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Acute appendicitis: the continuing role for active observation

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Abstract We present the results of a 6-year review of appendicitis. In the event of diagnostic doubt, a policy of active observation was instituted. This review endorses the validity of such a policy, indicating that it does not expose patients to increased morbidity. Data were collected prospectively over a 6-year period on 1,479 children admitted with suspected acute appendicitis (AA); 1,028 (69.5%) were discharged with a diagnosis of non-specific abdominal pain after a mean observation period of 2.5 days, whilst in the remaining 451 a clinical diagnosis of AA was confirmed. The male-to-female ratio was equal, with no difference in the mean age of males (11 years) or females (12 years); 95% of patients were over the age of 5 years. In 324 (72%) cases surgery was performed on the day of admission, whilst in the remaining 126 (28%) it was deferred for 1 to 6 days because the clinical diagnosis of AA remained doubtful. The mean hospital stay was 4 days (range 1 – 32). Analysis of the histological reports of all 451 cases confirmed a positive predictive value for clinical assessment alone of 97.9% and a normal appendicectomy rate of 2.6%. No mortality was observed; surgical morbidity was recorded at 6% with no correlation between postoperative morbidity and timing of surgery evident (Spearmans correlation coefficient = −0.079, $p = 0.9$). Active observation for suspected AA thus remains a valid technique for achieving an accurate diagnosis and successful outcome.

Keywords Active observation · Appendicitis

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Introduction

Since Tait [1] performed the first deliberate appendicectomy for acute appendicitis (AA) in May 1880 [2], surgeons have worked to not only improve the results of operative treatment, but also to enhance diagnostic skills. Continuing experience, coupled with an active interventionist approach, has contributed to a progressive reduction in mortality and morbidity associated with AA; the mortality of uncomplicated appendicitis is less than 0.1%, whilst the corresponding rates for gangrenous and perforated appendicitis are 0.6% and 5%, respectively [3]. In exchange for these improved figures, there exists a moderate incidence of negative explorations that may be considered a fair trade-off for containing morbidity consequent to perforation from delayed diagnosis. Nevertheless, it is quite clear that a negative appendicectomy is not in itself without serious consequence. A confidential enquiry into perioperative deaths reported 4 deaths occurring after appendicectomy, 3 following a negative laparotomy, and 1 following a laparotomy for pseudo-obstruction [4].

There remains a clear need to refine the diagnostic accuracy and so reduce the variable negative appendicectomy rate. In an attempt to achieve this aim, a variety of different diagnostic techniques have been employed [5]. Measurement of specific acute-phase reactants, computer-assisted decision-making models/scoring systems, imaging modalities such as ultrasound (US) and computed tomography (CT), sampling of peritoneal fluid, and diagnostic laparoscopy have all been utilised with the objective of improving diagnostic accuracy. Variable success has been achieved [6–13].

In contrast, it has been the policy of this unit to actively observe all children where the clinical diagnosis of AA remains doubtful after the initial clinical assessment [14]. Imaging techniques (limited to plain abdominal X-ray and/or US) are only additionally requested after consultant review with results from haematological and biochemical investigations available (white cell count [WBC] and C-reactive protein [CRP]). Moreover, emergency appendicectomy is only performed between midnight and 6 a.m. in the exceptional circumstance of resuscitation requiring urgent control of advanced peritoneal sepsis; otherwise, appendicectomy was restricted to "daylight" hours (6 a.m.–12 p.m.). We have reviewed the results of this policy over a 6-year period to determine whether or not our results require further improvement through greater utilisation of diagnostic imaging techniques as reported in the medical literature.

Materials and methods

All patients admitted to the surgical unit at the Royal Aberdeen Children's Hospital have diagnostic and procedural indices recorded prospectively on a standardised database by medical staff. This information is then entered into a computerised database system and validated. This system employs DataEase (DataEase International, Ilford, UK) and uses the Read Clinical Thesaurus (Computer Aided Medical Systems, Loughborough, UK).

Data for all patients admitted with suspected AA between 1991 and 1997 were retrieved and analysed. In addition, information was obtained from the database systems in the departments of pathology and radiology. All cases undergoing appendicectomy were studied; those involving incidental appendicectomy were excluded from this study, as were cases of abdominal pain from other documented surgical and medical causes.

In all patients, the diagnosis of AA was made on the basis of the clinical history and physical examination supplemented on occasion by the WBC, CRP value, and urinalysis. The use of plain abdominal radiographs was limited to the diagnostic assessment of particularly young children (<5 years) admitted with suspected AA. In instances where a positive diagnosis of appendicitis was made, all patients were commenced on an intravenous infusion and received prophylactic antibiotic cover: metronidazole 7.5 mg/kg and cefotaxime 30 mg/kg prior to surgery.

During appendicectomy peritoneal antibiotic lavage (cefotaxime (1 g/l) was used until a clear effluent was obtained. Stump inversion was not routinely employed, and all wounds were primarily closed with an absorbable subcuticular suture after infiltration with local anaesthesia. Neither intraperitoneal nor wound drains were used. Antibiotics were only continued into the postoperative period if there was concern about residual intraperitoneal sepsis. An intra-operative block with 0.25% bupivacaine provided analgesia. Postoperatively, patients routinely received diclofenac by suppository and oral analgesics if required when normal gut function had returned. Patient (or nurse)-controlled opiate analgesia with background basal infusions were reserved for particularly difficult cases. Operative contamination was prospectively recorded: (1) clean/contaminated – normal appendix; (2) contaminated – suppurative appendicitis; and (3) dirty – free pus ± perforation.

It was not our policy to routinely review our patients in the surgical clinic following discharge. In those instances where the diagnosis remained unclear, repeated abdominal examinations were performed and vital signs together with analgesic requirements reviewed, by the same clinician when feasible, at 2–3-hourly intervals. IV fluids were continued until a clear decision regarding surgery was made. During the period of active observation, it was our policy to provide analgesia for patients on the assumption that clinical assessment can best be performed with the co-operation of a willing patient and that analgesia does not suppress the clinical signs of peritonitis. Analysis of the data for correlation between the occurrence of postoperative morbidity (dependent variable) and timing of surgery (independent variable) was examined using Spearman's correlation coefficient on the Statistical Package Software System (SPSS) for Windows. A P value below 0.05 was taken as sufficient evidence with which to reject the null hypothesis of no difference between those undergoing surgery on the day of admission (day 1) and those undergoing surgery on day 2 or later.

Results

During the 6-year period, 1,479 children with suspected AA were admitted to the unit; 1,028 (69.5%) were discharged after a median stay of 2.5 days with a diagnosis of non-specific abdominal pain. In the remaining 451 (30.5%) a diagnosis of AA was made (Table 1) and surgery performed. In 72% of these cases appendicectomy was performed on the day of admission, whilst in only 4% was it performed beyond 48 h after admission; 96% of all recorded wounds were graded as at least contaminated.

Of the 451 admissions diagnosed with AA, only 13 proceeded to diagnostic preoperative US examination of the abdomen after initial clinical assessment. Further analysis of this small group was not performed, as the sample size was insufficient to provide meaningful statistical analysis. The mean in-patient stay was 4 days (range 1–32). A review of the histological reports confirmed the preoperative diagnosis of AA in all but 12 of the 451 cases. The positive predictive value for clinical assessment alone was 97.9% (429 cases) and the overall normal appendicectomy rate was 2.6% (male:female ratio = 1, median age: males 10 years, females 11 years).

Total recorded surgical morbidity in this series were 6.0% (Table 2) with no postoperative deaths. Analysis of the data (Table 3) suggested no correlation between postoperative morbidity and timing of surgery (Spearman's correlation coefficient = −0.079, $P = 0.9$).

Table 1 Summary of patients admitted with appendicitis

Characteristic (n = 451)
M/F: 1
Mean age (years)
Males: 11
Females: 12
Age distribution (years)
<3 = 1.1%
3–5 = 3.9%
>5 = 95%
Mean in-patient stay: 4 days (range 1–32 days)

Table 2 Recorded post-operative morbidity

Postoperative complication	Number (%)
Early wound infection (includes cases of wound erythema)	7 (1.5)
Delayed gut function	12 (2.6)
Chest infection	4 (<1)
Residual postoperative intraperitoneal sepsis	3 (<1)
Stump dehiscence	1 (<1%)
Total	27

Table 3 Postoperative morbidity and timing of surgery

Day of surgery, no. of patients	Wound infection	Delayed gut function	Chest infection	Residual peritoneal sepsis	Faecal fistula
Day 1, 324 patients	6	10	4	0	0
Day 2 or later, 126 patients	1	2	0	3	1
Total: 450	7	12	4	3	1

Spearmans correlation coefficient 0.079 ($P = 0.9$)

Discussion

Abdominal pain remains a common childhood complaint that may require emergency hospital admission. The majority of these admissions (70%) can be managed conservatively and be discharged within 48 h. Surgical exploration and appendicectomy in this series was reserved for 30% of admissions. The clinical picture of AA is typically one of progressive change and any diagnostic tool is most valuable if it is applicable in such a dynamic "real-time" way. Unless application is sequential, any evaluation is likely to merely reflect the stage of pathophysiology present at the moment of examination. Clinical evaluation and re-evaluation thus favour early diagnosis if doubt persists. Moreover, our results support the suggestion made by others that prompt surgical intervention following admission does not necessarily equate with early interruption of the inflammatory process and reduced post-operative morbidity, since the inflammatory process may be significantly advanced by the time of admission [15].

Although concern has been expressed regarding increased morbidity following delayed diagnosis and pre-emptive surgical exploration advocated to obviate potential morbidity [16], effective surgery combined with thorough peritoneal toilet and potent antibiotic administration appears to achieve equally low perioperative morbidity in suppurative and perforated appendicitis. The reported normal appendicectomy rate of 2.6% over 6 years appears favourable and lends support to the value of repeated clinical assessment and active observation in avoiding unnecessary operations. The reported wound-infection rate of 1.5% in this series also remains acceptable given the incidence of operative contamination; other authors have reported similar results [17]. Their results, however, were achieved by a regimen of triple antibiotic therapy preoperatively and at least two further doses post-operatively in all cases.

It is acknowledged that in the absence of routine review this low rate of sepsis is unconfirmed, but we assume that significant wound morbidity would have been notified to the unit, the sole provider of this service in the region. In addition, we observed that over 75% of postoperative complications occurring in our unit did so despite surgery being undertaken on the day of emergency admission. This finding does not support the suggestion that a policy of active observation necessarily increases surgical morbidity. Moreover, the low wound-infection rate and overall low surgical morbidity indicate that the delay inherent in active observation would not appear to adversely affect the stage of disease during active observation, is not prejudicial to outcome, and poses no additional risk [18, 19].

Many investigations used to refine diagnostic accuracy in AA, remain clinically impractical in children and may not always be immediately available during emergency hours. In particular, CT scanning of the appendix with colonic contrast, although reported to be both accurate and cost-effective in achieving an early diagnosis, remains poorly assessed with regard to the radiation risk, and probably remains unsuitable for young children [20]. Although laparoscopic evaluation of patients with right-illac-fossa (RIF) pain and the merits of laparoscopic appendicectomy continue to be debated, the perceived advantage remains slight and this is not a routine practice in our unit. Moreover, as the majority of children with RIF pain settle without any intervention or subsequent follow-up, laparoscopic evaluation is largely unnecessary.

Our approach to managing acute abdominal pain has evolved since Winsey and Jones reported their initial results from our institution just over 30 years ago [21]. This study confirms the primacy of active observation as the main diagnostic process in the detection of AA, and whilst adjunctive investigation is indicated when doubt remains, the technique remains applicable to contemporary practice.

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