

The Prevalence of Appendiceal Fecaliths in Patients with and without Appendicitis

A Comparative Study from Canada and South Africa

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Appendicitis is more common in developed than in developing societies and appendiceal fecaliths are thought to have an etiologic role in the disease. The geographic distribution of appendiceal fecaliths was investigated by systematic, intra-operative palpation of the appendix in patients in Toronto, Canada and Johannesburg, South Africa. The incidences of fecaliths found on pathologic sectioning of the appendix in appendicitis patients in both societies were compared. In the Canadian population, the prevalence of fecaliths in patients whose appendices were palpated incidentally was 32% versus 52% for those with appendicitis ($p < 0.01$). In the African population, the prevalence of fecaliths in patients whose appendices were palpated incidentally was four per cent versus 23% for those with appendicitis ($p = 0.04$). The difference in prevalence of incidental appendiceal fecaliths in the two populations was statistically significant ($p < 0.005$). The prevalence of fecaliths is higher in developed countries, such as Canada, than in developing countries, such as Africa, and is also higher in patients *with* than in those *without* appendicitis. These data support the theory that the low-fiber diets consumed in developed countries lead to fecalith formation, which then predisposes to appendicitis.

APPENDICITIS REMAINS the most common indication for emergency laparotomy in North America. Although its etiology is controversial, in the majority of patients, appendicitis is thought to be provoked by obstruction of the appendiceal lumen caused by fecalith impaction, muscular incoordination, lymphoid hyperplasia, or other processes.¹⁻⁵

The incidence of appendicitis, which varies among different geographic populations, is less common in rural populations in the Third World which ingest high fiber diets.^{6,7} We sought to investigate the hypothesis that fecaliths may be similarly, geographically distributed and conducted a study in two populations: Canadians

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in Toronto and Africans in Johannesburg. We propose that diets low in fiber promote the formation of appendiceal fecaliths, which may be a significant factor in the etiology of appendicitis.

Methods

During the course of all laparotomies performed by two of the authors (BAJ and DD) from July 1983 to June 1984, the appendix was palpated whenever possible. The cases were consecutive and unselected. Cases were excluded if the appendix had already been removed or could not be palpated, either because of right lower quadrant adhesions, a retrocecal, retroperitoneal location, urgency of the primary procedure in an unstable patient, or because the incision was inadequate for two-handed appendiceal palpation.

Appendiceal palpation was performed in a standard fashion. First, the base of the appendix was gently grasped to avoid inadvertent milking of fecaliths into the cecum. The opposite hand was then used to palpate from base to tip. The base was then released and the appendix palpated a second time, from tip to base, milking all fecaliths into the cecum. The presence or absence of fecaliths and their ability to be milked into the cecum was recorded. Note was also taken of the age of the patient, the reason for laparotomy, and the preoperative performance of bowel preparation.

All pathologic specimens of the appendix, removed from patients with a pathologic diagnosis of acute appendicitis, were opened and examined over a 6-month period for the Canadian group of patients (January-June 1984), and over the course of the entire study for

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African patients. The presence or absence of fecaliths or other obstructing lesions was noted.

Statistical Analyses

The prevalence of incidental fecaliths palpated during laparotomy was compared for the Canadian *versus* South African group using the chi square test with Yates' correction. The prevalence of incidental fecaliths *versus* fecaliths in acute appendicitis was compared using the chi square test for the Canadian and Fisher's exact probability test for the South African group. The prevalence of incidental fecaliths in the Canadian group who did not receive a preoperative bowel preparation, *versus* those who did, was compared using the chi square test.

Results

In the Canadian group, 136 patients whose appendix was palpated at laparotomy ranged in age from 19 to 86 years (mean = 55 years). Fifty-five per cent were male. The most commonly performed procedures were cholecystectomy and bowel resection. In the South African group, 90 patients ranged in age from 13 to 65 years (mean = 31 years). Sixty-eight per cent were male. Most laparotomies were for trauma.

The prevalence of incidental fecaliths in Canadian patients was 32% (44 of 136). All fecaliths could be milked into the cecum. The prevalence of incidental fecaliths in the South African patients was four per cent (4 of 90). This difference in proportions was statistically significant ($p < 0.005$, chi square test with Yates' correction).

The prevalence of incidental fecaliths in Canadian patients undergoing bowel preparation before surgery was 17% *versus* 39% for those patients not undergoing bowel preparation ($p < 0.025$, chi square test with Yates' correction). No patient acquired appendicitis in the immediate postoperative period.

There were 13 African patients who underwent laparotomy for acute appendicitis during the study period. Eleven were males and the age range was from 11 to 43 years (mean = 25 years). Fecaliths were observed in three appendices on pathologic sectioning, an incidence of 23%. The difference in frequency of fecaliths in African patients with and without appendicitis was statistically significant ($p = 0.04$, Fisher's exact probability test). In the Canadian group, in a 6-month period (January to June 1984), 63 patients underwent laparotomy for acute appendicitis. The patients, of whom 60% were male, ranged in age from 3 to 57 years (mean = 23 years). Fecaliths were found in 33 patients (52%) on pathologic sectioning. An additional two patients were found to have a carcinoid tumor obstructing the appen-

diceal lumen. The difference in frequency of fecaliths in Canadian patients with and without appendicitis was statistically significant ($p < 0.01$, chi square test).

Discussion

Appendicitis is the most common indication for emergency abdominal surgery in North America. Despite its usual benign course after surgery, it is still attended by major morbidity, and even mortality in some cases.⁸⁻¹⁰ Epidemiological evidence is accruing to suggest that appendicitis is associated with low fiber diets and, therefore, may be preventable.

Appendicitis is predominantly a disease of modern Western culture and of communities influenced by it. It is rare in traditionally living Africans^{6,7,11} and Indians.¹¹⁻¹³ Less refined carbohydrate diets ingested in European countries during both World Wars were associated with a fall in the prevalence of appendicitis.¹⁴ A lower incidence of appendicitis was also associated with coarse prison diets;¹¹ the disease incidence increases in Africans consuming Western diets.¹⁵

Appendicitis is presumed by most authors to be precipitated by obstruction of the appendiceal lumen in the majority of cases.¹⁻⁵ An impacted fecalith, associated muscle spasm, or lymphoid hyperplasia is believed to be the cause in most patients. Diets low in fiber cause hard, dry feces relative to those high in fiber.^{16,17} The wider appendiceal lumen in adults due to atrophy of lymphoid tissue could explain the preponderance of cases in childhood and adolescence. Softer fecal consistency in Third World communities could account for their rarity of disease, in spite of the narrower lumen in childhood.

If appendiceal fecaliths are associated with appendicitis and low fiber Western diets, fecaliths should have the same geographical distribution as appendicitis. Their prevalence should be higher in Western countries, such as Canada, than in developing countries, such as Africa. Furthermore, the prevalence of fecaliths in both populations should be higher in patients with appendicitis than without.

In this study, incidental fecaliths were present at the time of laparotomy in 32% of Canadian patients *versus* four per cent of African patients ($p < 0.005$). Palpation of the appendix during 500 laparotomies for a variety of ailments in Madras, South India revealed that five per cent contained fecaliths.¹⁸

In the present study, fecaliths were more commonly present in both Canadian and African populations in association with appendicitis than in patients undergoing laparotomy for other reasons. In the Canadian group, fecaliths were present in 52% of patients with acute appendicitis *versus* 32% of patients undergoing laparot-

omy for other reasons ($p < 0.01$). In the African group, patients with and without appendicitis were noted to have appendiceal fecaliths in 23% *versus* four per cent of cases, respectively ($p = 0.04$). These data suggest that appendiceal fecaliths may predispose to appendicitis.

There are other variables differing among patients with and without appendicitis in this study which may explain the difference in prevalence of fecaliths. The mean age in the Canadian group of patients with appendicitis was 23 years *versus* 55 years for those without appendicitis. Similarly, patients with appendicitis in the African group were younger, although the difference was less marked (25 years *versus* 31 years). The age-related prevalence of fecaliths in both populations is unknown.

Another factor to be considered is the method of fecalith detection. Incidental fecaliths were detected by palpation and fecaliths in patients with appendicitis were detected by observation of the opened pathological specimen. In order to test the ability of intraoperative palpation to determine the presence of fecaliths in the appendiceal lumen, Moolgaokar palpated 55 appendices.¹⁹ Appendectomy was then performed and the specimen subsequently opened. Fecaliths were neither palpated nor discovered on opening 32 appendices. In 22 appendices, fecaliths were detected by palpation and their presence was subsequently confirmed. In only one case was a thin fecalith found on opening the organ that had not been appreciated by palpation. These findings suggest that palpation is a reliable method of determining the presence of appendicular fecaliths.

Bowel preparation, consisting of a 3-day regimen of liquid diet, laxatives, and antibiotics, tended to decrease the prevalence of fecaliths in the Canadian population. Patients who had not had a preoperative bowel preparation had a prevalence of incidental fecaliths at laparotomy of 39%, *versus* 17% for those who had undergone bowel preparation ($p < 0.025$). This finding suggests that reduced fecal viscosity may decrease the prevalence of fecaliths.

We conclude that fecalith prevalence is geographically distributed, as is the incidence of appendicitis, being

higher in Western than developing countries. In both Canadian and African patients, fecaliths are more often found in patients with appendicitis than those without. These data provide further support for the theory that low fiber diets lead to fecalith formation, which in turn predisposes to appendicitis.

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