RESEARCH ARTICLE

DIAGNOSIS OF ACUTE APPENDICITIS BY RIPASA SCORING SYSTEM AS AN OBSERVATIONAL STUDY

Priya Kushwah1, Ashok Tarachand Kamble2, Sunil Gujar3, Akhilesh Kumar Patel3 and Manoj Kumar Chaudhary3

1. Surgical Oncology, Senior Resident, AIIMS Bhopal, Madhya Pradesh, India.
2. General Surgery, Professor, Jnmc Medical College, Wardha, Maharashtra, India.
3. General Surgery, Senior Resident, AIIMS Raipur, Chhattisgarh, India.

Abstract

Introduction: Acute appendicitis is one of the most common cause of surgical emergency. Acute appendicitis can progress to perforation, which has high mortality and morbidity. Hence surgeons are inclined to operate rather than waiting when the diagnosis is probable. When presenting in a teenager and with a classical history, presents the Surgeon with little by way of a diagnostic challenge.

Method: It was a prospective observational study of “Clinical evaluation of RIPASA scoring system in the diagnosis of acute appendicitis” was carried out in the department of general surgery, Acharya Vinoba Bhave Rural Hospital, affiliated to Jawaharlal Nehru Medical College, Sawangi, Wardha, from April 2012 to September 2014. Total 80 patient was included in this study.

Result: The most common position of appendix as found in our study was retro-caecal and the least common position was pre-ileal. We found that in our study sensitivity was 96%, specificity was 65%, positive predictive value was 67%, negative predictive value was 86% and diagnostic accuracy was 70%. The cut-off value, we have taken is 7.5. As compared to the study done by Chong CF et al18 in 2011, our sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy were 2% less, 16.3% less, 18.3% less, 11.4% less and 21.8% less respectively [Table 5]. ROC plots for the RIPASA scoring system. The optimal cut-off threshold score is 7.5, with a sensitivity and specificity of 0.96 and 0.65 (1-specificity= 0.35) respectively. The positive predictive value and negative predictive value are 0.67 and 0.86 respectively. The diagnostic accuracy of the study being 70%. So according to the above table we are taking: True positive = 44, True negative = 22, Hence True positive + true negative divided by total number of patients 44 + 22 = 66 / 80 = 70% is the diagnostic accuracy.

Conclusion: The RIPASA score is simple scoring system with high sensitivity and specificity for the diagnosis of acute appendicitis. RIPASA score is currently a better diagnostic scoring system for diagnosis of acute appendicitis compared to OTHER particularly in
Indian population. Making a correct and prompt diagnosis of acute appendicitis including its possible pathological stage is possible with the RIPASA score, which is easily obtained using simple clinical and laboratory data, without a need of unwanted admissions and expensive imaging studies like CT scan.

Introduction:-
Acute appendicitis is one of the most common cause of surgical emergency. Acute appendicitis can progress to perforation, which has high mortality and morbidity. Hence surgeons are inclined to operate rather than waiting when the diagnosis is probable. When presenting in a teenager and with a classical history, the surgeon with little by way of a diagnostic challenge. However this disease has ability to simulate other conditions and can also frequently be imitated by other pathologies. Despite more than 100 years of experience, accurate diagnosis still evades the surgeon. Owing to its myriad presentations; it is a common but difficult diagnostic problem. Many efforts are being taken towards early diagnosis and intervention as approximately 6% of population suffer from this disease during their lifetime. The accuracy of clinical examination has been reported in the range of 71% to 97%. Attempts to increase the diagnostic accuracy of acute appendicitis have included computer aided diagnosis, imaging by USG, laparoscopy and even radioactive isotope imaging. Appendicitis is most frequently found in 2nd to 4th decades of life with the mean age being 31.3 and median age being 22 years. There is a slight male to female predominance. Diagnostic difficulty in patients with atypical clinical findings has resulted in unnecessary appendectomies, which have been variably reported in surgery literature between 8% and 33% with an average of about 20%. In fact the rate of negative appendectomies increases to 35% - 45% in young women of childbearing age in whom differential diagnosis from pelvic inflammatory may be extremely difficult. Equally distressing is the fact that perforation may occur in up to 35% of cases. Appendicitis can occur due to various causes like difference in dietary habits, food adulterations, indulging in mixed diet habits, seasonal changes particularly colder periods. Etiology of appendicitis are plenty among which obstruction to the lumen and infection play an important role. Of all infections, E.coli is the most common organism to cause appendicitis. The classical signs and symptoms of acute appendicitis was first reported by Reginald Fitz in 1886. Apart from classical presentation, acute appendicitis presents with unusual features or associated with unusual conditions. The emergency surgeon must also remember that “one can’t step twice in to the same river” and that the patient with right iliac fossa pain, and a scar into abargain, is not the same patient psychologically or physically as before. Finally, there is the economic argument that, unnecessary appendectomy is a waste of scarce resources. Lawson Tait was 1st surgeon to do deliberate appendectomy (1567). Claudius Amyand operated on an 11 year boy with a long standing scrotal hernia with perforated appendix in it. (1686) Rate of negative appendectomy has remained constant at 10 per 10,000 patients per year. The percentage of misdiagnosis of appendicitis is significantly higher among women than men. (22.9 – 9.3%). The negative appendectomy rate for women of reproductive age group is 23.2% with the highest rate identified in women aged 40 – 49 years. The highest negative appendectomy rate noted for women more than 80 years of age. The operation of negative appendix is accompanied by the usual spectrum of immediate postoperative complications in up to 15% of patients (Lewis et al 1975). Some patients may have complications such as intestinal obstruction and incisional hernia. The operative techniques used for appendectomy have never become completely standardised, it varies from case to case. There are various scoring systems to aid the diagnosis of acute Appendicitis. One of them is RIPASA (Raja Isteri Pengiran Anak Saleha Appendicitis) scoring system which has been developed particularly applicable to south east-asian region. The Raja Isteri Pengiran AlakeSaleha (RIPASA) hospital is the national hospital of Brunei, Darussalem. This system has been shown to have significantly higher sensitivity, specificity and diagnostic accuracy than that reported for ALVARADO and MODIFIED ALVARADO scoring system. The Alvarado and modified Alvarado scores have been developed to aid diagnosis, but both scoring systems have poor sensitivity and specificity when applied in Middle Eastern and Asian populations. Not many studies have been done to assess the diagnostic accuracy of this promising scoring system when applied to populations in Indian subcontinent. He published his article by 2011 and its 3 years no study has been conducted. As far as our knowledge is concerned this study is the first one in India. Hence we in our institution wanted to assess the sensitivity, specificity and diagnostic accuracy of RIPASA scoring system.
Material And Methods:-
It was a prospective observational study of “Clinical evaluation of RIPASA scoring system in the diagnosis of acute appendicitis” was carried out in the department of generalsurgery, Acharya Vinoba Bhave Rural Hospital, affiliated to Jawaharlal Nehru Medical College, Sawangi, Wardha, from April 2012 to September 2014. Total 80 patient was included in this study. All the patients with right iliac fossa pain attending surgery department were subjected to clinical assessment by applying RIPASA scoring system and various clinical tests in consultation with senior surgeon for diagnosis of acute appendicitis and admitted to surgery ward. After admission toward the patients were examined according to RIAPASA SCORING SYSTEM which included: Gender, Symptoms like: Right iliac fossa pain, Migration of right lower quadrant pain, Anorexia, Nausea and vomiting, Duration of symptoms (<48hrs or >48hrs) and Signs like: Right iliac fossa tenderness, Right iliac fossa guarding, Rebound tenderness, Rovsing’s sign, Fever Laboratory tests: Raised white blood cells, Negative urine analysis. All patients were subjected to ultrasound examination to exclude any other associated pathology and also confirm the diagnosis in doubtful cases. Surgery in required cases was done under general anaesthesia or spinal anaesthesia. Abdomen was opened by Mc Burney’s or right Para median incision. At surgery the position of the appendix was first identified before disturbing the structures. Other intra-operative findings included length of the appendix and mesoappendix. After completion of appendectomy the specimen was subjected to histopathological examination by the qualified pathologist. Only those cases which were proved as appendicitis histopathologically were included in the study.

In Inclusion Criteria:
Patients of any age group and both sexes presenting to emergency department with pain in the right iliac fossa having clinical suspicion of acute appendicitis.

In Exclusion Criteria:
Patients having pain in the other quadrants of the abdomen.

Observation And Results:-

Graph No 1:- Shows age and sex distributions of patients with acute appendicitis.

Out of 80 patients 50 (62.5%) were males and 30 (37.5%) were females with male: female ratio (1.67:1). The maximum number of patients were in the age group of 11-20 years (31.3%) followed by 21-30 years (30%). The mean age of study population was 27.75 ± 11.80. RIPASA scoring system has given points as follows: Male = 1, Female = 0.5, Age < 39.9 years = 1, Age > 40 years = 0.5
Table No. 1: Showing sex wise distribution of patients according to symptoms under RIPASA scoring system.

| Gender | Total Pt. | Anorexia | Nausea/Vomiting | Migratory RIF Pain | RIF Pain | Fever |
|--------|-----------|----------|-----------------|--------------------|----------|-------|
| Male   | 50 (62.5) | 43       | 35              | 20                 | 50       | 32    |
| Female | 30 (37.5) | 28       | 26              | 11                 | 30       | 16    |
| Total  | 80 (100.0)| 71       | 61              | 31                 | 80       | 48    |

Table No. 2: Showing sex wise distribution of patients under various clinical Signs.

| Sex   | Clinical Signs |
|-------|----------------|
|       | Rebound Tenderness | Rovsing’s Sign | Tenderness in RIF | RIF Guarding |
| Male  | 38               | 18              | 50                | 6            |
| Female| 21               | 11              | 30                | 1            |
| Total | 59               | 29              | 80                | 7            |
Graph No. 2: Showing age wise distribution of patients according to intraoperative position of appendix

Graph No. 3: Showing distribution of patients according to signs, symptoms and laboratory test under RIPASA score in relation to histopathology.
Table No. 3: Showing distribution of patients under RIPASA scoring system in relation to histopathology.

| Score | Acute | Chronic | Acute on Chronic Appendicitis | Healed/Resolving | Recurrence | Total |
|-------|-------|---------|--------------------------------|-----------------|------------|-------|
| ≥ 7.5 | 39    | 15      | 3                              | 7               | 2          | 66    |
| < 7.5 | 1     | 10      | 1                              | 2               | 0          | 14    |
| Total | 40    | 25      | 4                              | 9               | 2          | 80    |

Chi Square = 15.719  p Value = 0.003

Table No. 4: Showing age wise distribution of patients under Leucocytosis.

| Leucocytosis | No. of Patients | Percentage |
|--------------|-----------------|------------|
| ≥ 11000      | 36              | 45.00%     |
| < 11000      | 44              | 55.00%     |
| Total        | 80              | 100.00%    |

Table No. 5: Showing distribution of patients under RIPASA scoring system in relation to histopathology.

| RIPASA Score | Histopathology | Total |
|--------------|----------------|-------|
|              | Acute          | Non Acute |       |
| < 7.5        | 2 (2.50)       | 12 (15.00) | 14 (17.50) |
| ≥ 7.5        | 44 (55.00)     | 22 (27.50) | 66 (82.50) |
| Total        | 46 (57.50)     | 34 (42.50) | 80 (100.00) |

Chi Square = 10.913  p-Value = 0.001
Score of ≥ 7.5 was found to be significantly associated with acute appendicitis (p-value < 0.05) with sensitivity of 96% and specificity of 65%. The additional parameter of foreign NRI as RIPASA had given 1 point. However, there is not a single NRI patient in our study.

**Curve No 1: ROC Curve:**

ROC plots for the RIPASA scoring system. The optimal cut-off threshold score is 7.5, with a sensitivity and specificity of 0.96 and 0.65 (1-specificity= 0.35) respectively. The positive predictive value and negative predictive value are 0.67 and 0.86 respectively. The diagnostic accuracy of the study being 70%. So according to the above table we are taking: True positive = 44, True negative = 22. Hence, True positive + true negative divided by total number of patients 44 + 22 = 66 / 80 = 70% is the diagnostic accuracy.

**Discussion:**
As per Chong CF et al (2011) in south East Asian region RIPASA scoring system is useful in terms of diet and ethnic origin. It is simple and easy to use. The clinical judgement for appendectomy depends upon ROC, sensitivity, specificity, negative predictive value, positive predictive value and diagnostic accuracy. We have done this study in 80 patients at Acharya Vinoba Bhave Rural Hospital. Acute appendicitis was more common in the age group 11 – 20 years. The mean age of study population was 27.75 ±11.80. There is male to female preponderance seen, males being 50 and females being 30 in number. Male is to female ratio being 1.67:1 [GRAPH 1].Symptom duration less than 48 hours was seen most frequently in the age group 21 – 30 years while symptom duration of more than 48 hours was seen most frequently in age group of 31 – 40 years [TABLE 1]. Symptom duration of < 48 hours was more frequenct amongst the males.Rovsing’s sign as well as rebound tenderness were most commonly observed in the age group of 21 – 30 years [TABLE 2]. Tenderness in the right iliac fossa was the most commonly observed sign in all the age groups. Most common sign present in both males and females were right iliac fossa tenderness followed by rebound tenderness and rovsing’s sign. The average length of the appendix was 7.85cm [GRAPH 2]. Mesoappendix was present throughout the length in all the patients. The most frequently observed symptom in our study was right iliac fossa pain followed by anorexia and nausea/ vomiting. Right iliac fossa pain followed by anorexia were the most common symptoms observed in both males and females [GRAPH 3]. In histopathology acute appendicitis was most common finding [TABLE 3]. In our study 55% patient have leucocyte count less than 11000 [Table 4]. The most common position of appendix as found in our study was retro-caecal and the least common position was pre-ileal. We found that in our study sensitivity was 96%, specificity was 65%, positive predictive value was 67%, negative predictive value was 86% and diagnostic accuracy was 70%. The cut-off value, we have taken is 7.5. As compared to the study done by Chong CF et al (2011), our sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy were 2% less, 16.3% less, 18.3% less, 11.4% less and 21.8% less respectively [Table 5]. ROC plots for the RIPASA scoring system. The optimal cut-off threshold score is 7.5, with a sensitivity and specificity of 0.96 and 0.65 (1-specificity= 0.35) respectively. The positive predictive value and negative predictive value are 0.67 and 0.86 respectively. The diagnostic accuracy of the
study being 70%. So according to the above table we are taking: True positive = 44, True negative = 22. Hence, True positive + true negative divided by total number of patients = 44 + 22 = 66 / 80 = 70% is the diagnostic accuracy. [See Curve 1]. So our results for RIPASA scoring system are not completely matching with Chong CF study. In order to obtain a higher diagnostic accuracy for acute appendicitis, different scoring systems should be utilized as none of the scoring system alone is clearly superior to others. Further studies may be undertaken to assess the usefulness of applying multiple scoring systems in patients suspected of acute appendicitis.

**Conclusion:**

The RIPASA score is simple scoring system with high sensitivity and specificity for the diagnosis of acute appendicitis. RIPASA score is currently a better diagnostic scoring system for diagnosis of acute appendicitis compared to OTHER particularly in Indian population. Making a correct and prompt diagnosis of acute appendicitis including its possible pathological stage is possible with the RIPASA score, which is easily obtained using simple clinical and laboratory data, without a need of unwanted admissions and expensive imaging studies like CT scan.

**References:**

1. Hoffmann J, Rasmussen OO. Aids in the diagnosis of acute appendicitis. Br JSurgery 1989; 76: 774-79.
2. Brown SP, Ellis BW. Hamilton Bailey’s Emergency Surgery. 13th edition. New York: Arnold; 2000.P 399-400
3. Anonymous. A sound approach to diagnosis of acute appendicitis (editorial). Lancet. 1987; 1: 198-200
4. John H, Neff U, Kelemen M. Appendicitis diagnosis today: clinical and ultrasonicateductions. World Journal Surgery 1993; 17: 243-249.
5. Balthazar EJ, Megibow AJ et al. C of appendicitis. Am J Radiology. 1986; 6: 185–193.
6. Takada et al. Ultrasonographic diagnosis of acute appendicitis in surgeryindication. In Surg. 1986; 68: 68-69.
7. Clarke PJ et al. The use of laparoscopy in the management of right iliac fossapain. Ann R College Surgery England. 1986; 68: 68-69.
8. Eric BR et al. Tc – 99 – HMPAO white blood cell scan for diagnosis of acuteappendicitis in patients with equivocal clinical presentation. Ann Surgery 1997; 226(1): 58 – 65.
9. Addis DG, Shaffer N, Fowler BS et al. The epidemiology of appendicitis and appendectomy in the United States. AM J Epidemiology. 1990; 132: 910.
10. Broushok KF, Jeffrey RB Jr, laing FC et al. Sonographic diagnosis of perforation in patients with chronic appendicitis. AJR. 1990; 154: 275 – 8.
11. Fitz RH. Perforating inflammation of the vermiform appendix: with specialreference to its early diagnosis and treatment. Am J. Med Science. 1886; 92: 321-346.
12. Korner H, Sondenna K, Soreide JA, et al. Incidence of acute non perforated andperforated appendicitis: Age – specific and sex specific analysis. World J surgery 1997; 21: 313.
13. Flum DR, Koeppell. Has misdiagnosis of appendicitis decreased over time? Apopulation based analysis. Arch surgery 2002; 137: 799.
14. Flum DR, Koeppell T. The clinical and economic correlates of misdiagnosedappendicitis: Nationwide analysis. Arch surgery 2002; 137: 799.
15. Olutola PS. Plain film radiographic diagnosis of acute appendicitis: an evaluationof the signs. Can Association Radiology J, 1988 Dec; 39(4): 254-6.
16. Arnbjornsson E. Scoring system for computer aided diagnosis of acuteappendicitis: the value of prospective versus retrospective studies. Ann ChirGynecology 1985; 74: 159 – 166.
17. Teicher I, Landa B, Cohen M, Kabnick L, Wise L. Scoring system to aid indiagnosis of appendicitis. Ann Surgery 1983; 198: 753-759.
18. Chong CF, Thien A, Mackie AJA, Tin AS, Tripathi S, Ahmad MA, Tan LT, AngSH, Telisenghe PU. Comparison of RIPASA and Alvarado scores for the diagnosis of acute appendicitis. Singapore Med j 2011; 52 (5): 340-345.
19. Chong CF, Adi MIW, Thien A, Suyo A, Mackie AJ, Tin AS, Tripathi S, JanamNH, 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(3): 220.
20. Kalan M, Talbot D, Cunliffe WJ, Rich AJ. Evaluation of the modified Alvaradoscore in the diagnosis of acute appendicitis: a prospective study. Ann R College Surgery England 1994; 76: 418-9.
21. Alvarado A. A practical score for the early diagnosis of acute appendicitis. AnnEmergency Med 1986; 15: 557-64.