The point of greatest tenderness is, in the average adult, almost exactly 2 inches from the anterior iliac spine, on a line drawn from this process through the umbilicus. (Charles McBurney, 1845-1913)

Introduction

Despite improvements in the diagnostic armamentarium, surgical exploration for suspected appendicitis resulting in a disappointingly normal looking appendix remains a cause of therapeutic dilemma. Indeed, the decision to remove a normal appearing appendix, whether or not another cause of infection or pain is present, is not always straightforward. Elements that should be taken into consideration include the possible consequences of appendectomy, and the risks or benefits of leaving it in situ.

A. Risks associated with Removal of the ‘normal’ Appendix

1. The appendix – more than a vestigial structure?

The appendix traditionally is considered an evolutionary misfit, a redundant part that serves little, if any, purpose in human beings. It is thought to have descended in our distant herbivorous ancestors from the caecum where it housed the bacteria that digest cellulose. Though it retained this function in modern herbivores, the human appendix contains no significant number of these bacteria and cellulose is indigestible to man. It seems likely that the appendix lost this function before our ancestors became recognizably human.

Recent data, however, suggest that the appendix may play an important role in gut-brain communication via a number of immunological pathways. Recurrence of symptoms caused by acute appendicitis is uncommon when the appendix is left in place. The decision to remove a normal appendix should therefore not be taken lightly, but after consideration of the patient’s age, medical history and expectations as well as the timing and specificity of the presenting symptoms. An overview of the relevant literature is provided with an algorithm to aid in clinical decision making.
appendectomy for perforated appendicitis (5). After nonperforated appendicitis, there was an increased risk among women but not among men, and patients operated on before age 10 yrs had a low risk. Crohn’s disease patients with a history of perforated appendicitis also had a worse prognosis. Riegler et al., in a smaller study, demonstrated that appendectomy had a worse prognosis. Riegler et al., in a smaller study, demonstrated that appendectomy and Crohn’s disease patients were at significantly increased risk of bowel resection (Odds Ratio 1.8-10.1 in multivariate analysis) (6).

2. Surgical complications following appendectomy

Intuitively, one would assume that the morbidity of removing a normal appendix is well below that of appendectomy for overt appendicitis, ranging from 15% to 35% (7). A recent Cochrane review suggests that, compared with the open approach, laparoscopic appendectomy is associated with less wound infection but results in more pelvic abscission (8). Investigators from the Academic Medical Center in Amsterdam reported the risks and costs associated with removing a normal appendix (9). They found a morbidity of 6%, while reoperation was needed in 2% and the mean extra hospital cost of a negative appendectomy was EUR 2,712. In the 18% of patients who were operated laparoscopically, however, the morbidity rate was 0.3%. These findings suggest that the morbidity and associated costs of removing a normal appendix, although usually minimal, can be considerable. Obtaining prior informed consent in a patient with equivocal clinical signs therefore seems a prudent measure.

B. Risks associated with leaving a normal appendix in situ

1. Risk of ultimate appendicitis

One of the main variables in deciding to remove a normal appendix is the risk of appendicitis later on. The incidence of appendicitis in Western countries rose during the end of the 19th century and the beginning of the 20th century. However, after 1930, there was a dramatic decrease. The exact cause for this decrease is unclear, but factors such as changes in diet, improved hygiene and alterations in childhood infection rates have been proposed. Appendicitis occurs at any age although a peak incidence has been found in the second and third decade. A male preponderance exists with a male to female ratio of 1.4:1 (10). The lifetime risk to develop appendicitis is 8.6% in men and 6.7% in women (9, 11). The perforation rate increases with age, and is significantly higher in patients older than 70 yrs (12). Taken together and in keeping with the literature concerning incidental appendectomy during unrelated abdominal procedures, the available data do not justify removal of a normal appendix to prevent the occurrence of appendicitis (13).

2. Risk of subclinical or ‘endo’-appendicitis

Obviously, the surgeon’s appreciation of the appendix is not infallible, and in a prospective study 25% of appendices judged ‘normal’ by the surgeon did show histological inflammation (14). More subtly, an interesting molecular study has shown that in a substantial number (23%) of clinically and histologically normal appendices removed in patients with suggestive clinical signs, expression of TNF alpha and IL-2 mRNA was similar to acute appendicitis specimens in germinal centres, submucosa, and lamina propria. Additionally, the concept of ‘neuro-appendicitis’ has been proposed as the cause of pain in patients with right fossa syndrome and absent inflammation on histology (16). In these patients, neural proliferation was demonstrated by increased expression of growth associated protein 43 (GAP-43) and larger amounts of SP-immunoreactive and VIP-immunoreactive nerves in the mucosal layer of the appendix compared to controls.

While these molecular findings may explain the symptomatology of certain patients, additional studies are required to confirm the clinical relevance of this preliminary concept.

3. Risk of a missed appendiceal malignancy

Neoplasms of the appendix are rare, usually benign, and found in 0.3-1.7% of appendectomy specimens (17). The age-adjusted incidence of cancer of the appendix is 0.12 cases per 1,000,000 people per year (18). Clinically, only a small minority of appendiceal cancers will be detected by incidental appendectomy, and most present as acute appendicitis (19). Histologically, appendiceal neoplasms may present as neuroendocrine tumors (‘carcinoid’, the most frequent type), mucinous adenocarcinoma, adenosquamous, goblet cell tumor, or signet-ring cell tumor. In a report of elderly patients with symptoms of acute appendicitis, 24% were found to harbor appendiceal malignancy (20). Both the duration of symptoms and preoperative hematocrit differed significantly from patients with acute appendicitis. Given the rarity of the disease and the usual typical manifestations, incidental appendectomy in order to cure a possible subclinical neoplasm seems unjustified.

4. Risk of persisting symptoms and patient confusion

In a setting of laparoscopy for abdominal pain, incomplete information or inadequate patient recall of the procedure performed may lead to patient dissatisfaction or further unnecessary surgery. In a paper by Murphy et al., 350 patients who underwent laparoscopy for abdominal
pain were questioned (21). As a striking finding, only 57% of patients in whom the appendix was not removed correctly stated this, whereas correct information was recalled by 83% of patients who had their appendix removed. Moreover, patients with persisting pain who did receive correct information about the fact that the appendix was not removed, may regard the appendix as the culprit. The risk of persisting symptoms following diagnostic laparoscopy with negative findings is highly variable. Teh et al. reported the clinical fate of 34 patients in whom the appendix was not removed (22). Recurrent symptoms developed in 38%, and two of these patients underwent removal of a normal appendix, yet without improvement of their complaints. These authors concluded that removal of the ‘normal’ appendix is unjustified in this clinical context. In the same vein, Van den Broek et al. reported the follow up of 44 patients without alternative diagnosis in whom the appendix was preserved (23). In only one patient was appendectomy required for histologically proven appendicitis during follow up. Similar findings were reported by Barrass et al., who observed one case of later occurring appendicitis in 65 patients in whom the appendix was left in situ (24). The available data suggest that when clinical findings are unspecific, the appendix can be left in place with a low risk of readmission. In this case, it is mandatory that the surgeon personally examines the patient and obtains informed consent prior to surgery.

Conclusion

When another obvious cause is found explaining the patient’s symptoms, appendectomy is not required unless it appears pathological (Fig. 1). The decision to remove the normal appearing appendix when no other cause can be identified should be based on the individual circumstances of the patient, taking into account factors such as age, gender, duration and characteristics of the symptoms, medical history, and presence of IBD. When clinical signs and symptoms are equivocal, prior informed consent is highly advisable, and when the appendix is not removed the patient should be provided with a relevant document in order to prevent later confusion.

References


W. Ceelen
University Hospital
De Pintelaan 185
B-9000 Ghent, Belgium
E-mail : wim.ceelen@ugent.be