



**Ministry of Higher Education
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University of Diyala
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Review article in

Evaluation of combined use of modified Alvarado score and ultrasound in predicting acute appendicitis

A project submitted to the council of College of Medicine / University of Diyala in Partial fulfillment of the Requirements for the Degree of bachelor in medicine and general surgery

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Abstract

Background.

Acute appendicitis is the most common abdominal pathology in the world, and it represents the main cause of emergency abdominal surgery; it is the most frequent cause of surgery in patients between 20 and 30 years of age, and it does not have a sex predominance. Its clinical picture is variable, and this fact should be considered in diagnostic studies for accurate diagnosis. The approach of acute appendicitis can be laparoscopic or open surgery.

Aim of study.

To make evaluation of combined use of modified Alvarado score and ultrasound in predicting acute appendicitis.

Patient and methods.

This study was conducted in the Baqubah Teaching Hospital, from 1st November 2022 to 28th February 2023. We collected 63 samples randomly. The age range was between 14 years to 65 years. Source of Data Patients with suspected clinically acute appendicitis and undergone appendicectomy.

Result.

Sixty-three patients were included in this study their mean + SE AS of male was 6.21 ± 0.28 and mean AS + SE of female were 6.46 ± 0.27 . there is association between age group and AS , 6.59 ± 0.27 the mean +SE of age group <20 and 6.56 ± 0.51 ab for age group 20-30 years while 5.75 ± 0.28 b for age group >30 years. distribution of sample study accordance to gender ,37(58.7%) of patient were male and 26(41.27%).

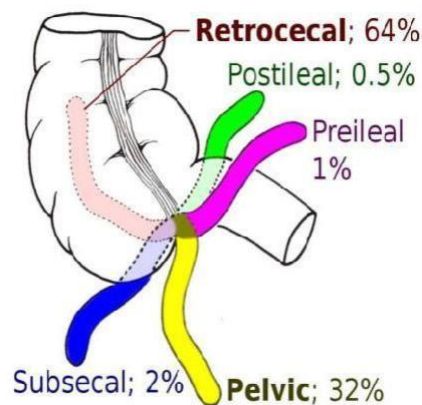
Conclusions.

throughout this study we concluded that both modified Alvarado score and ultrasound whenever available should be used to predict acute appendicitis to increase the number of positive cases and reduce negative appendectomy and hence reduce the morbidity and mortality.

Keywords: Alvarado score, ultrasound, acute appendicitis.

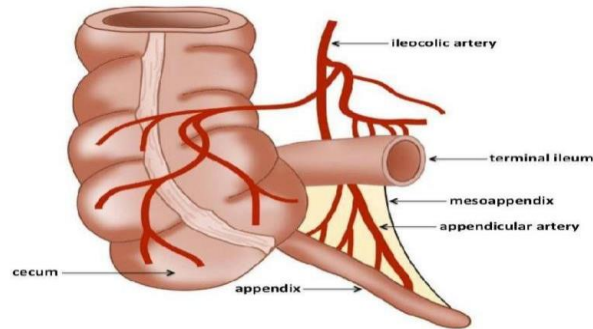
Introduction

The vermiform appendix is a tubular structure located on the posteromedial wall of the cecum, 1.7 cm from the ileocecal valve, where the taenia of the colon converges on the cecum. The appendix is a true diverticulum, since its wall is made up of mucosa, submucosa, longitudinal and circular muscle and serosa. Its anatomical relationships are the iliopsoas muscle and the lumbar plexus posteriorly, and the abdominal wall anteriorly. The irrigation of the cecal appendix comes from the appendicular artery, a terminal branch of the ileocolic artery, which crosses the length of the mesoappendix to end at the tip of the organ. The mesoappendix is a structure of variable size in relation to the appendix, which entails variability in its positions.¹⁻³ Therefore, the tip of the appendix can migrate to different locations: retrocecal, Sub cecal, pre ileal, post ileal, and pelvic.²⁻⁴



Arteria Supply of Appendix

The appendicular artery, also known as the appendiceal artery, commonly arises from the terminal branch of the ileocolic artery, or less commonly from the posterior cecal artery or an ileal artery. It descends behind the termination of the ileum and enters the mesoappendix of the vermiform appendix. It runs near the free margin of the mesoappendix and ends in branches which supply the appendix.⁻³⁻



Acute appendicitis

Appendicitis is defined as inflammation of the vermiform appendix and represents the most common cause of acute abdomen and emergency surgical indication in the world. The incidence of AA has been declining steadily since the late 1940s. In developed countries, AA occurs at a rate of 5.7–50 patients per 100,000 inhabitants per year, with a peak between the ages of 10 and 30.

The rate of perforation varies from 16% to 40%, with a higher frequency occurring in younger age groups (40–57%) and in patients older than 50 years (55–70%)

Clinical Feature

Abdominal pain is the most frequent symptom that occurs in patients, although other symptoms such as anorexia, nausea, constipation/diarrhea and fever are also described. Pain is typically periumbilical and epigastric, and later migrates to the lower right quadrant; however, despite being considered a classic symptom, migratory pain occurs only in 50 to 60% of patients with acute appendicitis. The appearance of nausea and vomiting occurs after the installation of pain, and fever usually manifests around six hours after the general clinical picture.

This varies considerably from person to person, which in some cases is attributable to the location of the tip of the appendix. For example, an anteriorly located appendix produces marked and localized pain in the lower right quadrant, whereas a retro-cecal one can cause dull abdominal pain or pain in the lower lumbar region. Likewise, due to the irritation produced by the appendix, other symptoms such as urinary urgency, dysuria or rectal symptoms such as tenesmus or diarrhea may appear. ⁵⁻⁶

The physical examination of these patients should initiate with the measurement of vital signs. A body temperature greater than 38 C, tachycardia and, in some cases, tachypnea can be found. The early clinical signs of appendicitis are often non-specific. However, as inflammation progresses, involvement of the parietal peritoneum causes tenderness in the right lower quadrant that can be elicited on physical examination; also, pain can be exacerbated by movement or cough. ⁷

The maximum localization of pain in the abdomen almost always corresponds to the McBurney point, which is located two thirds of the distance from the navel on a line drawn from it to the right anterior superior iliac spine. The patient will be sensitive and will show signs of peritoneal irritation with localized muscular defense (it occurs only if there is peritonitis).⁷

Rectal and/or vaginal examination can cause pain in patients with pelvic localized appendicitis, therefore their presence or absence does not rule out appendicular pathology, and its routine use in the exploration of these patients is controversial. ⁷⁻⁹

Different clinical signs have been described in the physical examination to facilitate diagnosis. It is worth mentioning that they are reported in only 40% of patients with appendicitis, so their absence does not rule out the diagnosis. These include Blumberg (pain from sudden decompression in the right iliac fossa), Rovsing (palpation in the left iliac fossa elicits referred pain in the right fossa), psoas sign (pain in the right iliac fossa [RIF] from extension of the right hip), obturator sign (pain in the RIF after flexion and internal rotation of the right hip), etc.^{10,11}

Role of Alvarado score in Assessment of Acute appendicitis

There are different systems for the diagnosis of acute appendicitis; Alvarado's scale is the most widely used for diagnosis and has been modified since its introduction. There are reviews in which this scale is compared with clinical judgment, and it has been found that the scale has a lower sensitivity (72% vs 93%), since some cases ruled out by the Alvarado score do occur. ¹²

Likewise, when comparing this scale with radiographic studies, it is comparatively less sensitive and specific in relation to computed tomography images.¹³

The modified Alvarado scale scores according to the following criteria: 14-16

1-Migratory RIF Pain	1 point
2- Anorexia	1 point
3- Nausea and vomiting	1 point
4- Fever	1 point
5- Tenderness	2 points
6-Rebound Tenderness	1 point
7- Leukocytosis	2 points
8-shift to left	1 point

Ultrasound sound of normal appendix

The normal appendix consists of 5 distinct layers; the innermost echogenic layer which represents the interface of mucosa and lumen, the hypoechoic mucosal layer, the echogenic submucosal layer, the hypoechoic muscularis propria layer and the outermost echogenic serosal layer.



The typical normal appendix in children has an inner hypoechoic band without folding, and this feature is **distinguishable** from other bowel structures. Therefore, recognition of this finding reduces the time and effort involved in identifying normal appendix and confidently excluding acute appendicitis. This inner hypoechoic band corresponds to the mucosal layer with abundant lymphoid tissue on histologic examination and disappears with aging.

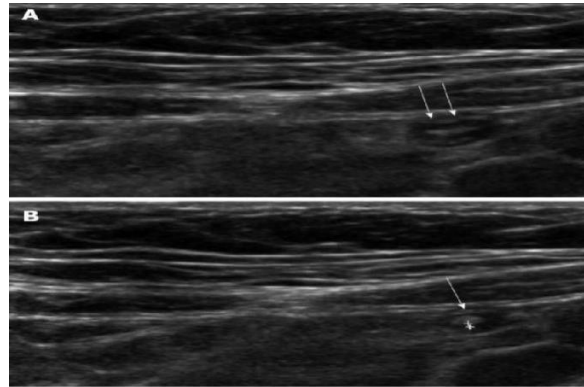


Figure Ultrasonographic and histologic findings of normal appendix. A: Normal appendix (arrows) with thin inner hypoechoic band was seen on high frequency ultrasonography; B: The thickness of the inner hypoechoic band (cursors) of appendix (arrow) was measured as 0.5 mm.

Patient and methods.

A total of 63 patients presenting with different gastrointestinal symptoms to Baqubah Teaching Hospital from 1st November 2022 to 28th February 2023 in different age groups (14-65), from various socio-economic status. Diagnosis of acute appendicitis has been based on history taking, physical examination findings, and, to a lesser extent, laboratory results. Patients admit to emergency room and had been examine for tenderness, rebound tenderness, Rovsing sign, psoas sign, Obturator sign and assessment the patients using Alvarado score. A total of 63 patients have had Ultrasound scan using HITACHI Aloka F31, 42 patients had a positive Ultrasound scan with typical appearance of acute appendicitis while 21 patients had negative Ultrasound. A total of 63 patients undergo appendectomy under general anesthesia. Total cases undergo statistical analysis to detect the effect of difference factors in study parameters.

Inclusion & Exclusion criteria

The study included Any patient presented with abdominal pain above age of 14 years of suspicion of acute appendicitis mainly new onset abdominal pain migrating to or in the right lower abdomen.

Any patient with abdominal pain that matches with the following was excluded:

- 1- Patients with the diagnosis of appendicular mass.
- 2- Patients with the diagnosis of appendicular abscess
3. All patients who were admitted under suspicion of diagnosis and not operated on and treated then discharged.

Figure 1 show Longitudinal (a) and transverse (b) US scan through RIF show thick wall, blind end tubular structure , fluid filled with surround echogenic fat measure 9.4 mm with surrounding free fluid consistent with acute appendicitis

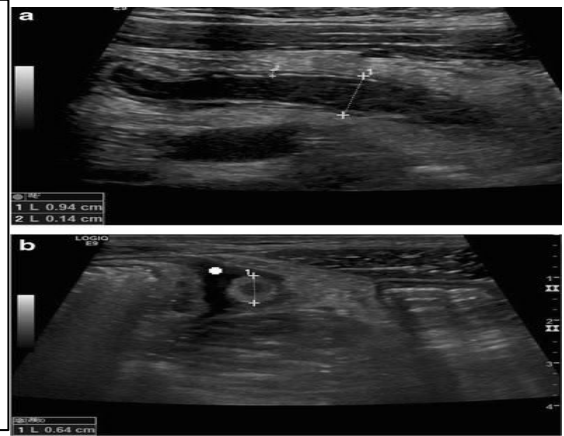
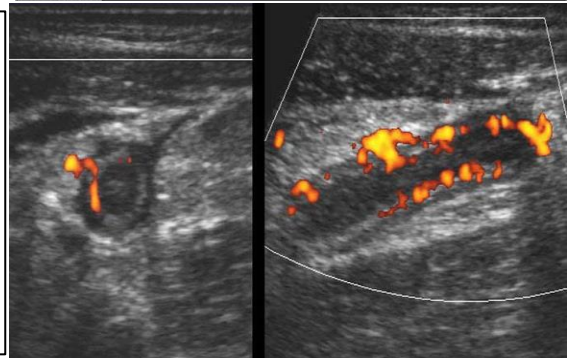


Figure 2

Doppler study increase vascularity (hyperemia) in the wall of inflamed appendix



Result

Sixty-three patients were included in this study their mean + SE AS of male was 6.21 ± 0.28 and mean AS + SE of female were 6.46 ± 0.27 .

Table 1: Relationship between Gender and Alvarado Score

Gender	Mean \pm SE of AS
Male	6.21 ± 0.28
Female	6.46 ± 0.27
T-test	0.804 NS
P-value	0.544
NS: Non-Significant.	

There were no significant differences between both male and female.

Table 2: Relationship between US and Alvarado Score

US	Mean \pm SE of AS
Positive	6.43 ± 0.24
Negative	6.09 ± 0.35
T-test	0.741 NS
P-value	0.0346
Significant.	

There were significant differences between US and Alvarado Score.

Table 3: Relationship between age group and Alvarado score

Age group (year)	Mean \pm SE of A\ S
<20 yr.<	6.59 ± 0.27 a
20-30 yr.	6.56 ± 0.51 ab
>30 yr.	5.75 ± 0.28 b
LSD	0.773 *
P-value	0.0416
* ($P \leq 0.05$).	

There were significant differences between age groups.

Table 4: Distribution of sample study according to Gender

Gender	No	Percentage (%)
Male	37	58.73
Female	26	41.27
Total	63	100%
P-value	---	0.0491 *
* (P≤0.05).		

There were no significant differences between genders of the study sample.

Table 5: Distribution of sample study according to US

US	No	Percentage (%)
Positive	42	66.67
Negative	21	33.33
Total	63	100%
P-value	---	0.0072 **
** (P≤0.01).		

There were significant difference study samples according to Ultrasound.

Table 6: Distribution of sample study according to Age groups

Age group (year)	No	Percentage (%)
<20 yr.	27	42.86
20-30 yr.	16	25.40
>30 yr.	20	31.76
Total	63	100%
P-value	---	0.0469 *
* (P≤0.05).		

There were no significant differences of study sample according to age group.

Discussion

Until surgery confirmed or disproved the diagnosis, Alvarado followed up patients admitted to the surgical unit at the Nazareth Hospital in Philadelphia in 1986 who had suspected acute appendicitis. Eight criteria had high diagnostic yields, he discovered. for acute appendicitis accuracy. The author of the study suggested diagnostic protocol incorporating Alvarado score was, if anything, safer, faster, and more accurate than graded compression sonography alone in randomized controlled trial of ultrasonography in diagnosis of acute appendicitis. (17)

Present study revealed that there was no significant difference correlating gender and AS where the mean and SE of AS in male were 6.21 ± 0.28 and the mean and SE of AS in female were 6.46 ± 0.27 and the p value were 0.544. this result agrees with result of Kurane et al. (18)

Our study demonstrates that there was relationship between US and Alvarado score, The mean + SE of positive US $6.43 + 0.24$ close to negative US $6.09 + 0.35$ and the p value 0.0346. this result accordance with Agarwal et al. (19)

We founded association between age group and AS $6.59 + 0.27$ the mean +SE of age group <20 and $6.56 + 0.51$ ab for age group 20-30 years while $5.75 + 0.28$ b for age group >30 years, this consistent with the result of nautiyal et al. (20).

In our study we research about distribution of sample study according to gender 37 (58.7%) of patient were male and 26 (41.27%) were females. This means there was a relationship between the genders, this may be contributed to frequent gynecological conditions that mimic acute appendicitis and causing female presented to emergency department. This result agrees with kanumbah et al. (21)

In our survey we found a strong relationship between sample study according to US where positive results was 42(66.67%) and 21(33.33%) results were negative, negative values as the ultrasound results depend on many factors including operator experience, patient obesity and technical specification of the device. this result confirms with the result of lambaralli et al. (22).

our study revealed higher percentage of acute appendicitis in younger age group: 27 (42.86%) <20 years and 16(25.4%) between 20-30 years while >30 were 20 (31.76%), higher prevalence seen in younger age group which is attributed to frequent pathological condition that mimic acute appendicitis in older age group . And this agrees with Zouari et al. (23)

Conclusion and Recommendations.

throughout this study we concluded that both modified Alvarado score and ultrasound whenever available should be used to predict acute appendicitis to increase the number of positive cases and reduce negative appendectomy and hence reduce the morbidity and mortality. We recommend more study and orient medical students about this study to increase positive and reduce negative appendectomy.

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