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Long-term outcome of simple inversion of the appendix as an alternative to incidental appendectomy

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BACKGROUND: Inversion of the appendix is an alternative to incidental appendectomy to prevent future appendicitis. This study investigated outcome and complications in a group of patients who underwent simple inversion of the appendix.

PATIENTS AND METHODS: Inversion of the appendix was performed in 41 patients, including 21 women (51%) and 20 men (49%) (mean age, 48.7 years; range, 12-85 years). A simple inversion technique was used in 65% of patients. Twenty-nine patients had colonoscopy between 3 to 44 months after surgery (mean, 8 months), none for the sake of the study.

RESULTS: During the follow up, none of patients developed intussusception or rectal bleeding. Colonoscopy demonstrated an absent appendix in 9 patients (31%). In the remaining 20 patients (69%), the inverted appendix persisted with no obvious change on visualized mucosa.

CONCLUSION: Neither intussusception nor hemorrhage was observed after simple inversion. In our view, persistence of the appendix is a welcome event since the presence of the appendix may carry several benefits as it continues to work as a specialized organ, exerting an important physiological role in facilitating forward passage of colon contents, providing antibacterial functions and possibly playing a preventive role against development of colon and other cancers.

Incidental appendectomy is a controversial subject. However, it has been widely practiced by different surgical specialties during the course of abdominal surgery for patients who are more prone to a future acute appendicitis. The main objective of doing the procedure is to prevent future appendicitis, hence reducing the mortality, morbidity and cost of this very common acute surgical emergency.¹ In clean surgery, incidental appendectomy may increase the risk of wound infection,² intraperitoneal sepsis, adhesions with subsequent intestinal obstruction,³ and may predispose to infertility in young women.⁴ Inversion of the appendix has been described as an alternative procedure to reduce complications. Simple inversion, as described by Lilly and Randolph,⁵ involves devascularization of the appendix through ligation and cutting of the mesoappendix. The appendix is turned inside out into the lumen of the cecum. A purse-string seromuscular suture is used to close the base of the appendix. This technique has been criticized for persistence of the appendix, which may predis-

pose to development of intussusception⁶⁻⁸ and confusion with cecal tumors on subsequent imaging studies. Bishop and Filtson⁶ proposed inversion-ligation as an alternative. In their modification the last 2 to 4 mm of the appendix near the base are kept protruding from the cecal wall and an absorbable suture is tied around that stump, a step that is necessary to deprive the appendix from its blood supply coming through the wall of the appendix, which will facilitate necrosis of the appendix. The appendiceal base is then buried by a purse-string suture. The authors claim that the appendix is completely devascularized, necrosed, detached and may be seen in the stool within a few days after operation. This modification has been practiced by others, who reported bleeding from the inverted-ligated appendix.⁹ This study sought to investigate the fate and complications, particularly episodes of intussusceptions and bleeding in a group of patients who had simple inversion of the appendix and an extended follow up as required for their original problem.

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PATIENTS AND METHOD

Between 3 September 1995 and 28 August 2004, 47 patients admitted to the Department of Surgery at Jordan University Hospital were considered eligible to enter the study. Six patients were excluded due to inability to invert the appendix because of its fibrotic tip or due to penetration of its wall during the procedure. Forty-one patients were included in the study due to a successful procedure and satisfactory follow up. These included 21 women (51%) and 20 men (49%) with a mean age of 48.7 years (range, 12-85 years). The original indications for surgery were colonic malignancy in 21 patients (51%), benign colonic diseases in 6 patients (14.5%), and operations to relieve intestinal obstruction due to adhesions in 8 patients (20%); the remaining 6 patients (14.5%) had surgery for miscellaneous causes. Informed consent was signed by the patient or next of kin for the management of the original disease and the possibility

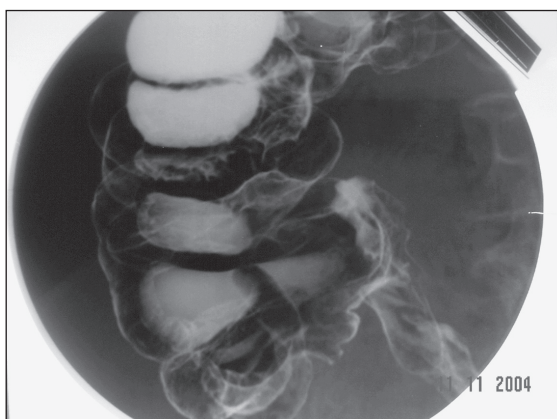


Figure 1. Double-contrast barium enema showing outlines of the inverted appendix.

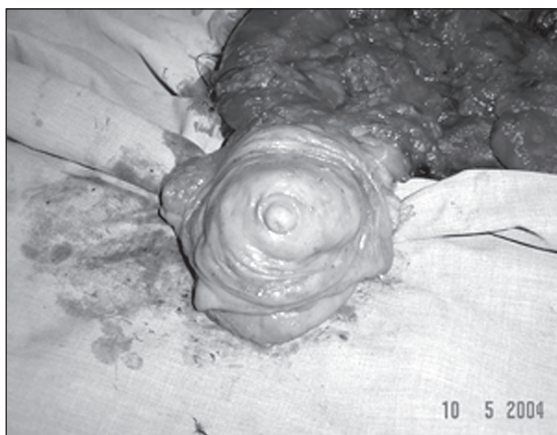


Figure 2. Colonic specimen taken 2 years after simple inversion from patient who developed recurrent colon cancer.

of inversion of the appendix. In all patients it was judged by the authors that the inversion procedure would require neither more significant time nor extra length to the original incision. The technique of inversion of the appendix used in the study was simple inversion as originally described by Lilly and Randolph.⁵ The appendix was totally devascularized by ligation and cutting of the mesoappendix, and a purse-string, seromuscular suture of 3-0 polygalactine (vicryl) was applied around the appendicular base, which was tied after successful inversion. No attempts were made to do colonoscopy for the sake of the study. The total number of patients who had colonoscopy was 29 (71%). Colonoscopy was performed between 3 to 44 months (mean, 8 months) after operation. The procedure was done more than once in some patients, with a mean of 2.2 colonoscopies for each patient. One patient had a barium enema due to recurrent lower abdominal pain (Figure 1), which clearly demonstrated persistence of his inverted appendix. In another patient who developed recurrent colon cancer, we saw the persistence of his inverted appendix in the colonic specimen (Figure 2) after completion of the colectomy.

RESULTS

All 41 patients in the study were followed up in the outpatient clinic after being discharged from the hospital. The mean follow-up period was 41.5 months with a range from 16 to 108 months. All 21 patients (51%) who had colon cancer had a follow-up colonoscopy. In 8 of the remaining 20 patients, who had benign colonic and noncolonic diseases, colonoscopy was required to follow up their original disease or for a new indication for colonoscopy. During the follow-up period none of the patients in the current study developed intussusceptions. One patient had an episode of lower gastrointestinal bleeding 10 months after inversion of his appendix. His colonoscopy revealed no explanatory pathology except bleeding hemorrhoids. The site of the inverted appendix was carefully visualized, and the appendix was viable and had healthy normal mucosa. Follow-up colonoscopy demonstrated an absent appendix in 9 of 29 patients (31%). None noticed an abnormal tubular worm-like structure in their stool prior to colonoscopy. In the remaining 20 patients (69%), their inverted appendix persisted with no obvious change noticeable on visualized mucosa such as pallor, edema or ulceration (Figure 3). All persistent appendices were floating in the cecum, non-curled or attached to the wall and none mimicked a malignant lesion (Figure 4).

DISCUSSION

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incidental appendectomy was discredited after publication of a few case reports⁶⁻⁹ that documented occurrence of intussusception due to persistence of the appendix after the procedure. In the current study, none of the 41 patients who were followed for a mean of 41.5 months developed intussusception. Although the number of patients is few, our report is significantly more informative than a few case reports, which exaggerate the phenomena of intussusception. It is important not to confuse pathological inversion with a therapeutic inversion. A pathological inversion could work as a leading head for a coloileal intussusception, which can be associated with other factors such as functional idiopathic hyperperistalsis of the appendix and neighboring bowel, or be secondary to an appendicular pathology such as benign or malignant tumors.¹⁰ Other, rare causes such as endometriosis of the appendix,¹¹ may also lead to pathological inversion. We found that simple inversion of a normal appendix as an alternative to incidental appendectomy is not associated with an increased risk of intussusception. Lower gastrointestinal bleeding was not observed after simple inversion of the appendix in this study. We had one patient who developed bleeding per rectum, and colonoscopy findings excluded the inverted appendix as a source. Bleeding is frequently reported after a pathologically inverted appendix and after burying the appendicular stump in a classical appendectomy. Bleeding due to the inversion-ligation technique was observed by some authors,⁹ which could be due to acute devascularization and necroses of the inverted appendix. Our study showed no bleeding events from an inverted appendix, which may be related to sufficient blood flow via the submucosal route, which protects the appendix from vascular insults, promotes its viability and subsequently its survival. In the case of insufficient blood but not total acute deprivation, as in inversion-ligation, gradual ischemia and atrophy could take place, thus reducing the chance of clinically significant bleeding and promotion of an uneventful disappearance of the appendix. After an extensive search we found no study dealing with the fate of the appendix by follow-up colonoscopy after simple ligation or ligation-inversion, as in the present study. This study demonstrated that the rate of disappearance was 31% by follow-up colonoscopy. In the remaining 69%, the appendix remained a viable floating tubular, easy identifiable structure in the cecum, with a mucosa similar to that of the adjacent bowel wall. There was no curling or adherence to the cecal wall, which could be confused with a benign or malignant lesion. Our results are similar to those of Jarvesivu et al,¹² who noticed persistence of the inverted appendix in 6 patients with a history of

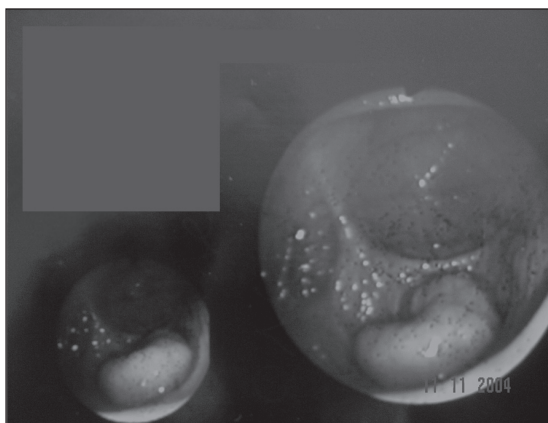


Figure 3. Persistent inverted appendix with no obvious changes by colonoscopic visualization.

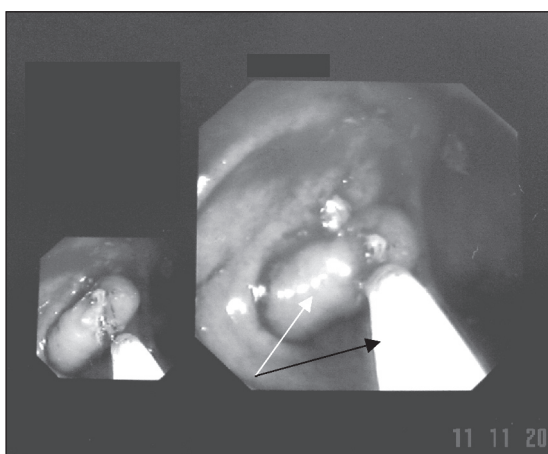


Figure 4. A persistent appendix (white arrow) floating in the cecum, and not curled or attached to the wall, mimicking a malignant lesion, as seen by colonoscopy.

inversion among 395 colonoscopy procedures done for various indications. Although the procedure is simple and easy to perform, technical obstacles such as the fibrotic tip of the appendix or penetration of its wall during manipulation may dictate termination of the procedure. Our inability to invert the appendix in 6 patients (12%) may be attributed to the fibrosis of the appendix, which increases with older age. One study¹³ reported a failure rate of 3%, but in a younger age group. The persistence of the appendix should not be considered a disadvantage of the simple inversion technique. In fact, its presence may have several benefits as it may continue to work as a highly specialized organ, exerting an important physiological role in facilitating the forward passage of colon contents, providing antibacterial functions and possibly a preventive role against development of colon and other cancers.¹⁴⁻¹⁶

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In conclusion, we confirmed that simple inversion as a substitute to incidental appendectomy will keep the surgical wound in the clean category, since neither intussusception nor hemorrhage could be observed. Only 31% of patients had their appendix disappear. The remaining 69% of patients had intact appendices, probably left performing some underestimated and im-

portant function after being disarmed of its capability to induce the commonest cumbersome acute surgical emergency. In our view, persistence of the appendix is a welcome event rather than a cause to refrain from using the simple inversion technique in the course of other clean abdominal surgery in patients who are prone to future development of acute appendicitis.

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