The use of diagnostic laparoscopy in patients with suspected appendicitis
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Chapter 1

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Chapter 1

GENERAL INTRODUCTION

Appendicitis is an inflammation of the vermiform appendix. It is mostly caused by obstruction of the lumen due to hyperplasia of the lymphoid follicles at younger age or by obstruction of the lumen by fecaliths in older patients. The vermiform appendix was first described by Leonardo da Vinci in 1492. Lawson Tait performed the first planned appendectomy for appendicitis in 1880. Hereafter, immediate surgery for appendicitis was recommended in 1886 by Reginald Fitz. Appendectomy was further popularised by Charles McBurney who introduced, in 1889, a new operating technique by performing appendectomy with the use of a less invasive muscle splitting incision and by describing in 1894 the McBurney point, localised "between an inch and a half and two inches from the anterior spinous process of the ilium on a straight line drawn from that process to the umbilicus". The most famous patient with appendicitis was King Edward VII; his huge abdominal abscess, due to a neglected appendicitis, was drained by Sir Frederick Treves just before his coronation in June 1902.

At present time, appendectomy is the most common abdominal operation because of the relatively high lifetime risk of men (8.6%) and women (6.7%) for developing appendicitis. The diagnosis appendicitis remains difficult and is usually made by clinical history (pain localised around the umbilicus moving toward the right lower abdominal quadrant, anorexia and nausea), physical examination (mildly elevated temperature, diminished bowel sounds with direct tenderness and spasm in the right lower abdominal quadrant and rebound tenderness at Mc Burney's point) in combination with laboratory findings (elevated White Cell Count (WCC) and C-reactive protein (CRP) levels). Especially in fertile women the diagnosis can be difficult because several gynaecological diseases can mimic appendicitis. Based on these clinical criteria are 15 to 30 percent normal appendices removed at open operation. This results in the removal of 2,285 normal appendices, yearly in the Netherlands. The removal of a normal appendix should be avoided because it has its own morbidity and costs.

On the other hand, a delayed appendectomy due to a missed diagnosis may lead to a perforated appendix and so to severe complications as peritonitis and infertility in females. As a result, perforated appendicitis still causes the death of 1 child per year in the Netherlands.

Therefore, nowadays, more sophisticated imaging techniques are introduced to lower the negative and delayed appendectomy rates. Both ultrasonography (figure 1) and computed tomography (CT) (figure 2) have shown to be of value in obtaining the diagnosis appendicitis. However, ultrasound appears to be highly observer dependent and not useful in ruling out appendicitis in the general population and CT–scan has a variable availability and the disadvantage of exposing a population, mostly of fertile women, to a relatively high radiation dose. Routine application of these new diagnostic tools in patients with suspected appendicitis might cause unnecessary delay, costs and patient discomfort.
General introduction and aim of the thesis

Due to an increased interest in laparoscopic surgery by general surgeons, diagnostic laparoscopy has also been introduced for patients with suspected appendicitis. Diagnostic laparoscopy is performed under general anesthesia. A pneumoperitoneum is created by insufflation of CO2 gas; hereafter a camera is introduced into the peritoneal cavity by means of a small umbilical incision. The abdominal cavity, including the appendix as well as of other organs, in particular the internal genital organs in women, can so be carefully inspected, as shown in figures 3 and 4\(^{19,20}\). In case of appendicitis, one can proceed with laparoscopic appendectomy, by introducing two extra trocarts or, in case of conversion; the localization of the muscle splitting incision can be specified. Nevertheless, diagnostic laparoscopy is an invasive procedure, which requires general anaesthesia and usually hospital admission with additional costs.
Although several meta-analyses showed (subtle) advantages of laparoscopic appendectomy (less post-operative pain and shorter hospital stay) compared to appendectomy by muscle-splitting incision, laparoscopic appendectomy is not (yet) the gold standard for appendectomy in the Netherlands and many other European countries. Routinely application of diagnostic laparoscopy in patients with suspected appendicitis would therefore lead to many conversions to open procedures and so to extra costs and morbidity.

So, diagnostic decision-making for patients with suspected appendicitis has been radically changed since 1880. At present, it is not clearly defined which patients could benefit from further diagnostic tools in case of suspected appendicitis.

AIM OF THE THESIS

The aim of this thesis is to assess different aspects of the use of diagnostic laparoscopy in patients with suspected appendicitis. In Chapter 2 a review of the literature concerning the diagnostic tools for appendicitis in the last 10 years is performed to evaluate the improvements made by these new diagnostic tools and to establish the place of diagnostic laparoscopy among these. Sensitivity and specificity rates for the diagnosis appendicitis of: history and physical examination, laboratory findings, scoring systems, ultrasonography, computer tomography, magnetic resonance imaging and diagnostic laparoscopy are retrieved or derived from the data. An algorithm of the diagnostic work-up based on these results is created.

These new diagnostic tools might also cause delay, discomfort, extra cost and morbidity in patients with suspected appendicitis. In order to assess if it is justified to expose patients with
suspected appendicitis to these new diagnostic tools, the results of a retrospective study of all patients who underwent a negative appendectomy for suspected appendicitis in the period 1991 – 1999 in the Medical Center Alkmaar are described in Chapter 3. Hospital stay, morbidity and mortality of performing a negative appendectomy are evaluated and a cost analysis is made by comparing hospital costs of a negative appendectomy with the hospital costs of other diagnostic tools.

In Chapter 4 we evaluate the results of a prospective study of all patients with suspected appendicitis sent to our hospital in the period 1994 to 1997 in which diagnostic laparoscopy is used selectively: in patients with doubt in the diagnosis of appendicitis. Therefore, patients are divided into three groups; group 1: patients in whom the diagnosis appendicitis is not likely: these patients are discharged immediately after evaluation or after an observation period of 24 hours, group 2: patients in whom there is doubt of the clinical diagnosis appendicitis: these patients undergo diagnostic laparoscopy and group 3: patients in whom the diagnosis of appendicitis is felt to be certain: these patients undergo primary appendectomy by muscle-splitting incision.

The use of diagnostic laparoscopy is evaluated in terms of false negative (e.g. delayed appendectomy) and negative appendectomy rates. Theoretical models of performing diagnostic laparoscopy in all patients and strategies in which diagnostic laparoscopy will be applied in different patients groups, are presented.

While after a muscle-splitting incision the normal appendix is always removed to avoid diagnostic confusion in the future, at diagnostic laparoscopy a normal appendix could be left in place, as there is no typical scar in the right lower abdominal quadrant suggesting previous appendectomy. It is not yet known if it is safe to leave a normal appendix found during laparoscopy for suspected appendicitis in place because the appendix might be unjustly interpreted as normal or patients could develop recurrent abdominal pain, eventually leading to an appendectomy at a latter point of time. Others claim also the existence of a histological diagnosis: “endo-appendicitis” which might not be recognised during laparoscopy. Therefore in Chapter 5, the strategy of leaving a normal appendix found during diagnostic laparoscopy for suspected appendicitis is evaluated in a prospective analysis of 109 patients in whom the normal appendix was not removed at diagnostic laparoscopy for suspected appendicitis. The short-term results (e.g. false negative rate and complications of the procedure) and long-term results (e.g. risks of developing appendicitis in the future and recurrent abdominal complaints) are evaluated by means of a questionnaire by telephone after a median follow-up time of 4.4 years.

If laparoscopic appendectomy is not attempted, diagnostic laparoscopy would lead to many conversions to open surgery and it could therefore be questioned to perform a laparoscopy on patients with all clinical signs of appendicitis. So diagnostic laparoscopy, and also other expensive diagnostic tools, should be reserved for clinical equivocal cases in which it can contribute in obtaining the diagnosis. To identify this subgroup of patients who can benefit from diagnostic laparoscopy, we created a scoring system for adults in Chapter 6. In a prospective study of all adults who were sent to our hospital for suspected appendicitis we divided patients into two independent groups: group 1: patients presented in the period 1994
to 1995 and group 2: patients presented in the period 1996 to 1997. By means of (univariate) chi-square tests we define variables that correlate significantly with appendicitis. In a (multivariate) logistic regression analysis these variables are weighed and form the base of a scoring system. The scoring system is created from the patients of group 1 in which patients are scored from 0 (appendicitis not likely) to 9 (appendicitis very likely) depending on the presence of the scoring variable. The scoring system will hereafter be applied to the independent patient group 2. Comparing odds ratios from group 1 with odds ratios from group 2 validates the reproducibility of the scoring system. By creating two cut-off points in the scoring system, patients are divided into the same three groups as described in chapter 4 and so, the group of patients with doubtful diagnosis appendicitis can be defined. The effectiveness of the scoring system is evaluated by calculating sensitivity and specificity rates and by comparing the number of performed laparoscopies, delayed and negative appendectomy rates obtained by clinical practice with the results that would have been accomplished on the basis of the scoring system. Because the incidence of appendicitis in children differs from adults, we performed the same strategy described for adults, on children in Chapter 7, resulting in a scoring system that can identify the children who may benefit from further diagnostic tools as diagnostic laparoscopy. In Chapter 8, the results of the performed studies in this thesis are summarised and shortly discussed.

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General introduction and aim of the thesis


