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Accuracy of the Diagnosis in Patient with Acute Right Iliac Fossa Pain Undergoing Appendectomy: Ramathibodi Experience

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Abstract

Introduction: **Acute right iliac fossa pain is a common and difficult problem encountered by surgeons. The purpose of this study was to review the overall accuracy of the diagnosis of appendicitis in patients presenting with acute right iliac fossa pain, in which preoperative diagnosis of an acute appendicitis was made and the patients underwent appendectomy at Ramathibodi Hospital from January 2005 to September 2006.**

Material and Methods: **From January 2005 to September 2006, 206 patients with acute right iliac fossa pain and with clinical diagnosis of acute appendicitis were treated by appendectomy at Ramathibodi Hospital. Ten patients with incomplete data were excluded. One hundred and ninety-six patients with complete intra-operative records were reviewed. Patient demographic data, clinical presentation, preoperative investigations, types of operation, pathological reports and postoperative complications were reviewed. Alvarado scores were collected by chart review of history, physical examination and blood test.**

Results: **There were 91 males and 105 females. Accuracy of Alvarado score in the diagnosis of acute appendicitis was 93.4% in male and 80.9% in female. The sensitivity and specificity of ultrasonography in the diagnosis of acute appendicitis were 86% and 100%, respectively. CT scan was performed as an initial investigation in 7 patients. All patients with positive CT scan were found to have pathologically confirmed acute appendicitis. Twenty-one of the 91 male patients were found to have perforation compared with 17 of the 105 female patients (23% vs. 16%). Rates of pathologically confirmed acute appendicitis were 94.5% in male group and 83.8% in female group with the overall rate of pathologically confirmed diagnosis at 88.8%. The rate of non-therapeutic appendectomy was 9.7%. Overall complications occurred in 14.6% and wound infection was the most common.**

Conclusions: **The diagnosis of acute appendicitis in patients with acute right iliac fossa pain who underwent appendectomy in our institution was comparable to previous studies with acceptable complication rate. We have slightly high rate of perforation in male patients but low rate of non-acute appendicitis appendectomy. Our results suggested that clinical diagnosis remains valuable tools in the diagnosis of acute appendicitis.**

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Introduction

Acute right iliac fossa pain is among the common and difficult problems encountered by emergency physicians and eventually surgeons. The most common diagnosis, acute appendicitis, was not totally confirmed in this group of patients as the typical presentation of acute appendicitis was found in only 40%-70%.[1-4] How to get a definitive diagnosis of this condition could be a challenge for physicians. In literature reviews, negative appendectomy rates were previously reported to range from 20%-30% and were significantly higher in female patients, especially in child-bearing age when based on clinical diagnosis.[5-8] Alvarado score is a ten-points scoring system based on clinical signs and symptoms and blood tests for the diagnosis of acute appendicitis[9] (Table 1). Previous reports used the over-6 score as a cut point to classify patients for appendectomy. The gold standard to report acute appendicitis should be confirmed by histopathology of resected appendix, which was routinely performed in our institution.

The purpose of this study was to review the overall accuracy of the diagnosis of appendicitis in patients presenting with acute right iliac fossa pain, in which preoperative diagnosis of acute appendicitis was made, and the patients underwent appendectomy at Ramathibodi Hospital from January 2005 to September 2006.

Materials and Methods

From January 2005 to September 2006, 206 patients with acute right iliac fossa pain and with clinical diagnosis of acute appendicitis underwent appendectomy at Ramathibodi Hospital. Ten patients with incomplete data were excluded. Only 196 patients with complete intra-operative records were reviewed. Patient demographic data, clinical presentation, preoperative investigations, type of operations, pathological reports and postoperative complications were reviewed. Alvarado scores of each patient were collected by chart review of history, physical examination and blood test.

The results of ultrasonography and CT scan were reported as compatible or incompatible with acute appendicitis or inconclusive in cases where appendix was not found. Perforation of the appendix was defined by grossly ruptured appendix found during operation or microscopically on appendectomy specimens.

Acute appendicitis is defined as the presence of transmural inflammation of appendix which should be demonstrated by the infiltration of polymorphonuclear (PMN) cells in at least mucosal layer. Non-acute appendicitis appendectomy is defined as appendectomy performed for clinically diagnosed acute appendicitis and the appendix was not found to have PMN infiltration on histopathological examination. Operations were considered therapeutic if pathology was found and this was thought to be the cause of the patient's pain and surgery was the appropriate treatment for the patient's pain. All other operations were classified as non-therapeutic.

Results

A total of 196 patients were available for analysis. There were 91 males and 105 females. The average age was slightly lower in male group (34.3 vs. 39.6 years). The demographic data were summarized (Table 2).

Alvarado score

The cut point of Alvarado score greater than 6 was used to determine that one had high index of suspicion to have acute appendicitis. Subgroup analysis of the accuracy of Alvarado score were shown in Table 3 for male and Table 4 for female patients.

Table 1 Alvarado score for the diagnosis of acute appendicitis

Symptoms/signs/tests	Score
Migration of pain	1
Anorexia	1
Nausea-vomiting	1
Tenderness at right iliac fossa	2
Rebound pain	1
Raised temperature (≥37.3 °C)	1
Leucocyte count $\geq 10^3 \times 10$ /mm^3	2
Differential white cell count with neutrophil ≥75%	1
Total	**10**

Table 2 Demographic data

	Number (%)	Mean age (yrs)
Male	91 (46%)	34.3 (15-76)
Female	105 (54%)	39.6 (15-83)

Ultrasonography

Ultrasonography was performed in 34 patients, 9 males and 25 females (Table 5). The sensitivity and specificity of ultrasonography in the diagnosis of acute appendicitis were 86% and 100%, respectively. There were 3 false negative results (1 male and 2 females). Patients whose appendices were not seen by ultrasound (inconclusive group), 9 of 12 (75%) were later found to have pathologically confirmed acute appendicitis

Table 3 Accuracy of Alvarado score for diagnosis of acute appendicitis in 91 males

Alvarado score	Pathologically confirmed acute appendicitis		Total
	Positive	Negative	
Score >6	82	2	84
Score ≤6	4	3	7
	86	5	

Sensitivity 82/86 = 95.3%, Specificity 3/5 = 60%, Accuracy 82+3/91 = 93.4%

Table 4 Accuracy of Alvarado score for the diagnosis of acute appendicitis in 105 females

Alvarado score	Pathologically confirmed acute appendicitis		Total
	Positive	Negative	
Score >6	79	11	90
Score ≤6	9	6	15
	88	17	

Sensitivity 79/88 = 89.8%, Specificity 6/17 = 35.3%, Accuracy 79+6/105 = 80.9%

CT scan of abdomen

CT scan was performed as an initial investigation in 7 patients (2 males and 5 females). All patients with positive CT scan were found to have pathologically confirmed acute appendicitis. One patient had false negative CT scan. One patient with an inconclusive CT scan (mucocele) was later found to have pathologically confirmed adenocarcinoma of the appendix (Table 6).

No male patient underwent both ultrasonography and CT scan. However, two female patients were investigated by both ultrasonography and CT scan. The results of the imaging were compatible with acute appendicitis and were finally confirmed histologically to be acute appendicitis.

In female group, gynecological consultation was made in 22 patients (20.9%). The average Alvarado score in this group was 7.3 (range 5-9).

Outcome

Of 196 appendectomies performed, 21 of the 91 male patients were found to have perforation compared with 17 of the 105 female patients (23% vs. 16%). Three male and one female patients had generalized contamination after perforation. Acute appendicitis was pathologically confirmed in 86 male group and in 88 female group (94.5% vs. 83.8%) with 88.8% overall

Table 5 Correlation between ultrasonography and pathological results

Sex	Pre-op U/S performed	Positive U/S		Inconclusive U/S		Negative U/S	
		Pathology confirmed	Pathology not app.	Pathology confirmed	Pathology not app.	Pathology confirmed	Pathology not app.
Male	9/91 (10%)	4	-	4	-	1	-
Female	25/105 (24%)	14	-	5	3	2	1

u/s = ultrasonography, app. = appendicitis

Table 6 Correlation between CT scan of the abdomen and pathological results

Sex	Pre-op CT performed	Positive CT		Inconclusive CT		Negative CT	
		Pathology confirmed	Pathology not app.	Pathology confirmed	Pathology not app.	Pathology confirmed	Pathology not app.
Male	2/91 (2.2%)	2	-	-	-	-	-
Female	5/105 (4.8%)	3	-	-	1	1	-

app. = appendicitis

Table 7 Outcome data

	Perforation rate (%)	Non-acute appendicitis appendectomy rate (%)	Overall complication rate (%)
Male	21/91 (23%)	5/91 (5.5%)	16/65 (24.6%)*
Female	17/105(16%)	17/105 (16%)	6/86 (7%) **

(Loss F/U = 26 cases)
***(Loss F/U =19 cases)*

Table 8 Pathology of appendix in non-acute appendicitis appendectomy

Cause	Male (N = 5)	Female (N = 17)
Normal	-	7*
Periappendicitis	2	4
Reactive lymphoid hyperplasia	3	3
Chronic appendicitis	-	1
Fibrous obliterans	-	1
Adenocarcinoma of appendix	-	1
Average Alvarado score	6.6 (5-9)	6.5 (0-9)

**1 had SO for ovarian tumor*

Table 9 Wound complications

	Wound infection	
	Ruptured	Not ruptured
No. of patients	6/38 (15.8%)	14/158 (8.9%)

rate of pathologically confirmed diagnosis (Table 7). Appendix was found histologically to be non-acute appendicitis in 22 of 196 patients operated on with a clinical suspicion of acute appendicitis; with a non-acute appendicitis appendectomy rate of 11.2%. Of these, 7 had a normal appendix without any other pathological findings in the appendix, 6 had inflammation around the appendix, 6 had reactive lymphoid hyperplasia, and 1 had luminal fibrosis. Three female patients had conditions that met the criteria for a therapeutic operation (ovarian tumor, chronic appendicitis and adenocarcinoma of the appendix). The overall rate of non-therapeutic appendectomy was 19/196 (9.7%). The average Alvarado score in non-acute appendicitis appendectomy group was slightly lower in female compared to male group (6.5 vs 6.6) (Table 8).

Overall complications occurred in 22 patients out of 151 patients (14.6%). Wound infection was the most common which was found in 14 male and 6 female patients (Table 9). One female patient developed intra-abdominal abscess and one male patient had cecal fistula.

Overall, the average Alvarado score was slightly higher in male compared to female (7.7 vs. 7.4) when the patients were evaluated upon admission. Also, the perforation rate was higher in male group (23 vs. 16%) However, the non-acute appendicitis appendectomy rate was higher in female (16% vs. 5.5%) (Table 10).

Discussion

Acute appendicitis has been rated as the most common emergency abdominal operation performed. The accuracy in the diagnosis of this condition using classic presentation can be influenced by sex, age, time at presentation, previous antispasmodic drugs administration, an experience of the examiners and the anatomical position of the appendix. Classically, the diagnosis of acute appendicitis is often based on a history, physical examination and laboratory findings. The diagnostic accuracy based on these clinical finding ranges from 70%-80% which corresponds to a mean false-negative appendectomy rate of 20%-30%.[5,10,11]

Alvarado[9] in 1986 published the first report using the clinical parameters and blood tests as Alvarado score to help interpret the confusion picture of appendicitis. However, the disadvantage of the Alvarado score is the high false-positive rate in female group so it is not widely used today. When the Alvarado score was applied to our data, using cut point >6, the accuracy of this score in the diagnosis of acute appendicitis was 93.4% in male and 80.9% in female patients.

Ultrasonography and CT scan of the abdomen have been used in the diagnosis of acute appendicitis, especially in atypical patients. Meta-analysis and systematic review of the role of these investigations have concluded that these investigations should be performed only in patients in whom a clinical diagnosis

Table 10 Number of patients and outcome

Sex	Clinically diagnosed appendicitis	Alvarado score (average score)	Perforation rate (%)	Non-acute appendicitis appendectomy rate (%)
Male	91	7.7	21/91 (23%)	5/91 (5.5%)
Female	105	7.4	17/105 (16%)	17/105 (16%)

Table 11 Outcome comparison between large series of appendectomy

Author	Year	Number of patients	Perforation rate (%)	Non-acute appendicitis appendectomy rate (%)	Overall complications (%)
Lewis, et al	1975	1000	21	20	NA
Jess, et al	1981	202	16	30	NA
Van Way III, et al	1982	476	37	24	NA
Marudanayagam, et al	2006	2660	14	29	NA
Lee, et al	2006	744	14	19	24
Yang, et al	2006	897	22	18	NA
Our study	2006	196	19.4	11.2	14.6

NA = Not available

of acute appendicitis cannot be made.[12,13] As ultrasonography studies are operator dependent, we have found high rates of false negative and inconclusive results. The diagnostic accuracy of CT scan appears to be superior to ultrasonography with 94% overall sensitivity and 95% specificity and has been associated with lower negative appendectomy rates in females, especially in the below 5-year and over 45-year age group.[13-15] In our study, the accuracy of ultrasonography in the diagnosis of acute appendicitis was 86%. Therefore, in female patients, this seems to be useful as an adjunct to clinical diagnosis in selected patients because of its higher accuracy compared to clinical diagnosis alone.

The non-therapeutic rate of appendectomy was 11.2%, which was slightly lower than previously reported which ranged from 20%-30%.[5-8,16,17] This rate was higher in female patients.

The 19.4% perforation rate in our study was comparable to previous studies at 14%-37%[5-8,18] (Table 11).

The mortality and morbidity are directly related to the stage of the disease and the increase in patients with perforation. The mortality in non-perforated appendicitis was 0.8 per 1000 compared to 5.1 per 1000 in perforated group.[18] As stated above, the average rate of perforation at presentation was between 14%-37%.[5-8,16,17] The increased mortality and morbidity associated with perforation has been traded for high rate of non-therapeutic appendectomy, quoted as between 20%-30%.[5-8,18] Temple et al.[11] published a study on the natural history of appendicitis in adults. Their study concluded that the delay in diagnosis and treatment increased the complication rate in acute appendicitis. Bickell et al.[17] recently studied the timing of acute appendicitis from pre-hospital onset of symptom to the time of surgery. This study concluded that rupture rate would rise significantly after 36 hours. Herscu et al.[19] reported higher perforation rate in retrocecal appendix. The rate of wound infection is mainly determined by intra-operative wound contamination. Rates of wound infection vary from less than 4% in simple appendectomy to 20% in cases with perforation and gangrenous type. The use of preoperative antibiotics has been shown to reduce the rates of postoperative wound infection. The rates of wound infection in our study were quite high, 15.8% in perforated group and 8.9% in non-perforated group. These results reflect that our sterile techniques have been broken during the operations.

Intra-abdominal abscess may occur in the postoperative period after gross contamination of the peritoneal cavity. The diagnosis can be confirmed by CT scan of the abdomen. Abscess can be treated non-operatively with percutaneous drainage with pigtail catheter drain, although open or rectal drainage may be indicated in some patients. Cecal fistula after appendectomy rarely occurs. Conservative treatment

with adequate drainage and parenteral nutrition is the main treatment as there is no sign of peritonitis until the fistula closed. In our study, both complications occurred in non-perforated group. The explanation for these complications is unclear and may be associated with unrecognized intra-operative contamination.

Our study has several important limitations since we included the data from chart review which were not systematically collected. This resulted in a significant number of missing data. In addition, the retrospective nature of this study was also a limiting factor.

Conclusions

The diagnosis of acute appendicitis in patient with acute right iliac fossa pain who underwent appendectomy in our institution was comparable to previous studies with acceptable complication rates. We have slightly higher rate of perforation in male patients but low rate of non-acute appendicitis appendectomy. Our results suggested that clinical diagnosis remains valuable tools in the diagnosis of acute appendicitis with no significant increase in rates of complicated appendicitis and negative findings on appendectomy.

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