

## Original article

# A Prospective Study of Christian Scoring System and its Co- Relation with Ultrasound in diagnosing Acute Appendicitis

Abhinandan. B. Vandakudri\*, Sanjay N Koppad\*, Arunkumar. Jeedi\*, Mallikarjun. Desai\*.

Department of General Surgery

\*Institution: SDM College of Medical Sciences, Sattur, Dharwad, Karnataka, India, Pin Code : 580009.

Corresponding author: Abhinandan. B. Vandakudri.

---

### Abstract:

**Background:** Diagnosis of acute appendicitis is still a clinical challenge. An early and accurate diagnosis at presentation helps in preventing perforation of the appendix and its complications, however a decision to operate based on clinical suspicion alone can lead to removal of normal appendix in 15-30% cases. In a prospective non randomised observational study the efficacy of five simple criteria described by Christian were used in the diagnosis of acute appendicitis along with Ultrasound to reduce negative appendectomy rate.

**Methods:** After ethical approval a total of 120 patients presenting with pain abdomen and at least two other positive criteria as described by Christian were enrolled in the study, and subjected to abdominal ultrasound, were categorised into two groups and treated accordingly. Patients diagnosed to have appendicitis, underwent appendectomy with pathological evaluation of the appendix. Study conducted at SDM College of Medical Sciences and Hospital Dharwad.

**Results:** The study shows Christian score combined with ultrasound had sensitivity of 91% and specificity of 90%. The positive and negative predictive values are 96.4% and 77% respectively.

**Conclusion :** Combined with ultrasound Christian scoring system has high sensitivity and specificity, and it is the simplest of all scoring systems in prediction of acute appendicitis and can be used by surgical residents, house surgeons and even the general practitioners in screening of patients with pain abdomen.

**Key words:** Pain Abdomen, Acute Appendicitis, Christian Score, Ultrasound Abdomen.

---

### Introduction:

Acute appendicitis is the most common abdominal emergency requiring surgery with an estimated lifetime prevalence of 7%[1]. The clinical presentation is often atypical and the diagnosis is especially difficult because symptoms often overlap with other conditions[2]. Attempts are being made worldwide to reduce the negative appendectomy rate [3]. The removal of a normal appendix carries a spectrum of immediate postoperative complications in up to 15%(4) and late complications such as intestinal obstruction [5], incisional hernias [6], and a three times greater chance of developing a right-sided inguinal hernia [7]. In women of child-bearing age, a negative

appendectomy may result in sterility from bilateral fimbrial adhesions to the operative site and wound. A small proportion of patients may even die after a negative appendectomy [8]. Several scoring systems have been devised to aid decision making in doubtful cases, including the Ohmann, Alvarado, Eskelinen, Raja Isteri Pengiran Anak Saleha Appendicitis (RIPASA) and several others[9-12]. The simplest scoring system of all incorporating essentially five clinical criteria is described by Christian.et.al[13]. This study was conducted to analyse the efficacy of Christian scoring system combined with ultrasound in diagnosis of acute appendicitis.

**Methods:**

The study was prospective and carried out by one general surgical unit over a period of two years from January 2013 to December 2014; a total of 120 patients presenting with pain abdomen to emergency department of SDM College of Medical Sciences, Dharwad with any two of the remaining four criteria were enrolled into the study. The following five criteria were used for the diagnosis of acute appendicitis as described by Christian.et.al[13].

1. Abdominal pain-defined for the study as abdominal pain (not right iliac fossa alone) occurring within 48 h of presentation.
2. Vomiting-one or more episodes.
3. Right lower quadrant tenderness.
4. Low grade fever-defined for the study as fever - 38.80C.
5. Polymorphonuclear leucocytosis-defined for the study as a total count  $\geq 10\ 000$  with polymorphs  $\geq 75\%$ .

Ultrasound was carried out on each patient by radiology residents, and a non-compressible blind loop equal to or greater than 6 mm in antero-posterior diameter indicated appendicitis. Appendicectomy specimen were sent for histo-pathological examination. Exclusion criteria were appendicular absces, phlegmon, evidence of generalized peritonitis and a palpable abdominal mass in the examination. All patients with four out of five or five out of five criteria was assigned as group – I and only three out of five criteria were assigned as group – II.

Group – I patients with ultrasound confirmation were operated on for appendicectomy forthwith. Group –II patients with ultrasound showing appendicitis were taken up for surgery with histo – pathologic confirmation of appendicitis were classified as ‘false negative’. On the other hand, group – II patients with ultrasound negative for

features of appendicitis, were treated conservatively. No antibiotics were given. If the fourth criterion appeared, a repeat ultrasound was performed and with features of appendicitis operation was undertaken immediately and re-assigned into group – I. But if the condition did not progress beyond three criteria, conservative treatment was continued until either the patient recovered or developed the fourth criterion. The appendix was considered inflamed if the operating surgeon recognised signs of inflammation during the operation and the pathologist confirmed acute appendicitis. Conversely, if the pathologist reported 'no evidence of acute inflammation' and/or if the surgeon did not recognise signs of acute inflammation in the organ, the case was designated a 'negative appendicectomy'. The whole length of the appendix was sectioned for histo-pathological study. Statistical analysis was performed using SPSS and sensitivity, specificity, positive predictive values and negative predictive value were calculated.

**Results:**

**Group - I:** 90 Patients were in the first group (Christian Score  $\geq 4$ ), who were considered to have appendicitis. They were subjected to Ultrasonography and 82 patients had documented features of appendicitis. They were subjected to appendicectomy and histo-pathologically proven to have appendicitis. Rest of eight patients had other findings on Ultrasound abdomen, of which two patients had probe tenderness and appendix was not visualised, they were subjected to appendicectomy, surgery and histo-pathological examination did not substantiate the diagnosis. Three female patients had Pelvic Inflammatory Disease, one female patient had ruptured ectopic pregnancy and two female patients had twisted ovarian cyst.

**Group – II:** 30 Patients were in the second group ( Christian Score of 3), patients not

considered to have appendicitis. After ultrasound abdomen three patients were found to have features of appendicitis on imaging and were subjected to appendicectomy and proven by histology (false negative). Rest of the cases (24) were treated conservatively, were observed and discharged after 3-4 days of stay in hospital and followed up every month for 6 months and none of them required surgery during the period of observation.

In our study patients ranged in the age from 10-59 years (The overall mean age being 26.23 years). The highest occurrence (42.5%) was seen in the age group of 20-29 years. The next age

group affected (25%) was 10-19 years. Overall 67.5% patients belonged to 10-29 years of age group. (Table -1). True positive and false positive in group- I along with age and sex distribution is as in Table -2. The diagnostic accuracy in group – I was 91.1%. True negative and false negative distribution of patients in group – II is as in Table -3. The diagnostic accuracy in group – II was 90%. The statistical analysis of our study showed Sensitivity of 91%, specificity 90%, positive predictive value 96.4% and negative predictive value of 77%(Table – 4).

**Table – 1 : Age Distribution;**

Age in years	No. of cases with Christian score(≥4)	No. of cases with Christian score(3)	Total	Percentage %
10-19	21	9	30	25
20-29	41	10	51	42.5
30-39	18	6	24	20
40-49	8	4	12	10
50-59	2	1	3	2.5
<b>Total</b>	<b>90</b>	<b>30</b>	<b>120</b>	

Categorisation of patients according to age group and Christian scoring system.

**Table -2 : Distribution of patients in Group – I ( scores ≥ 4);**

Sex	No. of cases with appendicitis	No. of cases without appendicitis	True positive(%)	False positive(%)
Male (n=52) 57.8%	51	1	98.07	1.92
Female (n=28) 31.1%	21	7	75	25
Children(n=10) 11.1%	10	0	100	0

Number of patients within group – I along with categorisation of true positive and false positive values.

**Table-3 : Distribution of patients in Group – II (scores -3)**

Sex	No. of cases without appendicitis	No. of cases with appendicitis	True negative(%)	False negative(%)
Male (n=16) 53.3%	15	1	93.75	6.25
Female(n=12) 40%	10	2	83.3	16.7
Children(n=2) 6.7%	2	0	100	0

Number of patients within group – II along with categorisation of true negative and false negative values.

**Table -4 : Overall Distribution of cases according to Christian Score;**

Category of cases	No. of cases with HP Appendicitis	No. of cases without Appendicitis	Total No of cases
Group 1(>=4)	82(91.1%)	8(8.9%)	90
Group 2 (3)	3(10%)	27(90%)	30
Total	85	35	120

Statistical analysis of our study

**Discussion:**

The diagnosis of acute appendicitis still represents one of the most difficult problems in surgery[14]. It is generally accepted that the removal of a normal appendix is safer in questionable cases and that delaying surgery leads to an increased rate of perforation [15]. The simple five criteria score system described by Christian[13] for reducing the negative appendectomy rate is clinically based which can be combined with ultrasound, and both in the developed and the developing world, it is the junior surgeon who performs the bulk of the emergency surgery of the acute abdomen. The idea of improving the diagnostic accuracy simply by assigning numeric values to defined signs and symptoms has been the goal of some of the scores that were previously described[9-13]. For the

scoring systems, sensitivity and specificity values higher than 80% are acceptable[16].

Our study showed Sensitivity of 91%, specificity 90%, positive predictive value 96.4% and negative predictive value of 77%. Similar studies done by others with various scoring systems such as, Alvarado scoring study done Memon ZA.et.al has Sensitivity and specificity of 93.5% and 80.6%, positive and negative predictive values were 92.3% and 83.3% respectively[17] The sensitivity and specificity of RIPASA score were 96.2% and 90.5% respectively in a study conducted by Mohammed A.et.al. [18] The Ohmann score study done by Zielke A.et.al has overall sensitivity, specificity, positive predictive value and negative predictive value of the 63%, 93%, 77% and 86% respectively [19]. The results of Eskelinen score

done by Sitter HI et.al has shown overall sensitivity, specificity, positive and negative predictive value of 72%, 91%, 76%, and 90% respectively [14] Our study has slightly higher specificity and positive predictive value and slightly lower sensitivity and negative predictive value as compared to Alvarado scoring by Memon ZA. et al. [17], the sensitivity and specificity of our study is slightly lower as compared to RIPASA scoring done by Mohammed A. et.al [18]. Our study has shown higher sensitivity and positive predictive value and lower specificity and negative predictive values as compared to Ohmann scoring study done by Zielke A1. et.al [19] and as compared

to Eskelinen score done by Sitter HI et.al, our study has shown a higher sensitivity and positive predictive value and slightly lower specificity and negative predictive value [14]

#### **Conclusion:**

From the present study it is concluded that Christian scoring system in association with ultrasound abdomen is as effective as many others studies described in literature.

However it is the simplest of all to perform. Which can be easily used by even the house surgeons and general practitioners in the diagnosis of acute appendicitis.

#### **References:**

1. Gwynn LK. The diagnosis of acute appendicitis: clinical assessment versus computed tomography evaluation. *J Emerg Med.* 2001;21(2):119-123.
2. Andersson RE. Meta-analysis of the clinical and laboratory diagnosis of appendicitis. *Br J Surg.* 2004;91(1):28-37.
3. Hoffmann J, Rasmussen OO. Aids in the diagnosis of acute appendicitis. *Br J Surg* 1989;76:774-9.
4. Lewis FR, Holcroft JW, Boey J et al. Appendicitis: a critical review of diagnosis and treatment in 1000 cases. *Arch Surg* 1975;110:677-84.
5. Pieper R, Kager L, Nasman P. Acute appendicitis: a clinical study of 1018 cases of emergency appendectomy. *Acta Chir Scand* 1982;148:51-62.
6. Van Way III CW, Murphy JR, Dunn EL, Elerding SC. A feasibility study of computer aided diagnosis in appendicitis. *Surg Gynecol Obstet* 1982;155:685-8.
7. Ambjornsson E. Development of right inguinal hernia after appendectomy. *Am J Surg* 1982;143: 174-5.
8. Deutsch AA, Shani N, Reiss R. Are some appendicectomies unnecessary? An analysis of 319 white appendices. *7 R Coll Surg Edinb* 1983;28:35-40.
9. Chong CF, Adi MI, Thien A, Suyoi A, Mackie AJ, Tin AS, Tripathi S, Jaman NH, Tan KK, Kok KY, Mathew VV, Paw O, Chua HB, Yapp SK. Development of the RIPASA score: a new appendicitis scoring system for the diagnosis of acute appendicitis. *Singapore Med J* 2010; 51: 220-225 [PMID: 20428744]
10. Ohmann C, Yang Q, Franke C. Diagnostic scores for acute appendicitis. Abdominal Pain Study Group. *Eur J Surg* 1995; 161: 273-281 [PMID: 7612771]
11. Alvarado A. A practical score for the early diagnosis of acute appendicitis. *Ann Emerg Med* 1986; 15: 557-564 [PMID: 3963537]
12. Eskelinen M, Ikonen J, Lipponen P. Contributions of history- taking, physical examination, and computer assistance to diagnosis of acute small-bowel obstruction. A prospective study of 1333 patients with acute abdominal pain. *Scand J Gastroenterol* 1994; 29: 715-721 [PMID: 7973431]

13. Christian F, Christian GP. A simple scoring system to reduce the negative appendectomy rate. *Ann R Coll Surg Engl* 1992; 74: 281-285 [PMID: 1416684]
14. Sitter H, Hoffmann S, Hassan I, Zielke A. Diagnostic score in appendicitis. Validation of a diagnostic score (Eskelinen score) in patients in whom acute appendicitis is suspected. *Langenbecks Arch Surg* 2004; 389: 213-218 [PMID: 14624293]
15. Borgstein PJ, Gordijn RV, Eijssbouts QA, Cuesta MA. Acute appendicitis--a clear-cut case in men, a guessing game in young women. A prospective study on the role of laparoscopy. *Surg Endosc* 1997; 11: 923-927 [PMID: 9294274]
16. Kırkıl C, Karabulut K, Aygen E, İlhan YS, Yur M, Binnetoğlu K, Bülbüller N. Appendicitis scores may be useful in reducing the costs of treatment for right lower quadrant pain. *Ulus Travma Acil Cerrahi Derg* 2013; 19: 13-19 [PMID: 23588973 DOI: 10.5505/tjtes.2013.88714]
17. Memon ZA, Irfan S, Fatima K, Iqbal MS, Sami W. Acute appendicitis: diagnostic accuracy of Alvarado scoring system. *Asian J Surg.* 2013 Oct;36(4):144-9.
18. N N1, Mohammed A2, Shanbhag V3, Ashfaq K4, S A P5. A Comparative Study of RIPASA Score and ALVARADO Score in the Diagnosis of Acute Appendicitis.. *J Clin Diagn Res.* 2014 Nov;8(11):NC03-5.
19. Zielke A1, Sitter H, Rampp TA, Schäfer E, Hasse C, Lorenz W, Rothmund M. discussion 784. [Validation of a diagnostic scoring system (Ohmann score) in acute appendicitis]. *Chirurg.* 1999 Jul;70(7):777-83;