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Acute abdominal pain : considerations on diagnosis and management

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Citation

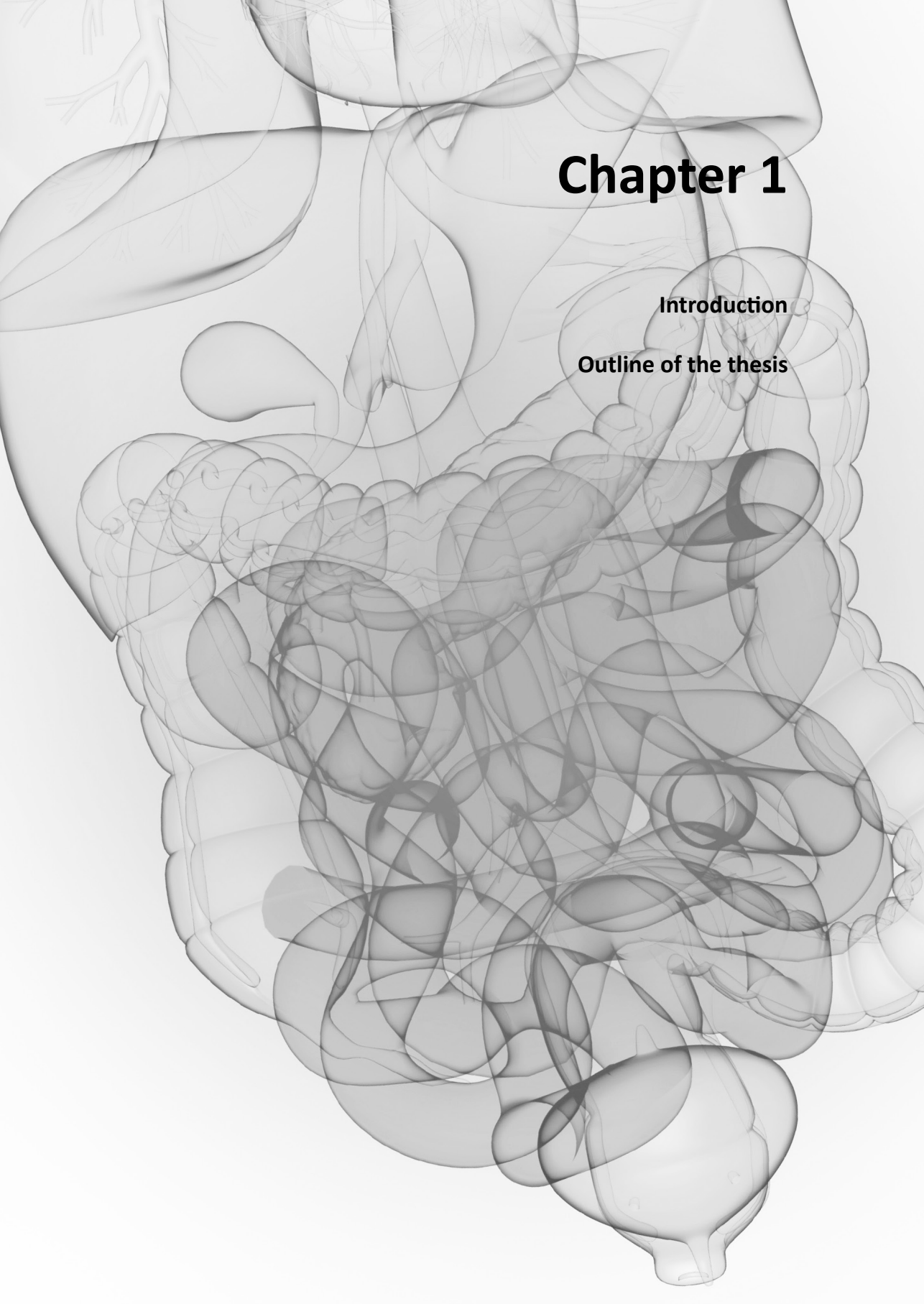
Toorenvliet, B. R. (2011, November 16). *Acute abdominal pain : considerations on diagnosis and management*. Retrieved from <https://hdl.handle.net/1887/18091>

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Chapter 1

Introduction

Outline of the thesis

Introduction

Approximately 5% of all patients evaluated at an emergency department present with acute abdominal pain¹. Most of these patients will have self-limiting disease for which no surgical intervention is required such as non-specific abdominal pain (NSAP), constipation and gastroenteritis. The most frequent surgical emergencies are acute appendicitis, colonic diverticulitis and cholecystitis², and patients with these disorders can have very different presentations and severity of disease. It is important to identify those patients that require emergency surgery promptly. However, clinical decision making for patients with acute abdominal pain can pose a dilemma for the evaluating physician or surgeon; false positive diagnoses for perceived surgical emergencies will lead to unnecessary surgical explorations (type I error), whereas false negative diagnoses for surgical emergencies may result in treatment delay (type II error). Both these 'flawed' decisions will be accompanied by a risk of unnecessary morbidity. An accurate diagnosis is therefore of great importance. Solid clinical evaluation by patient history, physical examination and blood and urine analysis is the cornerstone of any emergency department assessment for acute abdominal pain. Clinical evaluation however, is not perfect. The overall accuracy for the clinical diagnosis acute appendicitis is approximately 80%, which corresponds to a mean false-negative appendectomy rate of 20%³. The clinical diagnosis acute colonic diverticulitis has a reported sensitivity and specificity of 64% and 97% respectively, leaving 36% of the patients with acute colonic diverticulitis to be missed by clinical evaluation⁴. Due to the fallibility of clinical evaluation for the diagnosis and management of patients with acute abdominal pain, many additional diagnostic modalities have been proposed in the literature. Clinical scoring systems, computer based analysis, radiological imaging (computed tomography, ultrasound, magnetic resonance imaging), and diagnostic laparoscopy have all been recommended to complement the clinical evaluation of a patient with acute abdominal pain at the emergency department.

Clinical scores such as the Alvarado score for appendicitis⁵ and the pediatric appendicitis score described by Samuel⁶ were said to aid the clinician to determine

appropriate management for patients with suspected appendicitis. However, when these scores were prospectively validated by others, the accuracies reported by the original authors could not be reproduced^{7,8}, and the scores could not determine the need for surgery accurately⁹. A recent study comparing 4 clinical scores for appendicitis confirmed this¹⁰. The authors found that the clinical scoring systems were inadequate at identifying patients with a high probability of appendicitis that should undergo direct appendectomy. Scoring systems may aid the clinical assessment, but cannot be used to accurately determine management.

Another diagnostic tool for patients with acute abdominal pain is computer aided diagnosis. Early reports in the 1980's claimed an improved diagnostic accuracy, reduced negative laparotomy rates, reduced rates of perforated appendicitis, better patient management, and cost effectiveness¹¹. Unfortunately these impressive results were not reproducible and were attributed to the effects of structured data collection methods and audit feedback to clinicians^{12,13}. It was concluded that computer aided diagnosis based on Bayes formula did not have a useful role in the diagnosis of acute abdominal pain, and today such programs are not frequently used. Recently however, a systematic review of ten studies on computer aided diagnosis for acute abdominal pain demonstrated an overall improvement in clinical diagnostic accuracy of 17.25%¹⁴. The authors concluded that computer aided decision support (CADS) still has a role in the initial evaluation of patients with acute abdominal pain, and that more work should be done to assess the inception of CADS in the emergency department for patients with acute abdominal pain.

Radiological imaging is the most established addition to the 'basic' clinical evaluation for patients with acute abdominal pain. Abdominal ultrasound can assist in the diagnosis of many gastrointestinal causes of acute abdominal pain¹⁵, and its routine use by surgeons has been shown to increase diagnostic accuracy¹⁶. A recent meta-analysis showed ultrasound to have a sensitivity and specificity for acute appendicitis of 78% and 83% respectively¹⁷. For acute colonic diverticulitis ultrasound has a reported sensitivity and specificity of 77-98% and 80-99% respectively¹⁸⁻²².

The advantage of ultrasound is that it does not require ionizing radiation or the application of oral, rectal or intravenous contrast, and thus it can be repeated as often as needed. Furthermore, the costs are lower and the spatial resolution of a high-frequency ultrasound image is higher than that of a CT image providing more detailed information on the different bowel wall layers when a graded compression technique is used^{15,23}. A disadvantage of ultrasound is that it is operator dependent and that good imaging is difficult in patients with increased levels of body fat.

Computed tomography (CT) has also been reported to increase diagnostic accuracy, reduce hospital admissions²⁴, and is said to be the best predictor of the need for an urgent intervention²⁵. Surgical and radiological literature consistently report CT to have a higher accuracy than ultrasound for urgent surgical diagnoses. The sensitivity and specificity for acute appendicitis in a meta-analysis was 91% and 90% respectively¹⁷. For acute colonic diverticulitis CT has been reported to have a high sensitivity (93-97%) and specificity approaching 100%^{26,27}. A disadvantage of CT is that it exposes patients to ionizing radiation. This is an important issue as the rapidly growing use of CT is steadily increasing the collective dose of medical radiation to which patient populations are subjected. Even though the cancer risk from an abdominal CT is small for the individual, the increasing use of CT may create a future health concern, especially for children²⁸. The indications for ordering a CT should therefore always be carefully scrutinized by medical personnel, especially when other diagnostic modalities can attain similar results²⁹.

Magnetic resonance imaging (MRI) may be an attractive alternative to CT as it does not use ionizing radiation, has a high contrast resolution, and techniques that shorten the examination time are currently available³⁰. MRI has been shown to have an excellent diagnostic accuracy for acute appendicitis³¹, and may be helpful for the diagnosis of acute appendicitis in pregnant patients with equivocal ultrasound examinations³².

Laparoscopy can also accurately distinguish patients that require surgery from those that can be treated conservatively³³ and has been proposed as routine management for patients with acute abdominal pain in whom the decision to operate is uncertain³⁴.

However, we consider diagnostic laparoscopy in itself to be an operation, and believe that it is too invasive as a first line diagnostic measure when similar accuracy can be achieved without an operation. The guidelines of the European Association for Endoscopic Surgery state that diagnostic laparoscopy can be useful for patients with acute abdominal pain, but that noninvasive diagnostic aids should be exhausted first³⁵.

The data presented in chapters 2-6 was collected during a project at the Rode Kruis Hospital (currently Haga hospital) in the Hague from June 2005 until July 2006. This prospective cohort investigation (DIBAB study – ‘**D**agnostiek **b**ij **a**cute **b**uik’) was initiated in order to address some clinical issues concerning the diagnosis and management of acute abdominal pain. Our strategy was based on a premise that the least detrimental and non-invasive diagnostic modalities should always come first for diagnosing and managing patients with acute abdominal pain at the emergency department. - Primum non nocere. The last chapter is a review that embodies this same principle.

Outline of the thesis

Some of the patients presenting at the emergency department with acute abdominal pain can be easily recognized to require a hospital admission for surgical or medical treatment. When evaluating other patients it may be more challenging to distinguish urgent surgical diagnoses from non-surgical or self-limiting pathology. Additional radiological imaging may facilitate the diagnosis for some but preferably not all of these patients with equivocal abdominal pain. Outpatient re-evaluation is often used to differentiate mild disease from surgical pathology in equivocal cases. In **chapter 2** an assessment is made of the efficacy and safety of standard outpatient re-evaluation for patients that present with acute abdominal pain at the emergency department but who are not considered to require a hospital admission. The hypothesis is that standard outpatient re-evaluation for patients with equivocal abdominal pain is safe, can improve diagnostic accuracy, and will facilitate proper treatment selection.

When patients are clinically suspected to have acute appendicitis, additional radiological imaging such as ultrasound and CT, and diagnostic laparoscopy have been shown to improve diagnostic accuracy and avoid negative appendectomies³⁶⁻³⁹. In our opinion, the use of non-invasive modalities such as clinical evaluation, ultrasound and clinical re-evaluation should be the preferred method for diagnosing acute appendicitis. CT and diagnostic laparoscopy should only be used if these less detrimental modalities do not suffice. In **chapter 3** a diagnostic strategy for appendicitis is tested using non-invasive methods with a minimal use of complementary CT (ionizing radiation) and diagnostic laparoscopy.

Making an accurate diagnosis for children that present with acute abdominal pain can also be challenging. There are some self-limiting diseases that mimic acute appendicitis quite accurately, and the most common is acute mesenteric lymphadenitis⁴⁰. Acute mesenteric lymphadenitis is a self-limiting disorder that has been a common finding during negative surgical explorations for acute abdominal pain in children⁴¹ and is frequently diagnosed when patients undergo additional radiological imaging for suspected appendicitis⁴². In **chapter 4** we investigate whether it is possible to clinically

distinguish acute appendicitis from acute mesenteric lymphadenitis in children. Our hypothesis is that this is not possible and that additional imaging is necessary for an accurate diagnosis.

When children with acute abdominal pain are referred to the radiologist for additional imaging at our institution, ultrasound is the primary investigation of choice⁴³. While performing these ultrasound investigations for appendicitis in children, it is not always possible for the radiologist to visualize the appendix. In **chapter 5** we investigate the value of secondary signs of acute appendicitis during abdominal ultrasound for suspected appendicitis in children.

In **chapter 6** the diagnostic accuracy of clinical evaluation, ultrasound and CT is investigated for patients with suspected colonic diverticulitis at the emergency department. The hypothesis is that clinical evaluation is insufficient, and that additional radiological imaging is necessary for an accurate diagnosis. The aim is also to assess what impact these examinations have on clinical decision making.

The majority of patients diagnosed to have acute colonic diverticulitis at the emergency department can be treated conservatively. However, for patients presenting with generalized peritonitis due to perforated colonic diverticulitis the recommended treatment is an urgent colonic (sigmoid) resection. Regardless of the technique, a colectomy is associated with a substantial morbidity and mortality in these cases. Recently, several articles have reported laparoscopic peritoneal lavage, drainage and antibiotics as an alternative to acute colonic resection. In **chapter 7** a systematic review of the available literature evaluates the efficacy, mortality and morbidity of laparoscopic peritoneal lavage for patients presenting with acute perforated colonic diverticulitis.

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