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CLOSE CLINICAL OBSERVATION SAFELY REDUCES DIAGNOSTIC ERROR IN APPENDICITIS

*ABDULATIF AL-ARFAJ, *LADE WOSORNU, *ABDUL MONEIM AZAB, *SAAD SHAWAN, *MOHAMMED MOHANNA and **MOHAMMED SOHAIBANI

**Departments of Surgery and **Pathology, College of Medicine and Medical Sciences, King Faisal University, Dammam, Saudi Arabia*

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Close clinical observation has been considered superior to technical refinements such as ultrasound and NMR in the preoperative diagnosis of acute appendicitis. We did a prospective study on patients with suspected acute appendicitis and compared them with a historical control group.

In all, 475 patients were analyzed. Our results, "study" vs "control", were as follows: overall rates of exploration 82.8% vs 89.6% ($P < 0.02$); acute appendicitis 71.4% vs 70.5%; negative exploration rates were overall 7.6% vs 14.2% ($P < 0.02$, in females 7.4% vs 33.3% ($P < 0.001$), but in males and children there was no difference. The frequencies of perforated appendices were 2.3% vs. 3.3%, and, these patients' mean duration of symptoms was 20 hours longer than others', suggesting that perforation antedated hospital admission.

We conclude that, close clinical observation of the equivocal acute appendicitis is a simple, safe, and reliable way to keep rate of unnecessary appendicectomy below 8% without increasing that of perforated appendices.

KEY WORDS: Observer error, appendicitis, abdominal pain.

INTRODUCTION

Accurate preoperative diagnosis of acute appendicitis remains a clinical challenge. Useful diagnostic aids include abdominal ultrasound[1], laparoscopy[2], and NMR[3], but not barium enema[4], or leukocyte count[5]; and, until very recently, computer analyses had given conflicting results[2,6]. furthermore, the series with the highest diagnostic accuracy have reported the highest rate of perforation[7,8]; the reverse is also true[9].

Schwartz therefore concluded that in the diagnosis of acute appendicitis, there is no substitute for clinical judgement[10]. Thus, by using careful clinical observation in patients with equivocal diagnoses, other workers have safely reduced negative exploration to 2 to 4% in children, and 4 to 8% in adults[11–13].

We set out to see if this improvement, considered "superior to that achieved by technological refinement"[10], is attainable in other clinical settings also, including ours. If so, our findings should contribute positively to the published data on this common clinical dilemma.

Correspondence to: Dr. Abdulatif Al-Arfaj, Thoqbah, P.O. Box 20325, Al-Khobar 31952, Saudi Arabia.

PATIENTS AND METHODS

The King Fahd Hospital of the University (KFHU) Al-Khobar, is a referral hospital in the Eastern Province of Saudi Arabia. A protocol was approved by our Research Committee for the management of all patients presenting with suspected acute appendicitis. By the end of the "history and physical" and basic laboratory tests, patients were assigned to one of two diagnostic groups: "clear" or "equivocal". Duration of symptoms before admission, and the times of arrival in the Emergency Room (ER), ward, and of the subsequent appendicectomy were recorded. If the clinical diagnosis was clearly acute appendicitis, immediate appendicectomy was performed; if it was equivocal or an appendicular mass, close clinical observation was instituted.

Basic investigations were complete blood count, urinalysis, serum electrolytes and blood urea nitrogen, and, if indicated, liver function tests, plain abdominal radiographs and ultrasound to help rule out gallstones, urolithiasis, gynaecological and other causes of the acute abdomen.

Close clinical observation included 4-hourly temperature and pulse, 4–6 hourly abdominal palpation, and recording of pain and vomiting. During this period, a clearer clinical picture would emerge being either acute appendicitis, other cause of acute abdomen, or complete resolution of symptoms. Immediate exploration, other treatment, or discharge home without operation respectively were then indicated.

Period of Study and Control Group

Implementation of the protocol began on 1st October 1989; the study period presented here ended on 30th October 1990. The historical control group was a cohort of consecutive patients we admitted with suspected acute appendicitis from 1st October 1987 to 30th October 1988. (The 11 months, 1st November 1988 to 30th September 1989, were used to acquaint the department, especially Residents, with the requirements of the protocol).

In both groups, continuity of care was achieved with the "firm" system, and the decision to operate was made by the same level of staff: viz the Resident on call if the diagnosis was clear, or by the firm's consultant if it had been equivocal.

Definitions

All appendices were examined histologically and classified as "normal", "acute appendicitis" and "perforated", defined respectively as no evidence of acute inflammation, acute intramural inflammation including the gangrenous form, and histological evidence of perforation. Negative exploration meant removing a normal appendix without finding other pathology to explain the patient's symptoms.

RESULTS

A total of 475 patients have been analysed in the two groups over these 26 months (Table 1). Overall, the male: female ratio was 3:1, the mean age was 24 years (range 1–63 years); 88 were children aged 14 years or younger.

The rate of exploration in the study group, 82.8%, was significantly lower than the

Table 1. Distribution of clinical and histological variables in 475 patients with suspected acute appendicitis.

Clinical Variable	*Study Group*		*Control Group*	
	M/F/C	*: Total (%)*	*M/F/C*	*: Total (%)*
Clinical Course				
Resolved	20/10/7	: 37 (14.1)	5/12/3	: 20 (9.4)
Appendicular mass	8/0/0	: 8 (3.1)	1/0/0	: 1 (0.5)
Operated†	131/44/42	: 217 (82.8)	116/39/36	: 190 (89.6)
History of Appendix				
Normal (no other Pathology)*	11/4*/5	: 20 (7.6)	9/17*/4	: 30 (14.2)
Normal (other pathology)	0/1/0	: 4 (1.5)	2/3/0	: 5 (2.4)
Acutely inflamed	117/36/34	: 187 (71.4)	99/19/31	: 149 (70.3)
Performed	3/0/3	6 (2.3)	6/0/1	: 7 (3.3)
Total	159/54*/49	: 262**	122/51*/39	: 212

M = male, F = female, C = children.
† 82.8% vs 89.5% : $x^2 = 5.4$, $P < 0.02$
7.6% vs 14.2% : $x^2 = 6.05$, $P < 0.02$
* 4/54 vs 17/51 : $x^2 = 12.7$, $P < 0.001$
** 1 case was hydatid of liver

89.6% in the control group ($P < 0.02$). However, the freuency of acute appendicitis was similar in both groups: 71.4% vs 70.3%. The 9 cases of "other pathology" were 4 ovarian cysts in the study group, and, in the control group, a perforated Meckel's diverticulum, pinworm in an uninflamed appendix with mesenteric lymphadenitis, acute salpingitis, a luteal cyst, and a Graafian follicle.

The overall rate of negative exploration dropped significantly from 14.2% in the control group to 7.6% in the study group ($P < 0.02$). The drop was even greater in females, from 33% to 7.4% ($P < 0.001$), but remained unchanged in males and children at 6.6% vs 7.3% and 10.2% vs 10.2% respectively (Table 1).

The frequency of perforated appendix also remained unchanged (2.3% vs 3.3%). In the study group, these patients' mean duration of symptoms, 46.3 hours, was about 20 hours longer than 26.7 hours for those with acute appendicitis (Table 2). Figures for patients who had symptoms for 24 hours or longer before coming to KEMU were as follows: in the study group, 5 in 6 for perforated appendix vs 53 in 187 for acute appendicitis ($x^2 = 5.95$, $P < 0.02$); in the control group, the corresponding figures were 5 in 7 vs 20 in 149 ($x^2 = 12.7$, $P < 0.001$).

Of the 46 unoperated patients in the study group who were treated nonsurgically and discharged home, the diagnoses were 8 appendicular mass, 2 urinary tract infection, 2 urolithiasis, 1 each of duodenal ulcer, pelvic inflammatory disease, and liver hydatid cyst; 31 were "nonspecific lower abdominal pain".

Of the 24 normal appendices in the study group, 20 had been initially equivocal. The diagnosis was revised within an average of 12.6 hours (range 5–38); it took 10 hours or less in 10 of these 20 cases. In the unoperated patients, the mean observation time was 31.5 hours, the usual range being 8–48 hours with only 2 over 96 hours: 50% in the study group and 45% in the control group were discharged home within 24 hours or sooner.

Whereas the diagnosis of appendicular mass was made only once in the control group, there were 8 in the study group where it was clear clinically in 7 (confirmed by

Table 2 Average time (hours) between onset of abdominal pain, presentation in emergency room (ER), admission, and appendicectomy. (Mean and range)

Histology of Appendix	*Onset of Pain to Presentation in ER*	*ER to OR*	*Ward to OR*
Perforated Appendix			
Study group (n = 6)	46.3 (24–29)	6.7 (4–10)	3.2 (1–9)
Control group (n = 7)	56.6 (24–144)	9.9 (3–20)	4.1 (1–9)
Study Group Only			
Acute appendicitis (n = 187)	26.7 (1–72)	8.9 (2–24)	4.1 (1–19)
Normal appendix and other pathology (n = 4)	20.8 (5–36)	25.9 (0.5–216)	11.2 (3–38)
Resolved (n = 37)	25.2 (2–72)	--	--
Appendicular mass (n = 8)	60 (24–96)	--	--

ER = emergency room, OR = operating room

ultrasound in 6 of these) but required examination under anaesthesia in the eighth. None of the discharged patients returned to our hospital, including those who had had appendicular mass, although they had been specifically instructed to return for "interval appendicectomy".

DISCUSSION

Accurate preoperative diagnosis of acute appendicitis has always been a challenging clinical problem. Attempts to decrease the rate of negative exploration have resulted in higher rates of perforation, morbidity, and mortality[1,7,8,14]. Consequently, the conservative approach has been condemned [12–16]. Furthermore, since complications following the removal of normal appendices include wound infection, intestinal obstruction, and death[17–20], there remains a real need to find safe, simple, cost effective, and reliable ways to decrease the rate of diagnostic error.

Accordingly, there are series in which diagnostic aids such as high resolution ultrasound[1], laparoscopy and computer aided analyses[2] and NMR[3] were employed; and there are others based solely on active clinical observation of children[11,15], or children and adults[13]. An important outcome of all these clinical studies, including ours, is a significant reduction in the rate of negative exploration to between 4 and 8%, instead of the generally quoted 20–30%[21–24] without increased rates of perforation. An even higher diagnostic error, 70%, has been reported[25].

We affirm with others[11,26,27], that close inpatient observation for equivocal appendicitis can be carried out safely, and that the fear of perforation occurring during the observation is exaggerated. Thus, in our study group, the 7.6% rate of negative exploration could have been reduced further if we had extended the time of

observation to 24 hours or longer in our 20 equivocal cases; as it was, it induced a change of the diagnosis to acute appendicitis within 10 hours or sooner in 10 patients all of whom had normal appendices.

"Women in the child-bearing age admitted in hospital with abdominal pain are at a 3.5 higher risk to have a normal appendix removed"[28]. Our control group supports this observation where the risk for females was 3.4 and 4.5 times higher than that for children and males respectively, however, in our study group, this increased risk had almost disappeared. Therefore, females 14 years or older benefited most from the policy of close clinical observation in equivocal cases.

We observed 2 other advantages: more patients were safely discharged home without appendicectomy, and more cases of appendicular mass, where the conservative approach remains the optimal management, were detected. Although only few recurrences have been reported[27], none of our patients came back with recurrence, as has been noted also by White *et al*[1]. The period of inpatient observation was not considered a cause of significant socio-economic hardship.

There can be no question that even if this were not the era of "continuous quality improvement"[29], what constitutes an acceptable rate of negative exploration (as defined above) should and must be improved upon continuously. Thus, it had dropped from 20–30%[21–25], through 4–8%[11–13] and, recently, it is lower still by the use of selective laparoscopy[30], and peritoneal cytology[32].

However, we think that it can be reduced to below 4% only with these invasive diagnostic techniques. We would, therefore, advocate that, close clinical observation, being simple, consistently safe and reliable, merits wider adoption in the management of acute appendicitis, a disease which can still present a taxing clinical problem[32].

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