of choice for acute appendicitis⁹. Per-operatively, appendix can be non-inflamed, inflamed, gangrenous or perforated. Gangrenous appendix may result in adhesion formation and require expertise of experienced surgeons to minimize injuries to the surrounding

structures. Perforated appendix with resultant diffuse peritonitis advocates lower midline laparotomy incision to perform appendectomy and adequate peritoneal toilet. Complicated appendicitis when operated by experienced surgeon, results in less complication rates, as indicated by Wei P L et al¹⁰. There is considerable evidence that patients with complicated appendicitis had longer hospital stay and more treatment cost needing special facilities as indicated by Dhurpar R et al¹¹. There is a paucity of volume of studies available that have tried to predict the severity of acute appendicitis on clinical grounds. Thus, there is a need to quantify severity of appendicitis to aid in planning the surgery and appropriate referral to tertiary care hospitals if complicated acute appendicitis is suspected. This can result in better outcome in terms of decreased morbidity associated with this condition. We have used ALVARADO score, an existing widely used scoring system, to determine whether an increasing ALVARADO score was related to the severity of acute appendicitis, as reported in per-operative findings¹². Table 1 demonstrates ALVARADO score.

METHODOLOGY

This study was conducted in Surgical Unit-1, Jinnah Hospital, Lahore. The record of patients admitted in surgical unit-1 after appendectomy from July 2013 to December 2013 was analysed. The study design was cross-sectional analytical. The sampling technique used was non-probability purposive sampling. 174 patients, of all age groups and any

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gender, who were operated in surgical emergency with clinical diagnosis of acute appendicitis were included in this study. We excluded patients who were operated for diffuse peritonitis where inflamed appendix was the laparotomy finding, or in whom diagnostic uncertainty mandated midline laparotomy. We also excluded patients with mass formation on clinical examination, who were then admitted and those with other co-morbidities. ALVARADO score was calculated from history, examination findings and laboratory tests available in the patient records. Per-operative findings were noted from the procedure notes available to note the severity of acute appendicitis with. Severity of acute appendicitis was categorised as normal, inflamed, gangrenous and perforated, where perforated characterized the most severe inflammation. Mean ALVARADO score for each category of inflammation were then compared using anova t-test to analyze whether increasing ALVARADO score was related to severity of acute appendicitis, keeping $p < 0.05$ to be statistically significant.

RESULTS

The mean age of the patients was 21.5 ± 13.4 years, with minimum of 7 and maximum of 71 years. Among 174 patients who were operated in the emergency, there were 104 (59.8 %) male patients, while there were 70 (40.2%) female patients. Mean time after which patients were brought in the emergency after the start of the first symptom was 38.6 ± 17.9 hours, with minimum of 12 and maximum of 96 hours. Table 1 shows the number patients for each tier of ALVARADO score

Table 1 (n=174)

ALVARADO score	n	%age
1	0	0
2	0	0
3	0	0
4	19	10.9
5	30	17.2
6	40	23.0
7	58	33.3
8	19	10.9
9	7	4.0
10	1	0.6

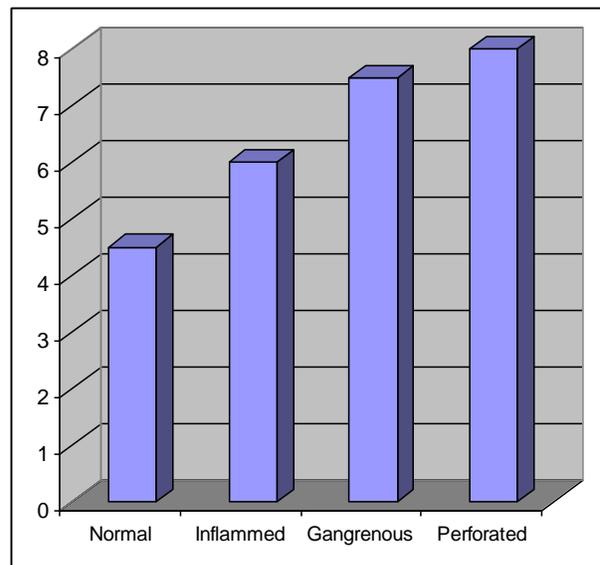
The maximum number of patients had 7 ALVARADO score when they presented in the emergency. While there was no patient having score of 3 or less, whose appendicectomy was done. Table 2 shows the number of cases of different forms of acute appendicitis for each tier of ALVARADO score. The cases where the appendix was declared as normal with no inflammation mostly resided in tier 4. The

negative appendicectomies, declared per-operatively, decreased as the ALVARADO score increased. There was only one case treated with appendicectomy who had ALVARADO score of 10.

Table 2

ALVARADO score	Not inflamed	Inflamed	Gangrenous	Perforated
4	15	4	0	0
5	4	25	1	0
6	2	33	3	2
7	0	38	12	8
8	0	3	9	7
9	0	0	3	4
10	0	0	0	1

Chart 1: Compare the mean ALVARADO score with the various forms of inflamed appendix according to severity of inflammation.



The mean ALVARADO score of different categories of inflamed appendix were compared with each other using anova t-test, and the p value was found to be 0.001 ($p < 0.05$), which is statistically significant.

DISCUSSION

Acute Appendicitis is the most common surgical emergency, with cases treated with surgical intervention. Initially there is localised inflammation due to innate immunity. This causes swelling and hyperaemia of the appendix. Left untreated the inflammation becomes severe resulting in gangrenous and then perforated appendix resulting in localised peritonitis. These stages correspond to the severity of inflammation, with perforation being the most severe¹³.

Traditionally it had been advocated that acute appendicitis, once diagnosed should be treated with appendicectomy. There is a growing trend seen towards using antibiotics to treat appendicitis. In our study, all patients who were diagnosed with acute appendicitis were treated with appendicectomy. However Varadhan K.K et al¹³ has mentioned all cases with uncomplicated appendicitis treated with antibiotics after being diagnosed with uncomplicated appendicitis on abdominal CT-scan¹⁴. However there was no mentioning of number of days of hospital stay and the cost / benefit ratio in those treated with conservative therapy. In our study the negative appendicectomy was 12.1% which was higher as compared to a study by Oguntola A S. et al where negative appendicectomy was 8.2 %¹⁵.

Complicated appendicitis may result in more aggressive options taken per-operatively. Ileocectomy is done when the inflammation has extended to caecum resulting in gangrenous patches that warrant ileocectomy. It has been described as definitive treatment by Lane J S. et al¹⁶. This procedure when employed, frequently involves expertise of senior surgeons and result in prolonged hospital stay. Hence complicated appendicitis poses a greater challenge for both the patient and the operating doctor which demands an early recognition, so that some planning can be done pre-operatively.

In our study the mean time of presentation of patient in emergency after start of the first symptom was 38.6±17.9 hours, which is more as compared to a study by Tannoury J, where the mean time of presentation is 12 hours. Delay in presentation can result in inflammation progressing to complicated appendicitis¹⁷.

CONCLUSION

In this study we have concluded that there is direct relationship between increasing ALVARADO score and severity of appendicitis. It is deduced from the results that there is a high probability of complicated appendicitis with an ALVARADO score of 7 or more. There is a need to develop a scoring system with or without incorporating radiological findings, to determine the severity of acute appendicitis. Having determined a case of complicated acute appendicitis will allow a better planning and decision making prior to the start of the surgical intervention.

REFERENCES

- Gonçalves JP, Cerqueira A, Martins S. (2011) 'The Alvarado score validation in diagnosing acute appendicitis in children at Braga Hospital', *Acta Med Port*, 24(S2), pp. 583-88.
- Shreef KS., Waly AH, Abd-Elrahman S., Abd Elhafez MA. (2010) 'Alvarado score as an admission criterion in children with pain in right iliac fossa', *Afr J Paediatr Surg*,7(3), pp. 163-65.
- Ohle R, O'Reilly F, O'Brien KK, Fahey T., Dimitrov BD. (2011) 'The Alvarado score for predicting acute appendicitis: a systematic review', *BMC Medicine*, 9, pp. 139-52.
- Chong C F, Thien A, Mackie A J A, Tin A S, Tripathi S, Ahmad M A, et al (2011) 'Comparison of RIPASA and Alvarado scores for the diagnosis of acute appendicitis', *Singapore Med J*, 52(5), pp. 340-45.
- Çaglayan K, Gunerhan Y, KOÇ A, Uzun M A, Altinli E, Koksak N. (2010) 'The role of computerized tomography in the diagnosis of acute appendicitis in patients with negative ultrasonography findings and a low Alvarado score', *Ulus Travma Acil Cerrahi Derg*, 16(5), pp. 445-48.
- Sallin K, Rothrock S G. (1997) 'Diagnosis of acute appendicitis: increasing accuracy, improving outcome, and decreasing liability', *J Fla Med Assoc*,84(9): 543-8
- Teipel J, Sommerfeld A, Klomp H J, Kapischke M, Eggert A, Kremer B. (2004) 'Prospective evaluation of diagnostic modalities in suspected acute appendicitis.', *Langenbecks Arch Surg*, 389(3), pp. 219.
- Jang S O, Kim B S, Moon D J. (2008) 'Application of Alvarado score in patients with suspected appendicitis', *Korean J Gastroenterol*, 52, pp. 27-32
- de Castro S M M, Unlu C, Steller E P, van Wagensveld B A., (2012) 'Evaluation of the Appendicitis Inflammatory Response Score for Patients with Acute Appendicitis', *World J Surg*, 36, pp. 1540–45.
- Wei P-L, Liu S-P, Keller JJ (2012) Volume-Outcome Relation for Acute Appendicitis: Evidence from a Nationwide Population-Based Study. *PLoS ONE* 7(12): e52539. doi:10.1371/journal.pone.0052539
- Dhupar R, Evankovich J, Ochoa JB, Vargas LG, Hughes SJ.. Outcomes of operative management of appendicitis. *Surg Infect* 2012; 13(3): 141-46.
- Konan A, Hayran M, Kilic Y A, Karakoc D, Kaynaroglu V. (2011) 'Scoring systems in the diagnosis of acute appendicitis in the elderly', *Ulus Travma Acil Cerrahi Derg*,17(5), pp. 396-400.
- Rivera-Chavez F A, Peters-Hybki D L, Barber R C, Lindberg G M, Ishwarlal Jialal I, Munford R S. (2004) 'Innate immunity genes influence the severity of acute appendicitis', *Ann Surg*, 240(2), pp. 269–77.
- Varadhan K K, Neal K R, Lobo D N. (2012) 'Safety and efficacy of antibiotics compared with appendicectomy for treatment of uncomplicated acute appendicitis: meta-analysis of randomised controlled trials', *BMJ*, 344, pp. 2156.
- Oguntola A S, Adeoti M L, Agodirin S O, Oremakinde A A, (2014) 'Further exploration during open appendicectomy; assessment of some common intraoperative findings', *Pak J Med Sci*, 30(2), pp. 316.
- Lane J S, Schmit P J, Chandler C F, Bennion R S, (2001) 'Ileocectomy is definitive treatment for advanced appendicitis', *Am Surg*, 67(12), pp. 1117-22.
- Tannoury J, Abboud B. (2013) 'Treatment options of inflammatory appendiceal masses in adults', *World J Gastroenterol*, 19(25), pp. 3942–50.

