Witness Statement Ref. No.	044/3
NAME OF CHILD: RAYCHEL FERGUSON	
Name: Robert Gilliland **Title: Mr**	
Present position and institution: Consultant Colorectal / General Surgeon, South Eastern Health and Social Care Trust	
Previous position and institution: Consultant Colorectal / General Surgery, Altnagelvin Hospital *[As at the time of the child's death]*	
Membership of Advisory Panels and Committees: *[Identify by date and title all of those since your Witness Statement of 13th July 2012]*	
Previous Statements, Depositions and Reports: *[Identify by date and title all those made in relation to the child's death since your Witness Statement of 13th July 2012]*	
OFFICIAL USE: **List of previous statements, depositions and reports attached:**	

Ref:	**Date:**	
044/1	01.07.2005	Inquiry Witness Statement
044/2	13.07.2012	Supplemental Inquiry Witness Statement

Having now been furnished with the expert witness report of Mr G Foster (written 2nd April 2012) and the supplementary report (written 21st January 2013) concerning the events surrounding the death of Raychel Ferguson, I wish to make the following observations. I will refer to Mr Foster's initial report by paragraph number. I will specify in the text where I am referring to comments in his supplementary report.

5.3 Comment

ii Mr Foster states that the administration of morphine prior to Raychel being examined by a surgeon is *"much to be regretted"*. He statesthat *"it is standard surgical teaching that unless symptoms are very severe, analgesia should be deferred until a patient is seen by a surgeon"*. However, if a surgeon is not immediately available to assess a child who is in pain as a result of a possible appendicitis, it seems inappropriate to allow that child to continue to be in pain. This view would be supported by advice from the "Up to date" website :-

We recommend that children with suspected appendicitis receive analgesia commensurate with the degree of pain, including intravenous opioid medications. In the past, analgesia for patients with appendicitis was discouraged in the mistaken belief that pain control would mask symptoms and cause clinicians to miss definitive signs of disease. However, trials in children indicate that diagnosis of appendicitis is not significantly impacted when they receive intravenous opioid medications for pain control as follows:

- *In a trial performed in 108 children (age 5 to 16 years) with suspected appendicitis who received intravenous morphine or normal saline while undergoing evaluation in a children's hospital emergency department, morphine administrations was* ***not*** *associated with perforation, negative appendectomy, or admission for observation after surgical assessment when compared to intravenous normal saline [Green et al 2005]. Missed appendicitis occurred in one patient who received normal saline. Morphine administration was associated with clinically significant greater pain relief.*

There appears to be no evidence that the administration of analgesia to children in these circumstances is detrimental with regards making a diagnosis in suspected appendicitis. Indeed, in this case there is no evidence that the morphine administered had any effect on masking the clinical signs which were present and recorded by Mr Makar when he examined Raychel (020-007-012). Therefore, the decision to administer analgesia to Raychel in A/E was reasonable.

iii Mr Foster states that failure to send a urine culture and microscopy prior to Raychel's surgery is a *"serious concern"* and shows *"evidence of less than reasonable practice"*. He bases this concern on the fact that proteinuria was noted on 2 urinanalyses and that this is *"an indication of renal disease or infection"*. I presume that his main cause for concern was over the possibility of Raychel having a urinary tract infection (UTI) hence his suggestion that urine culture and microscopy should be performed.

Isolated proteinuria on dipstick testing appears to be a poor indicator for urinary tract infection. The detection of leucocytes or nitrites on dipstick testing is more specific for a UTI. However, on both urine samples obtained from Raychel, dipstick testing for both nitrites and leucocytes was negative. The NICE guidelines on "Urinary Tract Infection in Children" state that in children aged 3 years or older *"dipstick testing for leukocyte esterase and nitrite is diagnostically as useful as microscopy and culture, and can safely be used"*. These guidelines

state that if both the leucocyte esterase and nitrite are negative then the child *"should not be regarded as having a UTI. Antibiotic treatment for UTI should not be started, and a urine sample should not be sent for culture. Other causes of illness should be explored"* (NICE Clinical Guideline 54; August 2007; page 13). Thus the assertion, which Mr Foster makes several times throughout both his initial and supplementary reports, that a direct microscopy and urine culture should have been performed following the detection of isolated proteinuria appears to be incorrect.

A urine culture test takes between 48 and 72 hours to complete and therefore should not influence the decision as to whether or not to perform an appendicectomy. Indeed delaying surgery for this period of time would significantly increase the risks of perforation of the appendix and potentially place the child's life at risk.

Mr Foster also states that the *"history of pain on urination ..... should have alerted Mr Makar to an alternative diagnosis to appendicitis"*. Dysuria can occur in children with appendicitis. An article by Wesson in 2012 states that in children aged between 5 and 12 *"Diarrhoea, constipation, and dysuria are less frequent, but occur enough to potentially confuse the diagnosis"*. Whilst this symptom is recorded on the initial A/E sheet, the absence of urinary symptoms is recorded by Mr Makar (*"no urinary symptoms"*; 020-077-011) and therefore this symptom may not have been consistent.

iv Mr Foster states that *"surgery in children at night should be carried out by a senior operator"* citing as evidence the NCEPOD report of 1989.

I disagree with Mr Foster's assertion that the recommendations of this report had become *"standard surgical and anaesthetic practice in 2001"*. They were not standard practice in Altangelvin in 2001 and I suspect that they had not been implemented elsewhere within N. Ireland at that time. Certainly another recommendation of the report namely that *"Surgeons and anaesthetists should not undertake occasional paediatric practice"* has proved impossible to implement in N. Ireland as most general surgeons in DGHs undertake emergency surgery in paediatric patients as and when required.

v Mr Foster states that *"Mr Gilliland did not know that Raychel was his patient until 11th June"* and that *"Mr Gilliland clearly did not know details of his patients admitted on 7th"*. I believe that it is highly likely that I would have been informed on the morning of 8th June that a child had been admitted overnight who had undergone a standard appendicectomy for appendicitis. Having not been made aware of any post-operative complications I had no reason to suspect that the child Mr Neilly referred to in his converstation with me on the evening of the 10th had been under my care. Thus what became apparent on the morning of the 11th June was that the child of whom I had likely been informed about on the morning of Friday 8th June as having had an appendicectomy, had died.

Mr Foster states that had he been consulted about a case like Raychel's he would *"certainly have advised conservatism through the night of 7th June"*. I think it is impossible for any of us to know with certainty how we may react in a particular circumstance. However, to suggest that a 9 year old girl who presents in the early evening with a history of abdominal pain and who, on examination, has tenderness, guarding and mild rebound tenderness in the right iliac fossa should always be treated conservatively overnight is open to question. I would submit that there would be other general surgeons who, if faced with this complex of symptoms and signs, would adopt an operative approach.

7.2 Comment

Mr Foster states that *"clearly there was no senior ward round on the morning of the 8th June"*. I assume he reaches this conclusion on the basis that I have said in my evidence that I did not see Raychel post-operatively. He goes on to say that *"after a 24 hour period a round of patients admitted should be made...ideally by the Consultant himself"*. He reports that this *"has been [his] practice throughout a 28 year career"*. This has been my practice also and I think it is highly likely that a post-take ward round was conducted by me on the morning of the 8thas would have been my usual practice. I think it is highly likely that I will have been told about Raychel on that morning and reassured that she was making adequate progress for a child on the morning after an appendicectomy.

Mr Foster states that *"had a senior ward round taken place on the morning of the June 8th I have no doubt that the reasoning behind an operation at 23.30 would have been queried. The abnormal urine tests would have been noted and further investigation performed"*. I think this statement is difficult to support for several reasons.

Firstly, I do not think the reason to perform an appendicectomy during evening hours would have been queried in a child reported to have clinical signs of appendicitis and in whom the appendix was reported to be mildly congested. The expression *"mildly congested"* is often reported in patients whose appendix is subsequently demonstrated to be histologically normal. However, on the morning of the 8th June histological analysis would not have been available and the verbal report of mild congestion would have had to be accepted at face value leading to the conclusion that a correct course of treatment had been followed.

Secondly, I do not think the abnormal urine test would have been further queried as it did not demonstrate any findings suggestive of urinary infection.

Finally, in a child who, in Mr Foster's own words, would *"have been well"* and where *"there would have been little cause for concern"*, it is very difficult to see how he concludes that at that point the diagnosis would have been questioned and *"further investigations performed"*. I think this pushes the bounds of credibility and I do not believe that had I, or any other senior member of the team, seen Raychel on the morning of the 8th June that futher investigations would have been requested.

In point 5.15 in his supplementary report Mr Foster makes some further comments about the conduct of morning ward rounds in his own practice. He says that the morning ward round was *"accompanied by the team that were on call from the night before plus the new team for the day ahead"*. This is not an arrangement that I can recall happening regularly at any stage of my surgical career. In 2001 the on call team from the night before would usually have had other commitments in the morning and would not be available to attend the morning round.

In 5.15 of his supplementary report Mr Foster states that the morning ward round *"always started on the children's ward"*. As I have stated in my evidence this would not always be possible in my experience as often there were adult patients who required attention as a priority. Furthermore, it would be normal practice in a number of other hospitals to commence the ward round on the adult wards prior to the children's ward. Thus the

arrangements in Mr Foster's hospital should not be taken as standard practice across the UK.

8.3 Knowledge of fluid balance expected of a surgical SHO

In this section Mr Foster outlines the knowledge of post-operative fluid balance that he believes should be understood by a surgical SHO and then states that this knowledge *"should have been understood by the nursing staff"* and that he would have *"thought that a senior nurse would have had some training in this"*. I doubt that the nursing staff in Altnagelvin had had specific training in this area and Mr Foster offers no evidence as to how this training would have been obtained. It is unclear from Mr Foster's CV as to whether he is qualified to offer an opinion on nurse training.

8.4 Comment

Mr Foster states that he has *"no doubt whatsoever that if he [Dr J Johnston] had been asked to attend [Raychel]...he would have taken the situation of continued vomiting seriously"*. This is conjecture as we know that Dr Johnston did not arrive until after the seizure occured and it is not possible to predict what he might have done earlier in the day.

9.5

I disagree with some of Mr Foster's suggested management for Raychel on the evening of 8th June. I doubt that she would have tolerated the passage of an NG tube and its presence would not have helped her situation.

10.3

Mr Foster states that *"the clinical note made by Dr Zafar does not confirm that Raychel was examined"*. This is correct. However examination of a child 8 hours post-appendicectomy who otherwise seems to progressing satisfactorily (a point that Mr Foster conceeds on several occasions in his report) would be of little value and certainly would not have helped influence the events that contributed to Raychel's death.

12.3

Mr Foster states that *"When Dr Johnston saw Raychel he immediately suspected that she was suffering from electrolyte imbalance secondary to vomiting"*. However, Dr Johnston saw Raychel after she had had a fit and as such a possible electrolyte imbalance is part of the differential diagnosis. It does not follow that if Dr Johnston had seen Raychel earlier in her illness that he would have suspected electrolyte imbalance or taken steps to correct the imbalance as Mr Foster postulates in his report.

12.7

On several occasions throughout his report Mr Foster expresses concerns about the absence of surgical staff following Raychel's fit. He states that the absence of surgeons is *"much to be regretted"*. He states that the *"absence of a surgical consultant must have been obvious to all the team involved"*. Indeed he thinks that the Consultant Surgeon on call *"should have*

come in and taken some responsibility". I have to disagree with Mr Foster's opinion for two reasons.

Firstly, he fails to state what difference the presence of either surgical juniors or a surgical consultant would have made to Raychel's care at that time. Indeed in paragraph 6.7 of his supplementary report he appears to contradict earlier statements by stating that he could not see "what Dr Zafar's input could have added" at a time when Raychel was being attended by paediatricians and anaesthetists.

Secondly, I would think that every one involved with Raychel when she became critically ill were focussed on her care and would have been unlikely to notice the absence of a surgical consultant. I think one has to put Mr Foster's comments in this matter into context with regards what happens in any NHS hospital on a daily basis. When a patient becomes unwell it is important to have those members of staff in attendance who are best able to deal with the situation at hand. This is what happened in Raychel's case. By Mr Foster's standard the Consultant Surgeon should "come in and take some responsibility" each time a patient under his/her care becomes critically ill as a result of an aspiration pneumonia, a myocardial infarction or some other non-surgical complication. This is unnecessary and therefore it is not a practice that happens routinely as part of the day to day running of the NHS.

Mr Foster reports that neither Dr Zafar nor Mr Bhalla "*made a clinical note*" at that time. There is no evidence that either doctor was involved in the resuscitation which was being carried out appropriately by more senior colleagues. Therefore I cannot see the necessity for either doctor to make a clinical note.

15.4

Mr Foster casts doubt on my evidence to the coroner that I "*only became aware of hyponatraemia after the death of Raychel*". My statement is correct. The statement was made in the context of an inquest relating to the death of a child from dilutional hyponatraemia following routine surgery. This was a scenario which I had never encountered either during my training or as a Consultant. Mr Foster, I presume, has taken my statement to mean that I had never heard of the term hyponatraemia or understood that it meant a low level of serum sodium. That is incorrect and I believe he has taken my statement out of context.

23.1

Mr Foster asks the question "*what was the cause of Raychel's pain*" and then states that "*the presence of a faecolith in a non inflamed appendix is irrelevant*". Whilst I acknowledge that there is some debate in the literature on this point, there is evidence that the presence of a faecolith is associated with abdominal pain (Fraser et al 2004) and that the removal of an otherwise normal appendix which contains a faecolith is associated with relief of the pain (Grimes et al 2010). I do not think the finding of a faecolith can be dismissed as "*irrelevant*".

23.2

Mr Foster reiterates his concern about the lack of microscopy and urine culture being requested. He states that microscopy results "*would have been readily available*". I am not sure that this was the case in Altnaglevin in 2001 and I do not recall ever asking for this

service out of hours on a child with suspected appendicitis. However, the point is immaterial as there was no indication to perform direct microsopy.

23.2 – 23.4

Mr Foster outlines some of the common differential diagnoses for right iliac fossa pain in children. However, none of the potential diagnoses that he proposes adequately explains the clinical findings of tenderness, guarding and mild rebound tenderness over McBurney's point.

Additional comments on the supplementary report (written 21st January 2013)

6.5

Mr Foster states that when Dr Zafar saw Raychel on the morning of 8th June that he gave *"reasonable advice"*. However, he then states that Dr Zafar *"would not have had the experience"* to make a decision about possible blood testing as a result of noting a single vomit on the fluid balance chart. Post-operative vomiting is common following appendicectomy and I would not expect a blood test to be requested after a single vomit in a child 8 hours post appendicectomy. Indeed such a practice would be outside the current guidelines formulated as a result of the issues with hyponatraemia.

Dr Zafar did not give the nursing staff *"specific advice on fluid management and possible modifications through the day"*. This would reflect normal practice at that time. The nursing staff had experience in looking after patients following appendicectomy. The advice given was to commence oral fluids and step down the IV fluids if all was well. I doubt that if Raychel had been seen by a more senior member of the team that morning that any more specific instruction would have been given.

Mr Foster is critical of Dr Zafar in that he did not give *"specific instructions to the nurses as to who to contact if there were problems"*. It would be standard practice for the nursing staff to contact medical staff if there were problems. In Altnaglevin at that time the JHO was the first point of contact. However, nursing staff would (and often did) contact more senior medical staff if they felt that the problem required more senior input. To re-iterate this accepted practice after seeing every patient, particularly a patient who at that time gave no cause for concern, would be inappropriate and I do not think Dr Zafar can be criticised for not doing so.

10.7

Mr Foster states that he finds it difficult to accept my evidence that I was not aware of the NCEPOD report of 1989 as I had worked in the RBHSC in 1992. I do not recall being made aware of that report nor do I recall informing the consultant every time I took a child to theatre whilst working as a registrar in the children's hospital.

10.8

I have stated in my evidence that the discussion I had with Mr Makar was informal. A specific meeting was not arranged and no notes were taken. I do not remember either asking Mr Makar or being told by him that he had informed a more senior doctor.

Robert Gilliland 29th January 2013

THIS STATEMENT IS TRUE TO THE BEST OF MY KNOWLEDGE AND BELIEF

Signed: Robert Gilliland Dated: 1st February 2013

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Early Analgesia for Children With Acute Abdominal Pain

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Abstract

Objectives. The objectives of this study were to determine whether the administration of morphine to children with acute abdominal pain would impede the diagnosis of appendicitis and to determine the efficacy of morphine in relieving the pain.

Methods. This was a double-blind, randomized, placebo-controlled trial involving 5- to 16-year-old children who presented to the emergency department of a children's hospital with a chief complaint of acute abdominal pain that was thought by the pediatric emergency attending physician to require a surgical consultation. Subjects were randomized to receive intravenously administered morphine or normal saline solution. Clinical data and the emergency physician's confidence in his or her clinical diagnosis (0–100%) were recorded systematically with a standardized form. This was repeated 15 minutes after administration of the study medication. The surgeon assessed the child within 1 hour and completed a similar data collection sheet. Pain was assessed, with a color analog scale, before and after study medication administration. Each subject was monitored for 2 weeks after enrollment.

Results. One hundred eight children were enrolled; 52 received morphine and 56 received a placebo saline solution. There were no differences between groups in demographic variables or the degree of pain. There were no differences between groups in the diagnoses of appendicitis or perforated appendicitis or the number of children who were observed and then underwent laparotomy. The reduction in the mean pain score was significantly greater in the morphine group (2.2 vs 1.2 cm). The emergency physicians' and surgeons' confidence in their diagnoses was not affected by the administration of morphine.

Conclusions. Our data show that morphine effectively reduces the intensity of pain among children with acute abdominal pain and morphine does not seem to impede the diagnosis of appendicitis.

Key Words:

abdominal pain

analgesia

appendicitis

diagnosis

surgery

Pain is a common symptom among children presenting for care at emergency departments (EDs). Traditionally, the physician's focus has been on the diagnosis of the condition producing the pain, rather than on the relief of the pain. However, emergency physicians are now concerning themselves with the latter, and several authorities have produced position statements on the management of pain in EDs.[1-3]

Fifteen percent of school-aged children are brought to a physician because of abdominal pain, making this symptom a common presenting complaint in the pediatric ED.[4] The most common serious, pediatric, abdominal emergency is appendicitis.[5] As with adult patients, it has been thought that analgesic use among pediatric patients with surgical abdominal findings may impede the diagnosis. Theoretically, analgesia may mask pain and subsequently diminish the physical signs associated typically with a surgical condition. Current practice in pediatric emergency medicine and pediatric surgery dictates that children should not receive analgesics when presenting with acute abdominal pain.[6,7] This practice among children is a result of traditional teaching and only recently has been challenged in a manner similar to that for adults.[8]

There is a need to determine whether the practice of analgesic administration to pediatric patients with acute abdominal pain impedes the diagnosis of the condition causing the pain. The objectives of this study were to assess whether morphine would increase the rate of missed appendicitis, to determine its efficacy in treating acute pediatric abdominal pain, and to examine its effect on physician confidence in the diagnosis of the condition causing the pain.

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METHODS

This study was conducted in the ED of a tertiary care, academic, pediatric ED with an annual census of 39 000. This facility is staffed by pediatric emergency medicine attending physicians. The study was a double-blind, randomized, placebo-controlled, clinical trial, with the primary outcome measure being the rate of missed appendicitis among children who received intravenous morphine treatment. The secondary outcomes were rates of perforated appendicitis, delays in diagnosis, pain relief, and confidence of pediatric emergency physicians and pediatric

surgeons in the diagnoses. Ethics approval for this study was obtained from our university's institutional review board.

Male and female patients between the ages of 5 and 16 years (inclusive) who presented with nontraumatic abdominal pain of <48-hour duration were eligible for the study if, after assessment by the attending pediatric emergency physician, it was thought that a surgical consultation was warranted for a possible surgical condition. Exclusion criteria included allergy to opiates, previous opiate use within the past 4 hours, hypotension, or the absence of a parent.

Children were enrolled 7 days per week between the hours of 8:00 AM and midnight. After midnight, often an attending surgeon was not available within the protocol time limits. The study center has 3 pediatric surgeons, but convenience sampling was used because 1 surgeon did not participate.

After emergency physician assessment, informed written consent was obtained from the parents and verbal assent was obtained from the children. For children who met the inclusion criteria, a premedication assessment form was completed by the emergency physician. Data collected on this form were clinical signs and symptoms, including the location of the pain, the presence or absence of abdominal tenderness, guarding, and psoas, obturator, and Rosving signs, and whether there was pain associated with jumping. The physician documented his or her diagnosis, with a degree of confidence ranging from 0% to 100%, on the form before the results of any laboratory testing or imaging studies were available.

A pain assessment was conducted with a validated color analog scale (CAS).[9] Children were asked to mark their current pain severity on the thermometer-shaped, standardized CAS anchored by the descriptors "no pain" and "worst pain." Children were asked to slide the marker to the point on the thermometer that best described the pain they were experiencing currently. The reverse side of this instrument has a numerical rating scale divided into unit marks separated by 0.25 cm, so that a number from 1 to 10 can be assigned to the individual assessments. A team of dedicated study nurses supervised compliance with the study protocol and administered all pain scales with a scripted dialogue.

Randomization was performed by the hospital pharmacy in a blinded manner, using a computer-generated, random-number list in blocks of 10. The pharmacy prepared identical syringes of morphine sulfate and normal saline solution as numbered prepacked syringes, to which all investigators and emergency staff members were blinded. Children were randomized to receive either 0.05 mg/kg morphine sulfate (maximum of 10 mg) or an equivalent volume of normal saline solution. Patients underwent continuous oxygen saturation monitoring, and vital signs were recorded by the study nurse every 10 minutes.

Fifteen minutes after administration of the study medication, the emergency physician reexamined the child and completed an identical assessment form, including an assessment of his or her confidence in the diagnosis. The study nurse repeated a pain scale assessment for the child at this time. All children were blinded to their initial CAS scores. If a child had ongoing pain, then the same dose of study medication was repeated at the emergency physician's discretion. The emergency physician reassessed the child within 15 minutes after the second dose. The emergency physician completed a second, identical, postmedication assessment form, and the study nurse repeated the pain scale assessment. Children who had ongoing pain after 2 doses of

study medication (total dose of 0.1 mg/kg morphine sulfate) did not receive additional medication until assessment by the pediatric surgeon.

Surgical assessment had to be performed within 1 hour after the initial study medication infusion. Attending pediatric surgical staff members or a senior surgical resident (postgraduate year 4 or higher) completed a surgical assessment form and arranged disposition. The surgical assessment form evaluated abdominal tenderness, guarding, the presence of positive or negative psoas, obturator, and Rosving signs, and whether there was pain with jumping. The surgeon was then asked to make a diagnosis and to indicate his or her confidence in the diagnosis, from 0% to 100%. Additional analgesia and other medications were administered at the surgeon's discretion.

Children were monitored if they were admitted to the hospital. All children who were discharged from the hospital received follow-up telephone calls from the study nurse within 2 weeks, to ensure that no surgical condition had been missed. Operating room and pathology reports were reviewed for final diagnoses for all children who underwent laparotomy.

Mean pain scores were analyzed with repeated-measures analysis of variance. The χ^2 test or Fisher's exact test (when appropriate) was used for comparisons of proportions, and the *t* test was used for comparisons of means. All statistical analyses were performed with SAS software, version 8.2 (SAS Institute, Cary, NC).

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RESULTS

During the 25-month study period from February 1, 2000, to March 30, 2002, 162 patients were eligible for our study. Of these, 54 were not enrolled because they met exclusion criteria (*n* = 17), refused (*n* = 16), or were missed (*n* = 21). A total of 108 children completed the study (Fig 1).

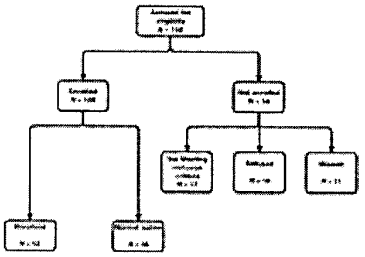

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Fig 1.

Study flowchart.

Fifty-two patients were randomized to receive morphine, whereas 56 received normal saline solution. The groups were similar with respect to mean initial pain scores, physical findings, and time from study drug administration to surgical assessment (Table 1).

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TABLE 1.

Initial Assessment Before Study Drug Administration

The outcomes for the 108 children are shown in Table 2. Appendicitis was missed for only 1 child, and this patient was in the normal saline solution group. There was no difference between groups in the diagnosis of appendicitis (P = .25) or perforated appendicitis (P = .51) or in the number of children who were observed and then underwent laparotomy (P = .77). Overall, there were 31 patients in the morphine group and 26 in the placebo group who had final diagnoses of appendicitis. Perforated appendicitis occurred for 27 patients, with no difference between groups (P = .51). Laparotomies were performed for 4 patients with normal appendices in the placebo group and 1 in the morphine group. The incidences of other diagnoses and self-resolving abdominal pain were not different between the groups (P = .70).

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TABLE 2.

Outcomes

Of the 41 children admitted for observation, 13 underwent a laparotomy subsequently, ie, 7 in the morphine group and 6 in the placebo group. All 7 children in the morphine group had appendicitis (3 perforated), as did 4 in the placebo group (1 perforated). There was no difference in the proportions of patients admitted for observation and subsequently found to have appendicitis (7 of 19 patients in the morphine group and 4 of 22 patients in the placebo group; P = .29).

Both groups experienced reductions in recorded CAS scores, as assessed by self-report. The mean pain scores and 95% confidence intervals (CIs) before and after morphine or placebo administration are shown in Table 3. Figure 2 shows that the reduction in the mean pain score was 2.2 cm in the morphine group, compared with 1.2 cm in the placebo group (P = .015).

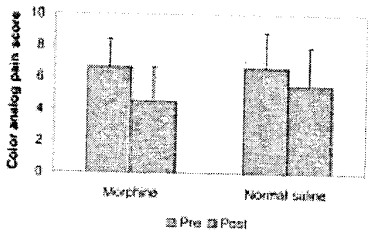

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Fig 2.

Mean (and SD) pain scores before (Pre) and after (Post) administration of morphine or normal saline solution for 108 children with acute abdominal pain (morphine versus normal saline solution: $P = .15$).

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TABLE 3.

Pain Scores

The emergency physicians thought that the pain had diminished for 46 (88.5%) children who received morphine, compared with 33 (63.5%) children in the placebo group ($P = .0005$). No emergency physician thought that the pain grew worse in either group, but physicians thought that the pain was unchanged for 6 (11.5%) children in the morphine group and 23 (44.2%) children in the placebo group ($P = .0002$).

Physician confidence in diagnoses was not altered for children who received morphine. Emergency physicians recorded no change in their confidence in diagnoses after patients received either morphine or placebo. The emergency physician confidence in diagnoses was 68.9% in the morphine group before study medication administration, compared with 65.5% in the placebo group. After morphine administration, physician confidence increased to 69.5% (effect size: 1.2%; 95% CI: −2.9% to 5.3%), compared with 70.9% in the placebo group (effect size: 5.3%; 95% CI: 2.7–7.9%). Similarly, there was no demonstrable effect of morphine on the surgeons' confidence in diagnoses. The surgeons were 73.8% confident of their diagnoses for the morphine group, compared with 73.6% for the placebo group (effect size: 0.01%; 95% CI: −0.39–0.40%).

Two children in our study were discharged from the hospital after receiving the study medication and subsequently returned with acute appendicitis. One child was in the morphine group and returned 4 months later with a perforated appendix. This child was asymptomatic in the interval between study enrollment and return to the hospital, making it unlikely that morphine had any effect in delaying the diagnosis. The other child was in the placebo group and returned 5 days later with acute appendicitis.

All children were monitored specifically for apnea, hypoxemia, hypotension, or changes in the level of consciousness. These adverse events were not observed in either group.

Four of the 13 children who underwent a laparotomy after being admitted to the hospital for observation were found to have a perforated appendix and intraabdominal infection. Their operations were performed 20 to 48 hours after presentation to the ED. Their case histories are as follows.

Patient 1 (randomized to the morphine group) was 12 years of age when she visited the ED because of abdominal pain that had begun 4 days previously, in the periumbilical region. During the previous 3 days, her pain had been in the suprapubic region and she had been vomiting. Diarrhea began 1 day before presentation, and the patient had dysuria. She had experienced a normal menstrual period 2 weeks previously. She walked with a hunched-over gait, and her vital signs were as follows: heart rate: 96 beats per minute; respiratory rate: 28 breaths per minute; temperature: 38.0°C; blood pressure: 122/76 mm Hg. There were decreased bowel sounds, with suprapubic tenderness. The patient had a positive psoas sign and rebound tenderness. Admission to the surgical inpatient unit was arranged. The following investigation results were obtained: white blood cell (WBC) count: 17 800 cells per mm^3 (14 600 neutrophils per mm^3); urinalysis: normal findings. A sonogram of the patient's abdomen found no abnormality; the report stated, "The appendix is well visualized and appears normal pre and post compression. A normal appearing appendix." The patient experienced pain requiring 3 doses of morphine through the night. In the morning, the surgeon noted tenderness and rebound tenderness in both lower quadrants but greater on the left side. Laparotomy was performed 20 hours after presentation to the ED. Free pus was found in the peritoneal cavity. The perforated appendix was found in the high pelvic region on the sacral promontory, with the sigmoid colon wrapped around the left side of it. Infected exudate was found on the sigmoid mesentery. The patient fared well after her operation and was discharged from the hospital 5 days later.

Patient 2 (randomized to the normal saline solution group) was 11 years of age when he visited the ED because of generalized abdominal pain that had been present for the past 15 hours. This had been preceded by a 7-day history of flu-like symptoms (sore throat, malaise, and fever). Amoxicillin treatment had been started 1 day before presentation. The patient had a poor appetite and no vomiting or diarrhea. His vital signs were as follows: heart rate: 112 beats per minute; respiratory rate: 20 breaths per minute; temperature: 37.3°C; blood pressure: 122/77 mm Hg. The patient had generalized tenderness over his abdomen, slightly increased in the right lower quadrant, and no rebound tenderness. Admission to the surgical inpatient unit was arranged. The following investigation results were obtained: WBC count: 12 900 cells per mm^3 (11 400 neutrophils per mm^3); urinalysis: normal findings. The findings of an abdominal radiograph were consistent with gastroenteritis. During the first 24 hours in the hospital, the patient experienced 6 episodes of diarrhea, with no vomiting, and his pain diminished. During his second night in the hospital, his temperature increased to 39.5°C and the patient was found to have marked tenderness in the right lower quadrant. Laparotomy was performed 48 hours after presentation to the ED. A periappendiceal abscess was found in the middle lower abdomen, extending toward the right. The patient fared well after surgery and was discharged from the hospital 6 days later.

Patient 3 (randomized to the morphine group) was 10 years of age when he visited the ED because of 3 days of lower abdominal pain in both quadrants. There had been no nausea, vomiting, diarrhea, dysuria, or anorexia. The patient's vital signs were as follows: heart rate: 84 beats per minute; respiratory rate: 24 breaths per minute; temperature: 36.7°C; blood pressure: 116/67 mm Hg. The patient had normal bowel sounds and left lower quadrant tenderness, with rebound tenderness. Admission to the surgical inpatient unit was arranged. The following investigation results were obtained: WBC count: 11 500 cells per mm^3 (9 500 neutrophils per mm^3); urinalysis: normal findings. The results of an abdominal radiograph were normal. The patient's abdominal pain persisted during the first 24 hours in the hospital. The patient was allowed fluids and had no emesis. At 13 hours, he was found to have mild left lower quadrant

tenderness, with no guarding or rebound tenderness. His temperature increased to 39.1°C on the evening of his first hospital day, 24 hours after admission. However, his abdominal findings were unchanged. The patient slept well through the night and was afebrile in the morning. He had some abdominal tenderness. The results of an abdominal sonogram were normal. Later that day, however, the patient experienced marked right lower quadrant pain and tenderness. Laparotomy was performed 43 hours after presentation to the ED. A small amount of pus was encountered after entry into the peritoneal cavity. The cecum had turned up on itself in a cranial manner, with the appendix being adherent behind the ileum toward the middle of the abdomen, in a wall of omentum. Free pockets of pus were found. The patient fared well after surgery and was discharged from the hospital 6 days later.

Patient 4 (randomized to the morphine group) was 5.5 years of age when she visited the ED because of abdominal pain that had begun 1 day previously. The pain was generalized and progressive in severity. The patient had vomited once and passed 1 normal stool. She had a 2-day history of sore throat, cough, and rhinorrhea. Fever began 8 hours before arrival. The patient preferred to lie still, and her vital signs were as follows: heart rate: 199 beats per minute; respiratory rate: 20 breaths per minute; temperature: 38.3°C; blood pressure: 119/74 mm Hg. The patient had normal bowel sounds, with tenderness in both lower quadrants and a distended bladder. After voiding, she seemed more comfortable and her abdomen seemed softer. Admission to the surgical inpatient unit was arranged. The following investigation results were obtained: WBC count: 8500 cells per mm^3 (6800 neutrophils per mm^3); urinalysis: 2 to 6 pus cells per high-power field. No imaging studies were performed. The patient was allowed clear fluids, and there was no emesis. In the morning, the patient's temperature was 38.1°C and her condition was judged to be improved. The patient seemed to be more comfortable, and her pain seemed diminished. Her abdomen was soft, and she had periumbilical and right lower quadrant abdominal pain. The notation in the record at that time stated, "I do not think this is appendicitis." Several hours later, the patient's abdomen was distended and she had decreased bowel sounds and increased tenderness. Laparotomy was performed 23 hours after presentation to the ED. The appendix was found behind the bladder. There was purulent exudate confined to the periumbilical region. The patient fared well after surgery and was discharged from the hospital 3 days later.

These 4 children demonstrate the well-known heterogeneity of the presentation and clinical course of appendicitis and the challenge of making this diagnosis for some children. Common to all 4 of these children was the fact that their inflamed appendix was not in the right lower quadrant, which is the likely explanation for their atypical presentations and clinical courses. Their clinical courses demonstrate that the delays in diagnosis and the development of perforation were not consequences of analgesic administration.

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DISCUSSION

Pain is one of the most common presenting symptoms in primary care practice. Some estimate that 5% of patients seek medical attention for a variety of painful conditions.[10] These patients expect pain relief. However, the practice of analgesic use in the ED is a relatively recent topic in the literature. Wilson and Pendleton[11] retrospectively reviewed 198 charts of patients with "painful medical and surgical conditions," such as chest pain, abdominal pain, and renal colic, and found that 56% of these patients received no analgesia. Although 44% did receive some

analgesia, 69% of them waited >1 hour. The authors concluded that "oligoanalgesia" is prevalent in the ED setting. Other studies have also demonstrated inadequate analgesia use in the ED.[12,13]

This has also been studied among children. Friedland et al[14] retrospectively reviewed the charts of pediatric patients who presented to the ED with 3 painful conditions. They found that children with sickle cell crisis received analgesia 100% of the time but those with long-bone fractures and burns received analgesia in only 31% and 26% of cases, respectively. The authors concluded that there was suboptimal use of analgesia for children.

The realization that frequently physicians do not provide their patients with optimal analgesia has led to widespread concern, with many organizations publishing policies that integrate the need for pain management with an ethical obligation.[1-3,14,15] Abdominal pain is often a diagnostic challenge. Surgical practice has dictated that no analgesic should be given to these patients, for fear of obscuring the diagnosis. An editorial in the *British Medical Journal* addressed this issue in 1979,[16] but studies were conducted only more recently. Zoltie and Cust[17] were the first to address this issue and others followed,[18-20] by comparing opiate use with placebo use among adults with acute abdominal pain. All found analgesic use to be safe and effective in reducing pain without increasing morbidity.[17-20] These studies changed practice in adult emergency medicine and adult general surgery. It is now the accepted standard of care to provide pain relief to adults with acute abdominal pain, before definitive diagnosis and before surgical assessment.

Typically, children with acute abdominal pain requiring surgical referral are not provided with analgesia. This stems from a combination of traditional surgical teaching, limited confidence in the assessment of pediatric acute abdominal conditions by referring physicians, and healthy skepticism in the extrapolation of adult data to the pediatric population.[21] Unfortunately, despite the frequency of abdominal pain as a presenting complaint in the pediatric ED, only 1 previous study addressed this issue. Kim et al[8] randomized 60 children to received morphine or placebo and found a significant reduction in pain scores between the study groups, with no change in the number of areas of abdominal tenderness or decrease in the diagnostic accuracy between the study groups. In their study, however, surgeons evaluated children both before and after study medication administration; in our study, the surgeons performed their evaluation after the intervention.

One of our primary outcome variables was whether morphine administration would result in an increase in missed appendicitis cases. This condition was missed for only 1 child, who was treated with placebo. The number of patients with a normal appendix who underwent an appendectomy can also indicate diagnostic accuracy; there were 5 such patients, 4 of whom were treated with placebo.

Another of our primary outcome variables was whether morphine decreased acute abdominal pain among children. Our data demonstrated a significant decrease in abdominal pain, as measured with a CAS. A statistically significantly greater decrease in mean pain scores was found for the group that received morphine, compared with the placebo group. Statistical significance does not necessarily indicate clinical significance. Previous studies demonstrated that reductions in mean pain scores, with the CAS, must be at least 2 cm to be clinically significant.[9] Children in our placebo group had a reduction of 1.2 cm and, although it was statistically significant, this was likely not clinically significant. The reduction of 2.2 cm in the morphine group was both statistically and clinically significant.

Studies among adults with acute abdominal pain concluded that analgesic use may increase diagnostic accuracy.[19] In our study, there was no difference between groups in diagnostic accuracy or confidence in diagnoses by emergency physicians or surgeons.

The sample size is a limitation of this study. A post hoc sample size calculation determined that this study had a power of 0.16 to detect a difference in missing the diagnosis of appendicitis. From this, it was calculated that >1000 children per group would need to be enrolled in a randomized, controlled trial to attain a power of 0.80.

Our data showed that morphine effectively reduced the intensity of pain among children with acute abdominal pain, and it seems that morphine does not mask the physical signs of acute appendicitis. A multicenter trial to study this issue in more depth may be warranted.

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Footnotes

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No conflict of interest declared.

CAS, color analog scale · ED, emergency department · CI, confidence interval · WBC, white blood cell

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NICE clinical guideline 54

Urinary tract infection in children: diagnosis, treatment and long-term management

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Table 4 Urine-testing strategies for children 3 years or older Dipstick testing for leukocyte esterase and nitrite is diagnostically as useful as microscopy and culture, and can safely be used.	
If both leukocyte esterase and nitrite are positive	The child should be regarded as having UTI and antibiotic treatment should be started. If a child has a high or intermediate risk of serious illness and/or a past history of previous UTI, a urine sample should be sent for culture.
If leukocyte esterase is negative and nitrite is positive	Antibiotic treatment should be started if the urine test was carried out on a fresh sample of urine. A urine sample should be sent for culture. Subsequent management will depend upon the result of urine culture.
If leukocyte esterase is positive and nitrite is negative	A urine sample should be sent for microscopy and culture. Antibiotic treatment for UTI should not be started unless there is good clinical evidence of UTI (for example, obvious urinary symptoms). Leukocyte esterase may be indicative of an infection outside the urinary tract which may need to be managed differently.
If both leukocyte esterase and nitrite are negative	The child should not be regarded as having UTI. Antibiotic treatment for UTI should not be started, and a urine sample should not be sent for culture. Other causes of illness should be explored.

Acute appendicitis in children: Clinical manifestations and diagnosis

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All topics are updated as new evidence becomes available and our peer review process is complete.

Literature review current through: Dec 2012. | **This topic last updated:** Dec 21, 2012.

INTRODUCTION — Appendicitis is the most common condition in children requiring emergency abdominal surgery. The key to a successful outcome is early diagnosis followed by appendectomy before gangrene or perforation develops.

Older children and adolescents develop appendicitis more often than younger children and often have clinical features that are similar to those seen in adults. Younger children can be particularly difficult to diagnose because the presentation may be nonspecific, symptoms cannot be adequately expressed, and the child is often apprehensive and uncomfortable, making the evaluation challenging. Laboratory testing and imaging studies, primarily ultrasound and computed tomography or magnetic resonance imaging, are helpful adjuncts in selected children undergoing evaluation for appendicitis.

This topic will discuss the epidemiology, clinical features, and evaluation of children with suspected appendicitis. Detailed discussions of diagnostic imaging and treatment for appendicitis are found elsewhere. (See "Acute appendicitis in children: Diagnostic imaging" and "Acute appendicitis in children: Management".)

Clinical features by age

Neonates (0 to 30 days) — Appendicitis in neonates is rare [24]. The low frequency of appendicitis in these patients is attributed to anatomic differences in the appendix (more funnel-shaped than tubular), soft diet, infrequent diarrheal illnesses, and recumbent positioning [39]. Mortality from neonatal appendicitis approaches 28 percent and reflects the difficulty in establishing the diagnosis prior to advanced disease with bowel perforation and sepsis [40].

Case reports indicate that abdominal distension, vomiting, and decreased feeding are the most commonly reported findings in infants with neonatal appendicitis [24]. Temperature instability and septic shock may also develop. The frequency of clinical features in these patients as illustrated by a case review of 33 neonates is as follows [24]:

- Abdominal distension – 75 percent
- Vomiting – 42 percent
- Decreased oral intake – 40 percent
- Abdominal tenderness – 38 percent
- Sepsis – 38 percent
- Temperature instability – 33 percent

- Lethargy or irritability – 24 percent
- Abdominal wall cellulitis – 24 percent
- Respiratory distress – 15 percent
- Abdominal mass – 12 percent
- Hematochezia – 10 percent

Thus, findings of neonatal appendicitis are nonspecific and overlap with other more common neonatal surgical diseases, especially volvulus and necrotizing enterocolitis. (See "Intestinal malrotation", section on 'Volvulus' and "Clinical features and diagnosis of necrotizing enterocolitis in newborns", section on 'Clinical presentation'.)

Young children (<5 years) — Appendicitis is uncommon in infants and pre-school children. Typical findings on history are nonspecific such as fever, vomiting, and abdominal pain, all of which can also occur with intussusception. Diarrhea is also relatively common making appendicitis difficult to differentiate from acute gastroenteritis, a much more common condition in these patients [25,26,28]. Fever and diffuse abdominal tenderness with rebound or guarding are the predominant physical findings although irritability, grunting respirations, difficulty with or refusal to ambulate, and right hip complaints may also be present. Localized right lower quadrant tenderness occurs in less than 50 percent of patients. The high frequency of rebound or diffuse tenderness and guarding reflects the high prevalence of perforation and peritonitis in this age group.

Based upon observational studies, the relative frequency and variability of clinical findings in infants and children younger than five years is as follows [25,26,28]:

- Abdominal pain – 72 to 94 percent
- Fever – 62 to 90 percent
- Vomiting – 80 to 83 percent
- Anorexia – 42 to 74 percent
- Rebound tenderness – 81 percent
- Guarding – 62 to 72 percent
- Diffuse tenderness – 56 percent
- Localized tenderness – 38 percent
- Abdominal distension – 35 percent
- Diarrhea – 32 to 46 percent

School-age (5 to 12 years) — Appendicitis is more frequent in this age group when compared to younger children. Abdominal pain and vomiting are commonly present in school-age children; although the typical migration of periumbilical pain to the right lower quadrant may not occur. On physical examination, right lower quadrant tenderness is noted in the majority of patients. Involuntary guarding and rebound tenderness indicate perforation. Other prominent symptoms include fever, anorexia, and pain with movement [41]. Diarrhea, constipation, and [illegible] are less frequent, but occur enough to potentially confuse the diagnosis.

The relative frequency of these findings is illustrated in an observational study of 379 children 3 to 12 years (84 children under five years of age) [27]:

- Anorexia – 75 percent
- Vomiting – 66 percent
- Fever – 47 percent
- Diarrhea – 16 percent
- Nausea – 79 percent
- Maximum abdominal tenderness in the right lower quadrant – 82 percent
- Inability to walk – 82 percent
- Pain with percussion, hopping, or coughing – 79 percent

Appendicular colic and the non-inflamed appendix: fact or fiction?

Fraser N, Gannon C, Stringer MD.

Source

Department of Paediatric Surgery, Leeds Teaching Hospitals NHS Trust, Leeds, UK.

Abstract

AIMS:

Appendicoliths cause acute appendicitis and appendicular perforation. Do appendicoliths cause acute abdominal pain in the absence of acute appendicitis?

METHODS:

A retrospective observational study was undertaken of histology reports of all appendicectomy specimens from children < 16 years of age between January 1995 and December 2001. Specimens were categorised as perforated or uncomplicated acute appendicitis, non-inflamed, and "incidental" (removed during abdominal surgery for other indications). The presence of an appendicolith was noted. Clinical details were supplemented by selected case note review. Specimens in which the diagnosis of appendicitis or the presence of an appendicolith were not clearly defined (n = 20) were reviewed by an experienced, independent pathologist.

RESULTS:

601 consecutive appendicectomy reports were analysed. The mean age of the study population was 9 years (range 1 day - 15.9 years) and there were 357 boys. An appendicolith was identified in 31/118 (26%) cases of perforated appendicitis, 60/352 (17%) cases of uncomplicated appendicitis, 12/59 (20%) cases of non-inflamed appendices, and only 1/72 (1%) cases of incidental appendicectomies. All patients with an appendicolith in the non-inflamed appendix group had presented with acute abdominal pain mimicking acute appendicitis. The frequency of an appendicolith in perforated appendicitis was significantly greater than in uncomplicated acute appendicitis (chi (2) = 4.8, 1 df, $p < 0.05$). There was no significant difference in the frequency of an appendicolith between non-inflamed appendices and acute appendicitis (either perforated or intact). Appendicoliths were rarely found in incidental appendicectomies, but these patients were younger. The frequency of appendicoliths in non-inflamed appendices was much greater than that expected from published autopsy data.

CONCLUSION:

Appendicoliths may cause acute abdominal pain that mimics acute appendicitis.

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PMCID: PMC3024620

Appendiceal faecaliths are associated with right iliac fossa pain

Caris Grimes, Diana Chin, Catherine Bailey, Szabolcs Gergely, and Adrian Harris

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See letter "Is the association found between faecaliths and right iliac fossa pain reliable?" on page 270a.
Go to:

Abstract

INTRODUCTION

There is debate over whether a normal-looking appendix should be removed at diagnostic laparoscopy performed for right iliac fossa (RIF) pain. Faecaliths are associated with appendicitis. This study assessed whether there was an association between the removal of normal appendices containing faecaliths and improvement of symptoms.

PATIENTS AND METHODS

Analysis of the histology database for all appendicectomies during 2003–2007 with normal histology, noting presence of a faecalith. Retrospective study using a telephone questionnaire for frequency/duration of pre-operative symptoms, postoperative symptom recurrence, re-admission rates and complications. The faecalith-positive (f^+) group was compared to a similar control group of patients who had a normal appendix removed which did not contain a faecalith (f^-).

RESULTS

Out of 203 appendicectomies performed with normal histology, 26 (13%) were f^+. Of these, 21 responded to the questionnaire. Thirty-one consecutive patients with normal histology and no faecalith were identified. A similar proportion in each group presented with three or more episodes of pain prior to appendicectomy (38% f^+; 39% control). Only one (5%) of the f^+ patients had recurring symptoms after the operation, compared with 14 (48%) of the control group ($P = 0.0016$). Only one (5%) of the f^+ patients underwent further investigations, compared with 11 (36%) of the control group ($P < 0.02$). None of the f^+ patients were re-admitted, compared to 19% of the control population. There were no significant postoperative complications in either group.

CONCLUSIONS

Appendiceal faecaliths may be a cause of right iliac fossa pain in the absence of obvious appendiceal inflammation. In this study, the policy of routine removal of a normal-looking appendix at laparoscopy in the absence of any other obvious pathology appeared to be an effective treatment for recurrent symptoms in those cases with a faecalith. Further studies are needed to assess this putative association.

Keywords: Appendicitis, Faecalith, Appendicolith

There has been much debate in the literature as to whether a normal appendix should or should not be removed at diagnostic laparoscopy. On the one hand, it has been argued that a normal appendix should be removed as it may contain endoluminal inflammation, only apparent on histology.[1] Removal of the appendix ensures that future presentations of right iliac fossa pain are not due to appendicitis. On the other hand, it has been argued that removal of a normal-looking appendix constitutes unnecessary surgery and risks complications such as stump leakage and is, therefore, not justified.[2,3]

We examined the role of the appendiceal faecalith as a possible cause of abdominal pain in people with histologi-cally normal appendices. We hypothesise that faecaliths may cause intermittent abdominal symptoms by causing temporary luminal obstruction; this is relieved when the distal luminal pressure in the appendix becomes sufficient to expel the faecalith. Repeated cycles of obstruction–expulsion would thus cause recurrent abdominal symptoms, which would never amount to convincing appendicitis but cause repeated admissions and investigations. Thus removal of a normal appendix containing a faecalith would lead to resolution of symptoms.

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Patients and Methods

The Hinchingbrooke Hospital histology database from 2003–2007 was searched for the keyword 'appendix'. Each individual pathology report was then analysed for its findings and a note made of all those that were histological normal and which did and did not contain a faecalith. We retrospectively studied the group of patients that had normal histology but contained a faecalith (f^+) using a telephone questionnaire, looking at pre-operative symptoms, postoperative symptoms, recurrence of the pain, re-admission rates, further investigations and postoperative complications. For those who had recurrent pain, we asked whether this was the same pain as they had prior to the operation, or whether it was a different sort of pain. We compared this group to a control group of patients with normal appendices but no faecalith (f^-). This control group was derived from the first 31 patients at the beginning of the database who had a normal appendix, no faecalith and responded to the questionnaire. Statistical significance was obtained using Fisher's exact test.

Go to:

Results

Database analysis showed the proportion of normal appendices to the total number of appendices removed was consistent at approximately 30% (range, 28–31%). Of a total of 203 normal appendices, 26 (13%) were found on histology to contain faecaliths. Of the 26 (f^+ group), 21 responded to the questionnaire and these were compared with the f~ group (Table 1). The duration of follow-up (time between operation and questionnaire) was 3 months to 5 years in the faecalith group, and 2 months to 2 years in the non-faecalith group. A similar proportion reported presenting with pain that started centrally but then 'moved' to the right hand side (33% f^+; 29% f^-), or with right iliac fossa pain alone (86% f^+; 79% f^-). There was little in the presenting history to distinguish between the two groups (Table 2). In both groups, the total number of times patients had experienced the pain before varied from once, to daily for several months, or intermittently for several years. Similarly, the total duration of symptoms prior to operation varied from hours to weeks, months or years. However, there was marked differences in symptoms postoperatively. Only one (5%) of the f^+ group had recurrence of the same pain after the operation and underwent an ultrasound scan. None were referred to another specialty. No other diagnosis was obtained and the pain then settled spontaneously.

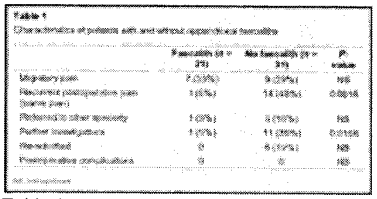

Table 1
Characteristics of patients with and without appendiceal faecaliths

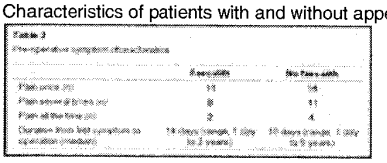

Table 2
Pre-operative symptom characteristics

This compared with 16 (52%) of the f^- group who said they had recurrent pain after the operation, 14 (48%) of whom said that this was the same pain as before the operation. Of these 14 patients, five said although the pain was the same, it was milder than before the operation. Eleven (36%) of the f^- group were referred to another speciality, and underwent further investigation. Overall, the relative risk of recurrence of the same pain following surgery for those without a faecalith compared with the control group, was 9.48.

None of the f^+ group were re-admitted, compared with six of the f^- group, one of whom was re-admitted six times and underwent a variety of investigations (CT, barium swallow and ultrasound) with no other diagnosis being made. There were no postoperative complications in either group.

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Discussion

There have been few studies looking at the role of appendi-coliths in adults presenting with right iliac fossa pain. Studies in children have suggested that those presenting with symptoms of appendicitis and treated conservatively, are more likely to have recurrent symptoms and to require appendicectomy.[4] Similarly, removal of a non-inflamed appendix relieved symptoms in 98% of children with chronic right iliac fossa pain, with 26% of these appendices containing faecaliths, and only 14% being histologically entirely normal.[3] Other findings on histology in the non-inflamed appendix included enterobius, lymphoid hyperplasia and fibrosis.

Another paediatric study found that, when appendices were removed for right iliac fossa symptoms, the incidence of faecalith was similar in normal and uncomplicated appendicitis, but higher in perforated appendices. However, similar to our study, all patients with a faecalith in a normal appendix presented with acute abdominal pain mimicking appendicitis. The frequency of faecaliths in non-inflamed appendices removed for suspicion of appendicitis was greater than expected from published autopsy data.[5]

A study in adults which looked at the removal of the appendix in 11 patients with cramping recurrent right iliac fossa pain found that four of these contained faecaliths. At follow-up (which ranged from 2 weeks to 20 years), all but one were symptom-free.[7] A similar study looking at CT findings in a series of adults with chronic right lower quadrant pain found this was associated with a faecalith and appendiceal wall thickening. There was an absence of fever, peritoneal tenderness or leukocytosis.[8] These studies appear to agree with our findings that faecaliths in a normal appendix may be symptomatic and removal of such may relieve the symptoms.

Other published literature shows that 7–18% of histologically normal appendices contain faecaliths when removed for symptoms and signs of clinical appendicitis. This is more frequent than for appendices removed for other reasons (2%) as part of a procedure such as colecto-my for inflammatory bowel disease or colonic neoplasm, again suggesting that they may be associated with symptoms and signs of appendicitis. These studies also show that faecaliths are associated with complicated appendicitis, being present in an estimated 42% of appendiceal abscesses, 18% of perforated appendicitis and 39% of acutely inflamed appendices.[9,10] Furthermore, faecaliths are associated with earlier and higher rates of perforation in children.[11] In addition, there is some evidence that the presence of an appendiceal faecalith may increase the risk of subsequent appendicitis.[12]

Although it is not our policy to perform imaging in cases of suspected appendicitis routinely, a recent systematic review looking at accuracy of imaging in detecting appendicitis showed CT scanning to have an overall sensitivity of 0.94 (CI, 0.91–0.95) and specificity of 0.95 (CI, 0.93–0.96). For ultrasound, the overall sensitivity was 0.86 (CI, 0.83–0.88) and specificity of 0.81 (CI, 0.78–0.84).[13] However, both have a lower positive predictive value for appendicitis than a typical history or leukocytosis, and thus may delay diagnosis and treatment.[14]

Study limitations

Our study is limited in that it was a small and retrospective study. The questionnaire style meant that there may have been an element of re-call bias in the answers to the questions posed. This association between right iliac fossa pain and faecaliths does not prove causation. A prospective randomised controlled trial comparing patients with right iliac fossa pain and normal biochemical and haematological parameters who fail to improve with conservative management would be the next step in investigating this further.

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Conclusions

This study suggests that appendiceal faecaliths may be associated with recurrent right iliac fossa pain. Routine removal of a normal-looking appendix during diagnostic laparoscopy will pick up the 10–15% that contain a faecalith. Such a policy would not only offer these patients a potential cure, preventing further unnecessary re-admissions and investigations, but would also for the same reasons yield an economic benefit. As faecaliths are also associated with complicated appendicitis, routine removal may prevent later admission with perforated or purulent appendicitis. Further studies are recommended in order to evaluate this putative association.

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