

Comparison between Accuracy of Alvarado Scoring and USG Abdomen in Diagnosis of Acute Appendicitis

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Abstract: Introduction:- Acute appendicitis is the most common surgical emergency of the abdomen with significant morbidity, which increases with diagnostic delay. Misdiagnosis is not uncommon. In fact, despite diagnostic and therapeutic advancement in medicine, appendicitis remains a clinical emergency and is one of the common causes of acute abdominal pain. Decision making in cases of acute appendicitis poses a clinical challenge specially in developing countries where advanced radiological investigations are not cost effective and so clinical parameters remain the mainstay of diagnosis. Several diagnostic scoring systems have been devised as an aid to the early diagnosis of acute appendicitis and to reduce the incidence of negative appendectomy. This prospective study was conducted to compare the accuracy of Alvarado Scoring and USG abdomen in diagnosis of Acute Appendicitis in MGM Medical College, Navi Mumbai, during January 2012 November 2013 on 80 patients who presented with right iliac fossa pain **Methods:** This is a prospective study in which 80 pts. with right iliac fossa pain, suspected of acute appendicitis were taken for the study. Detailed examination and investigations were done. These patients were then categorized according to Alvarado score and open/lap appendectomy was performed. The diagnosis was confirmed by histopathology examination. **Results:** The result of this study showed that high score (7-10) in both males and females had high sensitivity, 97.06% and 95.45% respectively. The overall sensitivity rate was 96.43%, whereas the USG had sensitivity of 88.89%. The score (5-6) in males and females had sensitivity of 20.0% and 62.5% respectively. The overall sensitivity rate in this group was 53.85% which was quite low than that of USG i.e. 85.71%. **Conclusion:-** From the present study it may be concluded that high scores (7-10) in Alvarado score is dependable aid in early diagnosis of acute appendicitis both in males and females. In females, because of other conditions mimicking appendicitis like pelvic inflammatory disease, ruptured ectopic pregnancy, ultrasonography of abdomen act as a useful tool in ruling out these conditions and therefore avoiding negative appendectomy. The result of present study showed that a Negative appendectomy rate was significantly higher in Group 2 (score 5-6), 46.15%. out of which males had higher rate (60%) than females (37.5%). But in Group 3 (score 7-10 the negative appendectomy rates were quite low (3.57%). Out of which females had higher rate (4.55%) than males (2.94%).

Keywords: Alvarado Score, Appendicitis, Surgery, Appendectomy

1. Introduction

Acute appendicitis is the most common surgical emergency of the abdomen with significant morbidity, which increases with diagnostic delay. Misdiagnosis is not uncommon. In fact, despite diagnostic and therapeutic advancement in medicine, appendicitis remains a clinical emergency and is one of the common causes of acute abdominal pain. Arriving at the correct diagnosis is essential, however, a delay may allow progression to perforation and significantly increased morbidity and mortality. Incorrectly diagnosing a patient with appendicitis although not catastrophic often subjects the patient to an unnecessary operation. The diagnosis of acute appendicitis is essentially clinical; however a decision to operate based on clinical suspicion alone can lead to removal of a normal appendix in 15-30% cases. The premise that it is better to remove a normal appendix than to delay diagnosis doesn't stand up to close scrutiny, particularly in the elderly. As the various radiological modalities are not available at many places, especially rural areas, or the patient could not afford these investigations, surgeon has to rely on clinical diagnosis for the management of acute appendicitis. A number of clinical and laboratory based scoring systems have been devised to assist diagnosis. The most commonly used is the Alvarado score.

Diagnostic Scores:- Various diagnostic scoring systems have been developed in an attempt to improve the diagnostic accuracy of acute appendicitis. The most prominent of these scores is developed by Alvarado. (Table 1) This score, developed in 1978, consist of elements from the patient's history, physical examination and from lab tests.

Symptoms	Migratory RIF pain	1
	Anorexia, Nausea, vomiting	2
Sign	Tenderness RIF	2
	Rebound Tenderness	1
	Elevated Temperature	1
Laboratory	Leucocytosis	2
	Shift to left (more premature lymphocyte)	1
Total		10

2. Aims and Objectives

Acute appendicitis is a clinical diagnosis. So, it's impossible to have a definitive diagnosis by gold standard (Histopathology) pre-operatively.

- About 6% of population is expected to have appendicitis in their lifetime.
- Routine history and physical examination still remain most practical diagnostic modalities.

- Absolute diagnosis is possible only after Histopathology examination. Examination.
- High negative appendectomy rate- 15-20%,
With associated morbidity rate- 10
And associated mortality rate -0.3- 1%

Aim of this Study

- To evaluate the reliability of Alvarado scoring system and comparing it with USG Abdomen findings.
- To reduce negative appendectomy rates.
- Early diagnosis to prevent morbidity and mortality in Acute Appendicitis.
- To reduce the complications due to misdiagnosis and delay in surgery.

3. Methodology

This is a prospective study conducted on patients presenting with pain in right ili fossa whose clinical evaluation were provisionally diagnosed as Acute Appendicitis and admitted in MGM medical college Kamothe, MGM Hospital Vashi and MGM Hospital Belapur during the study period of JAN 2012 Nov 2013.

• Inclusion Criteria

The study group includes the patients who were randomly selected irrespective of their age, sex and nature of disease, undergoing laparoscopic surgeries. The study also includes all those cases who are operated initially for laparoscopic surgeries but were latter taken for open surgeries. The diagnosis has been confirmed by histopathological examination.

• Exclusion Criteria:

Pt with urological, gynaecological and surgical pre-existing problems other than appendicitis.

• Collection Of Data

A total of 80 cases of suspected acute appendicitis who were admitted, investigated and treated were taken for the study. After detailed examination and investigations a modified Alvarado score was applied to each case.

All patients underwent ultrasonography of abdomen primarily to rule out other conditions mimicking acute appendicitis. Following decisions were taken:-

Cases with score of 1-4 were observed and not operated and were followed up after discharge for next six months for development of acute appendicitis.

Cases with score 5-6 were observed for next 24 hours for revision of scoring. If score became 7 or their clinical condition was highly suspicious of acute appendicitis they were subjected for appendectomy.

Cases with score of 7-10 were considered candidates for appendectomy, they were Patients with operated.

All the specimens of appendix were sent for histopathological confirmation of acute appendicitis. Final correlation between the scoring system and final diagnosis

was made. Eighty patients who constituted present study group were divided in to 3 groups
 Group -I Patients who were between score 1-4
 Group-III: Patients who were between score 7-10.

4. Observation and Results

1. Group 1: 11 patient were in first group (1-4) who were not considered likely to have appendicitis. They were observed and were treated conservatively. Discharged after 2-3 days and were followed up every month for 6 months and none of them required surgery.

Group 2: 13 patient were in second group (5-6), all were operated upon clinical suspicion of high probability of acute appendicitis. Of the 13 patient, 5 were male and 8 were female.

Distribution of cases according to Alvarado score (5-6)

Gender	No of cases operated	No of cases with HP Appendicitis	No of cases without HP Appendicitis	Proportion of true positive	Proportion of false positive
Male	5	2	3	20	60
Female	8	5	3	62.50	37.50
Total	13	7	6	53.85	46.15

2 out of 5 male and 5 out of 8 female, had acute appendicitis. The overall negative appendicitis rate of patient with score 5-6 is 46.15%.

Group 3: Constituted 56 patient, all underwent appendectomy on the basis of the score.

Distribution of cases according to Alvarado score (7-10)

Gender	No of cases operated	No of cases with HP Appendicitis	No of cases without HP Appendicitis	Proportion of true positive	Proportion of false positive
Male	34	33	1	97.06	2.94
Female	22	21	1	95.45	4.55
Total	56	54	2	96.43	3.57

54 cases out of 56 cases had acute appendicitis. The sensitivity of Alvarado score of >7 was 96.43%. the sensitivity was highest among male is 97.06%. while in female is 95.45%.

2. Sex Distribution

Total Score	Male	Female	Total
1-4	5 45.5%	6 54.5%	11 100%
5-6	5 38.5%	8 61.5%	13 100%
7-10	34 60.7%	22 39.3%	56 100
Total	44	36	80

In this study, there were 44(55%) male patient, 36(45%) female.

3. Age sex distribution

Age	male	female	total
Less than 20	15	18	33
Less than 20	45.5%	54.5%	100%
20-40	26	17	43
20-40	60.5%	39.5%	100%
40-60	2	1	3
40-60	66.7%	33.3%	100%
60 & above	1	0	1
60 & above	100%	0%	100%
Total	44	36	80
Total	55%	45%	100%

maximum in age group of 20-40years followed by <20years.

Incidence greatly decreases after 40years of age. Apart from migratory right iliac fossa pain anorexia was common symptom in 53 cases whereas nausea & vomiting was seen in 51 cases.

Elevated temperature was second most prominent sign seen after tenderness in RIF and leucocytosis and shift to left were prominent features of group 3.

Interpretation

Incidence is maximum in 20-40yrs of age group. Also the incidence is more in males in this age group as compared to less than 20yrs age group.

4. Symptom Distribution

Symptom	Total score			
Symptom	1-4	5-6	7-10	total
Migratory RIF pain	11	13	56	80
Migratory RIF pain	13.75%	16.25%	70%	100%
Anorexia	4	8	43	55
Anorexia	5.00%	10%	53.75%	68.75%
Nausea vomiting	2	7	42	51
Nausea vomiting	2.50%	8.75%	52.50%	63.75%

Interpretation

Apart from migratory right iliac fossa pain, anorexia was common symptom seen in 55 cases, whereas nausea & vomiting was seen in 51 cases.

5. Sign Distribution

Signs	Total score			total
Signs	1-4	5-6	7-10	total
Tenderness in RIF	9	12	56	77
Tenderness in RIF	11.3%	15%	70%	96.3%
Rebound tenderness	2	7	29	38
Rebound tenderness	2.8%	8.8%	36.3%	47.5%
Elevated temperature	4	8	44	56
Elevated temperature	5%	10%	55%	70%

Interpretation-

Elevated temperature was second most prominent sign seen after tenderness in RIF.

6. Lab Diagnosis Distribution

Lab diagnosis	Total score			total
Lab diagnosis	1-4	5-6	7-10	Total
Leucocytosis	0%	1	51	52
Leucocytosis	.0%	1.3%	63.8%	65%

Interpretation

Leucocytosis and shift to left were prominent features of group 3.

5. Discussion

The study included 80 patients out of which 44 were males and 36 females. When classified according to age group, incidence of acute appendicitis was seen to be

Comparison of negative appendicectomy rates

	males	Females	Total
Group2	60%	37.5%	46.15%
Group3	2.94%	4.55%	3.57%

The result of present study showed that a negative appendicectomy rate was significantly higher in group 2, 46.15%. out of which males had higher rate than females. But in group 3 the negative appendicectomy rates were quite low, out of which females had higher rate than males.

Comparison of true positive cases (sensitivity) in group2

Category	Present study	kalanM, Rich, AJ, Talbot D	PK, Bhattacharjee, T. chowdhary
Male	20	67%	83.3%
Female	62.5	50%	66.7%
Total	53.85	62.5%	73.7%

Comparison of true positive cases in group 3

Category	Present study	Kalan M, Rich, AJ, Talbot	PK, BHttacharjee, T. chowdhary
Male	97.06	93%	94.1%
Female	95.45	67%	71.9%
Total	96.43	83.7%	82.7%

Comparison between sensitivity rates of Alvarado score and USG

	Group 2	Group 3
Alvarado	53.85%	96.43%
Usg	85.71%	88.89%

In group 3, Alvarado score was more sensitive as compared to USG but in group 2.

6. Anatomy of Appendix

Embryology of the Appendix - The appendix becomes visible in the eighth week of development as a protuberance off the caecum. At an early embryonic stage it has the same calibre as the caecum and is in line with it. During development the growth rate of caecum (mainly the right wall) exceeds that of appendix, displacing the appendix medially towards the ileocaecal valve. Congenital absence of the appendix is extremely rare

Gross Anatomy

The vermiform appendix is a narrow, vermian (worm-shaped) tube which arises from the posteromedial caecal wall, 2 cm below the end of the ileum. Its length ranges from 0.5 in (12mm) to 9 in (22 cm). The diameter of the appendix is usually between 7 and 8 mm. It may occupy one of several positions. The relationship of the base of the

appendix to the caecum remains constant, whereas the tip can be found in a retrocaecal, retrocolic (behind the caecum or lower ascending colon respectively) pelvic (when it hangs dependently over the pelvic brim, in close relation to the right uterine tube and ovary in females) position. These are the commonest positions seen in clinical practice. Other positions are occasionally seen especially when there is a long meso-appendix allowing greater mobility. These include subcaecal (below the caecum) preileal (anterior to the terminal ileum), ileal (behind the terminal ileum), subhepatic.

The three taeniae coli on the ascending colon and caecum converge on the base of the appendix, and merge into its longitudinal muscle. The anterior caecal taenia is usually distinct and can be traced to the appendix, which affords a guide to its location in clinical practice. The appendix varies from 1 to 30 cm in length; most appendices are 6-9 cm in length. It is often relatively longer in children and may atrophy and shorten after mid-adult life. It is connected by a short mesoappendix to lie in lower part of the ileal mesentery. This fold is usually triangular, extending almost to the appendicular tip along the whole viscus.

The lumen of the appendix is small and opens into the caecum by an orifice lying below and slightly posterior to the ileocaecal opening. The orifice is sometimes guarded by a semilunar mucosal fold forming a valve. For many years, the appendix was erroneously viewed as a vestigial organ with no known function. It is now well recognized that the appendix is an immunologic organ that actively participates in the secretion of immunoglobulins, particularly immunoglobulin A. Lymphoid tissue first appears in the appendix approximately 2 weeks after birth. The amount of lymphoid tissue increases throughout puberty, maximum in adults (approx. 200 in no.) and remains steady for the next decade, and then begins a steady decrease with age. After the age of 60 years, virtually no lymphoid tissue remains within the appendix, and complete obliteration of the appendiceal lumen is common.

7. Vascular Supply and Lymphatic Drainage

Appendicular Artery

The main appendicular artery, a branch from the lower division of the ileocolic artery runs behind the terminal ileum and enters the mesoappendix a short distance from the appendicular base. Here it gives off a recurrent branch, which anastomoses at the base of the appendix with a branch of the posterior caecal artery: the anastomosis is sometimes extensive. The main appendicular artery approaches the tip of the organ, at first near to and then in the edge of the mesoappendix. The terminal part of the artery lies on the wall of the appendix and may be thrombosed in appendicitis, which results in distal gangrene or necrosis. Accessory arteries are common, and many individuals possess two or more arteries of supply.

Appendicular Veins The appendix is drained via one or more appendicular veins into the posterior caecal or ileocolic vein and thence into the superior mesenteric vein

Lymphatic Drainage

Lymphatic vessels in the appendix are numerous: there is abundant lymphoid tissue in its walls. From the body and the apex of the appendix 8-15 vessels ascend in the mesoappendix, and are occasionally interrupted by one or more nodes. They unite to form three or four larger vessels which run into the lymphatic vessels draining the ascending colon, and end in the inferior and superior nodes of the ileocolic chain.

Innervation

The appendix and overlying visceral peritoneum are innervated by sympathetic and parasympathetic nerves from the superior mesenteric plexus. Visceral afferent fibres carrying sensation of distension and pressure mediate the symptoms of pain felt during the initial stages of appendicular inflammation. In keeping with other structures derived from the midgut, these sensations are poorly localized initially, and referred to the central (periumbilical) region of the abdomen. It is not until parietal tissues adjacent to the appendix become involved in any inflammatory process that somatic nociceptors are stimulated, and there is an associated change in the nature and localization of pain.

Mesoappendix

The mesentery of the appendix is a triangular fold of peritoneum around the vermiform appendix. It is attached to the posterior surface of the lower end of the mesentery of the small intestine close to the ileocaecal junction. It usually reaches the tip of the appendix but sometimes fails to reach the distal third, in which case a vestigial low peritoneal ridge containing fat is present over the distal third. It encloses the blood vessels, nerves and lymph vessels of the vermiform appendix, and usually contains a lymph node.

Caecal Recesses

Several folds of peritoneum may exist around the caecum and form recesses. Paracaecal recesses are common sites for abscess formation following acute appendicitis.

Superior ileocaecal recess

The superior ileocaecal recess is usually present and best developed in children. It is often reduced and absent in the aged, especially the obese. It is formed by the vascular fold of the caecum, which arches over the anterior caecal artery, supplying the anterior part of the ileocaecal junction, and its accompanying vein. It is a narrow slit bounded in front by the vascular fold, behind by the ileal mesentery below by the terminal ileum and on the right by the ileocaecal junction. Its orifice opens downwards to the left.

Inferior ileocaecal recess

The inferior ileocaecal recess is well marked in youth but frequently obliterated by fat in adults. It is formed by the ileocaecal fold, which extends from the anteroinferior aspect of the terminal ileum to the front of the mesoappendix (or to the appendix or caecum. It is also known as the bloodless fold of Treves', although it sometimes contains blood vessels and will often bleed if divided during surgery. If inflamed, especially when the appendix and its mesentery are retrocaecal, it may be mistaken for the mesoappendix. The recess is bounded in front by the ileocaecal fold, above by the posterior ileal surface and its mesentery, to the right by

the caecum, and behind by the upper mesoappendix. Its orifice opens downwards to the left.

Retrocaecal recess

The retrocaecal recess lies behind the caecum. It varies in size and extent and ascends behind the ascending colon, often being large enough to admit an entire finger. It is bounded in front by the caecum (and sometimes the lower ascending colon), behind by the parietal peritoneum and on each side by caecal folds (parietocolic folds passing from the caecum to the posterior abdominal wall. The vermiform appendix frequently occupies this recess when in the retrocaecal position.

Pathogenesis

Obstruction of the lumen is the dominant causal factor in acute appendicitis. Faecoliths are the usual cause of appendiceal obstruction. Less common causes are hypertrophy of lymphoid tissue, inspissated barium from previous x-ray studies, tumors, vegetable and fruit seeds, and intestinal parasites. The frequency of obstruction rises with the severity of the inflammatory process. Faecoliths are found in 40% of cases of simple acute appendicitis, 65% of cases of gangrenous appendicitis without rupture, and nearly 90% of cases of gangrenous appendicitis with rupture.

There is a predictable sequence of events leading to eventual appendiceal rupture. The proximal obstruction of the appendiceal lumen produces a closed-loop obstruction, a continuing normal secretion by the appendiceal mucosa rapidly produces distension. The luminal capacity of the normal appendix is only 0.1 ml. Secretion of as little as 0.5 ml of fluid distal to an obstruction raises the intraluminal pressure to 60 cm H₂O. Distension of the appendix stimulates nerve endings of visceral afferent stretch fibers producing vague, dull, diffuse pain in the mid-abdomen or lower epigastrium. Peristalsis is also stimulated by the rather sudden distention, so that some cramping may be superimposed on the visceral pain early in the course of appendicitis. Distension continues from continued mucosal secretion and from rapid multiplication of the resident bacteria of the appendix. Distension of this magnitude usually causes reflex nausea and vomiting, and the diffuse visceral pain becomes more severe. As pressure in the organ increases, venous pressure is exceeded. Capillaries and venules are occluded, but arteriolar inflow continues, resulting in engorgement and vascular congestion.

The inflammatory process soon involves the serosa of the appendix and in turn parietal peritoneum in the region, producing the characteristic shift in pain to the right lower quadrant. The mucosa of the gastrointestinal tract, including the appendix, is susceptible to impairment of blood supply, thus its integrity is compromised early in the process, allowing bacterial invasion. As progressive distension encroaches upon first the venous return and subsequently the arteriolar inflow, the area with the poorest blood supply suffers most: ellipsoidal infarcts develop in the anti-mesenteric border.

As distension, bacterial invasion, compromise of vascular supply, and infarction progress, perforation occurs, usually through one of the infarcted areas on the anti-mesenteric

border. Perforation generally occurs just beyond the point of obstruction rather than at the tip because of the effect of diameter on intraluminal tension.

This sequence is not inevitable, however, and some episodes of acute appendicitis apparently subside spontaneously. Many patients who, at operation, are found to have acute appendicitis give a history of previous similar, but less severe, attacks of right lower quadrant pain. Pathologic examination of the appendix removed from these patients often reveals thickening and scarring, suggesting old, healed, acute inflammation.

Bacteriology

The bacteriology of the normal appendix is similar to that of the normal colon. The appendiceal flora remains constant throughout life with the exception of *Porphyromonas gingivalis*. This bacterium is seen only in adults. The bacteria cultured in cases of appendicitis are therefore similar to those seen in other colonic infections such as diverticulitis. The principal organisms seen in the normal appendix, in acute appendicitis, and in perforated appendicitis are *Escherichia coli* and *Bacteroides fragilis*. However, a wide variety of both facultative and anaerobic bacteria and mycobacteria may be present. Appendicitis is a polymicrobial infection, with some series reporting up to 14 different organisms cultured in patients with perforation. As discussed above, the flora is known and therefore broad-spectrum antibiotics are indicated. Peritoneal culture should be reserved for patients who are immuno-suppressed, as a result of either illness or medication, and for patients who develop an abscess after the treatment of appendicitis. Antibiotic coverage is given for 24 to 48 hours in cases of non-perforated appendicitis. For perforated appendicitis, 7 to 10 days is recommended. Intra-venous antibiotics are usually given until the white blood cell count is normal and the patient is afebrile for 24 hours.

Presentation

In 1905, Murphy clearly described the appropriate sequence of symptoms of pain followed by nausea and vomiting with fever and exaggerated local tenderness in the position occupied by the appendix. The classic presentation of acute appendicitis begins with crampy, intermittent abdominal pain, thought to be due to obstruction of the appendiceal lumen. The pain may be either periumbilical or diffuse and difficult to localize. This is typically followed with nausea; vomiting may or may not be present. If nausea and vomiting precede the pain, patients are likely to have another cause for their abdominal pain such as gastroenteritis. Classically, the pain migrates to the right lower quadrant as transmural inflammation of the appendix leads to inflammation of the peritoneal lining of the right lower abdomen. This usually occurs within 12-24 hours of the onset of symptoms. The character of the pain also changes from dull and colicky to sharp and constant. Movement or Valsalva maneuver often worsens this pain, so that the patient typically desires to lie still.

Patients may report low-grade fever up to 101 F (38.3°C). Patients who have appendicitis commonly report anorexia; appendicitis is unlikely in those with a normal appetite.

The classic presentation of acute appendicitis is not present in all patients. Patients may have none or only a few of the symptoms just described. For instance, they may not notice or recall the initial colicky pain. When the pain becomes constant, it may localize to other quadrants of the abdomen due to an alteration in appendiceal anatomy as in late pregnancy or malrotation. In patients with a retrocaecal appendix, the pain may never localize until generalized peritonitis from perforated appendicitis occurs. Urinary or bowel frequency may be present due to appendiceal inflammation irritating the adjacent bladder or rectum. Because appendicitis is so common, a high index of suspicion for appendicitis is warranted in all patients with abdominal pain.

8. Diagnosis

History and Physical Examination

As always, the diagnosis begins with a thorough history and physical examination. The patient should be asked about the classic symptoms of appendicitis, but the surgeon should not be dissuaded by the absence of many of the symptoms. Many patients with acute appendicitis do not have a classic history. Because the differential diagnosis of appendicitis is extensive, patients should be queried about certain symptoms that may suggest an alternative diagnosis. Surgeons must also remember that a previous appendectomy does not definitively exclude the diagnosis of appendicitis, as "stump appendicitis" (appendicitis in the remaining appendiceal stump after appendectomy), although rare, has been described.

On inspection, patients look mildly ill and may have slightly elevated temperature and pulse. They often lie still to avoid the peritoneal irritation caused by movement. The surgeon should systematically examine the entire abdomen, starting in the left upper quadrant away from the patient's described pain. Maximal tenderness is typically in the right lower quadrant, at or near McBurney's point, located one-third of the way from the anterior superior iliac spine to the umbilicus. This tenderness is often associated with localized muscle rigidity and signs of peritoneal inflammation, including rebound, shake, or tap tenderness. Right lower quadrant tenderness is the most consistent of all signs of acute appendicitis; its presence should always raise the specter of appendicitis, even in the absence of other signs and symptoms. Because of the various anatomic locations of the appendix, however, it is possible for the tenderness to be in the right flank or right upper quadrant, the suprapubic region, or the left lower quadrant. Patients with a retrocaecal or pelvic appendix may have no abdominal tenderness whatsoever. In such cases, rectal examination can be helpful to elicit right-sided pelvic tenderness

Multiple signs can be detected on physical examination to contribute to the diagnosis of appendicitis.

- 1) Rovsing's sign, pain in the right lower quadrant on palpation of the left lower quadrant, is further evidence of localized peritoneal inflammation in the right lower quadrant.
- 2) Poses sign, pain with flexion of the leg at the right hip, can be seen with a retrocaecal appendix due to inflammation adjacent to the psoas muscle.

- 3) The obturator sign, pain with rotating the flexed right thigh internally, indicates inflammation adjacent to the obturator muscle in the pelvis.

Special features, according to position of the appendix

Retrocaecal Rigidity is often absent, and even application of deep pressure may fail to elicit tenderness (silent appendix), the reason being that the caecum, distended with gas prevents the pressure exerted by the hand from reaching the inflamed structure. However, deep tenderness is often present in the loin, and rigidity of the quadrates lumborum may be in evidence. Psoas spasm, due to the inflamed appendix being in contact with that muscle, may be sufficient to cause flexion of the hip joint. Hyperextension of the hip joint may induce abdominal pain when the degree of psoas spasm is insufficient to cause flexion of the hip.

Pelvic:

Occasionally, early diarrhoea results from an inflamed appendix being in contact with the rectum. When the appendix lies entirely within the pelvis, there is usually complete absence of abdominal rigidity, and often tenderness over McBurney's point is also lacking. In some instances, deep tenderness can be made out just above and to the right of the symphysis pubis. In either event, a rectal examination reveals tenderness in the rectovesical pouch or the pouch of Douglas, especially on the right side. Spasm of the psoas and obturator internus muscles maybe present when the appendix is in this position. An inflamed appendix in contact with the bladder may cause frequency of micturation. This is more common in children.

Post-ileal:

Although this is rare, it accounts for some of the cases of missed appendix'. In this case, the inflamed appendix lies behind the terminal ileum. It presents the greatest difficulty in diagnosis because the pain may not shift, diarrhoea is a feature and marked retching may occur. Tenderness, if any, is ill defined, though it may be present immediately to the right of the umbilicus.

Special features, according to age

Acute appendicitis in Infants and Young Children : The diagnosis of acute appendicitis is difficult in infants and young children for many reasons. The patient is unable to give an accurate history, and although appendicitis is infrequent, acute nonspecific abdominal pain is common in infants and children. Because of such factors, the diagnosis and treatment are often delayed, and complications develop. Vomiting, fever, irritability, flexing of thighs, and diarrhea are likely early complaints. Abdominal distention is the most consistent physical finding. As in adults, the total leucocyte count is not a reliable test. The incidence of perforation in infants less than 1 year of age is almost 100%, and although it decreases with age, it is still 50% at 5 years of age. The mortality rate in this age group remains as high as 5%.

Appendicitis in young women

Although the overall incidence of negative laparotomy in patients suspected of having appendicitis is as high as 20%, the incidence in women less than 30 years of age is as high as 45%. Pain associated with ovulation, diseases of the

ovaries, fallopian tubes, and uterus and urinary tract infections account the majority of misdiagnosis. Appendicitis during pregnancy The risk of appendicitis during pregnancy is the same as it is in non-pregnant women of same age; the incidence is 1 in 2,000 pregnancies. Appendicitis occurs more frequently during the first two trimesters, and during this time period the symptoms of appendicitis are similar to those seen in non-pregnant women. Surgery should be performed during pregnancy when appendicitis is suspected, just as would be in a non-pregnant woman. The diversity of clinical presentations and the difficulty in making the diagnosis of acute appendicitis in pregnant women is well established. This is particularly true in the late second trimester and the third trimester, when many abdominal symptoms may be considered pregnancy related. In addition, during pregnancy there are anatomic changes in the appendix and increased abdominal laxity that may further complicate clinical evaluation.

Appendicitis in the Elderly Population, Severely ill and Comatose Patients :

Appendicitis has a much greater mortality rate among elderly persons when compared with young adults. The increased risk of mortality appears to result from both delays in seeking medical care and delay in making the diagnosis. The presence of other diseases associated with aging contributes to mortality, but the major reason for the increased mortality of appendicitis in the aged is delay in treatment. Classic symptoms are present in elderly persons but are often less pronounced. In elderly, severely ill and comatose patients, on initial physical examination, the findings are often minimal, although right lower quadrant tenderness will eventually be present in most patients. This is due to atherosclerosis of the vessels supplying appendix, which may be age related or due to co-morbid conditions like diabetes and hypertension. Distention of the abdomen and a clinical picture suggesting small bowel obstruction are commonly seen. As these patients are already immunocompromised and signs of inflammation are less pronounced, the diagnosis is often delayed. More than 30% of elderly patients will have a ruptured appendix at the time of operation. A high index of suspicion is crucial for diagnosis. USG and CT scan of abdomen plays a vital role in diagnosing and confirming acute appendicitis in these patients. It is imperative, therefore, that once the diagnosis of acute appendicitis is made, an urgent operation must be advised

Differential Diagnosis: Although acute appendicitis is the most common abdominal surgical emergency, the diagnosis at times can be extremely difficult. There are a number of common conditions that it is wise to consider carefully and, if possible, exclude. The differential diagnosis differs in patients of different ages, in women, additional differential diagnoses are diseases of the female genital tract.

Adult:

1. Terminal ileitis in its acute form may be indistinguishable from acute appendicitis unless a doughy mass of inflamed ileum can be felt. An antecedent history of abdominal cramping, weight loss and diarrhoea suggests regional ileitis rather than appendicitis. The ileitis may be non-specific, due to Crohns disease or Yersinia infection. Yersinia

enterocolitica causes inflammation of the terminal ileum, appendix and caecum with mesenteric adenopathy. If suspected, serum antibody titres are diagnostic, and treatment with intravenous tetracycline is appropriate. If Yersinia infection is suspected at operation, a mesenteric lymph node should be excised, divided and half submitted for microbiological culture (including tuberculosis and half for histological examination.

2. Ureteric colic does not commonly cause diagnostic difficulty, as the character and radiation of pain differs from that of appendicitis. Urinalysis should always be performed and the presence of red cells should prompt a supine abdominal radiograph. Renal ultrasound or intravenous urogram is diagnostic.

3. Right-sided acute pyelonephritis is accompanied and often preceded by increased frequency of micturition. It may cause difficulty in diagnosis, especially in women. The leading features are tenderness confined to the loin, fever (temperature 39°C) and possibly rigors and pyuria.

4. Perforated peptic ulcer (duodenal contents pass along the para-colic gutter to the right iliac fossa). As a rule there is a history of dyspepsia and a very sudden onset of pain that starts in the epigastrium and passes down the right paracolic gutter. In appendicitis, the pain starts classically in the umbilical region. Rigidity and tenderness in the right iliac fossa are present in both conditions but, in perforated duodenal ulcer, the rigidity is usually greater in the right hypochondrium. An erect abdominal radiograph will show gas under the diaphragm in 70% of patients. An abdominal CT examination is valuable when there is diagnostic difficulty.

5. Testicular torsion in a teenage or young adult male is easily missed. Pain can be referred to the right iliac fossa, and shyness on the part of the patient may lead the unwary to suspect appendicitis unless the scrotum is examined in all cases

6. Acute pancreatitis should be considered in the differential diagnosis of all adults suspected of acute appendicitis and when appropriate excluded by serum or urinary amylase measurement.

7. Rectus-sheath hematoma is a relatively rare but easily missed differential diagnosis. It usually presents with acute pain and localized tenderness in the right iliac fossa, often after an episode of strenuous physical exercise. Localized pain without gastrointestinal upset is the rule. occasionally, in an elderly patient, particularly one taking anticoagulant therapy, a rectus sheath hematoma may present as a mass and tenderness in the right iliac fossa after minor trauma.

Adult Female:

It is in women of child-bearing age that pelvic disease most often mimics acute appendicitis. A careful gynaecological history should be taken in all women with suspected appendicitis concentrating on menstrual cycle, vaginal discharge and possible pregnancy. The most common diagnostic mimics are pelvic inflammatory disease (PID),

mittelschmerz, torsion or haemorrhage of an ovarian cyst and ectopic pregnancy

- 1) Pelvic inflammatory disease: Pelvic inflammatory disease comprises a spectrum of diseases that include salpingitis, endometritis and tubo-ovarian sepsis. The incidence of these conditions is increasing, and the diagnosis should be considered in every young adult female. Typically, the pain is lower than in appendicitis and is bilateral. A history of vaginal discharge, dysmenorrhoea and burning pain on micturition is a helpful differential diagnostic point. The physical findings include adenexal and cervical tenderness on vaginal examination. When suspected, a high vaginal swab should be taken for Chlamydia trachomatis and Neisseria gonorrhoeae culture and the opinion of a gynaecologist obtained. Transvaginal ultrasound can be particularly helpful in establishing the diagnosis. When serious diagnostic uncertainty persists, diagnostic laparoscopy should be undertaken.
- 2) Mittelschmerz: Mid-cycle rupture of a follicular cyst with bleeding produces lower abdominal and pelvic pain, typically mid-cycle. Systemic upset is rare, pregnancy test is negative and symptoms usually subside within hours. occasionally diagnostic laparoscopy is required. Retrograde menstruation may cause similar symptoms.
- 3) Torsion haemorrhage of an ovarian cyst: This can prove a difficult differential diagnosis. When suspected, pelvic ultrasound and a gynaecological opinion should be sought.
- 4) Ectopic pregnancy It is unlikely that a ruptured ectopic pregnancy, with its well-defined signs of haemoperitoneum, will be mistaken for acute appendicitis, but the same cannot be said for a right-sided tubal abortion, or still more for a right-sided unruptured tubal pregnancy.
- 5) In the latter, the signs are very similar to those of acute appendicitis, except that the pain commences on the right side and stays there. The pain is severe and continues unabated until operation. Usually, there is a history of a missed menstrual period and urinary pregnancy test may be positive. Severe pain is felt when the cervix is moved on vaginal examination. Signs of intraperitoneal bleeding usually become apparent, and the patient should be questioned specifically regarding referred pain in the shoulder. Pelvic ultrasonography should be carried out in all cases in which an ectopic pregnancy is a possible diagnosis.

Elderly

- 1) Sigmoid diverticulitis: In some patients with a long sigmoid loop, the colon lies to the right of the midline, and it may be impossible to differentiate between diverticulitis and appendicitis. Abdominal CT scanning is particularly useful in this setting and should be considered in management of all patients over the age of 60.
- 2) Intestinal obstruction The diagnosis of intestinal obstruction is usually clear, the subtle lies in recognizing acute appendicitis as the occasional cause in the elderly
- 3) Carcinoma of the caecum: When obstructed or locally perforated, carcinoma of the caecum may mimic or cause obstructive appendicitis in adults. A history of antecedent discomfort, altered bowel habit or unexplained anaemia

should raise suspicion. A mass may be palpable and barium enema diagnostic.

9. Conclusion

APPENDICITIS is a common and urgent surgical illness. significant diagnostic delay is encountered as the clinical entity has manifestations that tend to overlap with further condition.

Alvarado scoring system is found to be helpful in diagnosis & management of acute appendicitis. Diagnosis virtually confirms with score of 7-10 & they should undergo appendicectomy. Patient with score of 5-6 maybe admitted and scored frequently. Scores of 1-4 maybe discharged. In this study all the patients presenting with acute pain in RIF were admitted and grouped accordingly to Alvarado score. patients with score >7 were operated irrespective of usg findings. patients with score 5-6 observed & treated symptomatically with analgesics & iv fluids. No antibiotics were given to these patients & observed for increase in their Alvarado score. They were operated when progressed to score >7. Patients with score <4 were admitted and treated symptomatically. They were discharged next day & followed up. All the samples were sent for histopathology for confirmation of diagnosis.

From the present study it maybe concluded that high score 7-10 in Alvarado score is dependable aid in early diagnosis of acute appendicitis both in males and females.

In females because of other condition mimicking appendicitis like pelvic inflammatory disease, ruptured ectopic pregnancy, ultrasonography of abdomen act as a useful tool in avoiding negative appendicectomy.

Ultrasound has been reported more helpful in clinically equivocal cases because of false positive and false negative results, ultrasound should not be allowed to override the clinical acumen in extremes of wide clinical spectrum of acute appendicitis. In conclusion it is useful adjuvant to clinical armamentarium of present day surgeon.

There are various other radiological modalities like CT abdomen is helpful mainly in atypical cases like those who are overweight, pregnant, elderly or very young. Although the sensitivity of CT is upto 98% in many cases the diagnosis maybe missed. The most common reason for a false negative diagnosis of appendicitis related to paucity of intraabdominal fat. intra abdominal fat serves as a natural contrast agent, allowing inflammatory changes to be easily noted, even when stable. The CT maybe much more difficult to visualize in patients with a lean body habitus.

Because of unavailability of various radiological modalities in a clinical setting as that of India where 68.84% of total population come from village, surgeons have to rely on this clinical score which equally sensitive and accurate. The alvarado scoring system can be recommended as a standard tool for diagnostic decision making in acute appendicitis as it is reliable, cheap and handy tool in diagnosis of acute appendicitis.

By the overall above observation we found that the early cases and late cases of appendicitis pose greater problem. In early cases the fear of negative appendicectomy is eminent & in late cases missing the appendicitis because of generalization of signs and symptoms. In early cases one should wait and watch without antibiotics on threshold of appendicectomy. These cases if having appendicitis will progress to higher score of alvarado and should be operated if not then discharged. In late cases if in doubt let skin not come in your way of treating the patient (open and see).

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