

MEDICO-LEGAL ISSUES IN DELAYED APPENDECTOMY FOR ACUTE APPENDICITIS AND RISK MANAGEMENT STRATEGIES

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Abstract: Acute appendicitis is a major healthcare problem, being one of the most frequent emergency abdominal condition, and one of the leading causes of malpractice claims. Currently, the diagnosis of acute appendicitis relies on clinical examination, and there is no paraclinical test to confirm or infirm the diagnosis. 30% of patients with proven appendicitis are misdiagnosed and discharged by a physician before the correct diagnosis is made.

The paper is a comprehensive review regarding the cases of successful litigation in cases of delayed diagnosis of acute appendicitis and to analyze the current practical guidelines and general approach to cases with abdominal pain possible due to acute appendicitis versus the patients' expectations regarding the standard of care, resulting in possible legal claims.

The leading cause of successful malpractice claims related to acute appendicitis is the delay of failure to diagnose acute appendicitis before perforation occurred, accounting for 65-90% in various studies. This may cause harm to the patients by increased rate of intraabdominal and surgical site infection, prolonged pain and hospitalization, but also death. Careful patient examination, the judicious use of scoring systems based on clinical and paraclinical data and in cases with intermediate risk, of imaging tests are useful to minimize the diagnostic errors.

Understanding the causes of malpractice litigation in acute appendicitis resolved successfully in favor of the plaintiff is important to understand how these faults can be avoided in the future.

Keywords: acute appendicitis, malpractice claims, delayed diagnosis, morbidity, litigation.

INTRODUCTION

Acute appendicitis is one of the most common pathologies in surgical emergencies, with a frequency of 7-8% during lifespan [1,2]. An extensive review over the worldwide epidemiological trends in acute appendicitis showed that there is an emerging trend in developing countries, while in the United States and Western European Countries, the incidence for both uncomplicated and complicated appendicitis remained stable, with a small decrease in appendectomies

performed yearly, partially related to the improvements in diagnosis and increasing trends in conservative medical approach. In the patient's perception, acute appendicitis is a common pathology, but with generally rapid evolution favorable under specialized treatment [1].

However, it has a still incompletely elucidated etiology, with a very heterogeneous clinical presentation pattern, ranging from simple uncomplicated appendicitis to generalized peritonitis due to perforation [3], with serious consequences, including death. The variety of

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clinical forms covered all ages, which created a wide semiotic palette. The rate of “white” appendectomies remains relatively high, of 9-15% [4-6], higher in the case of women, being a factor of morbidity and preventable costs in the health system. This percentage is accepted as standard of care, in order to prevent failure or delay of diagnosis. A recent study estimates that approximately 3.4 million patients present annually to the United States in emergency departments for abdominal pain, and acute appendicitis has to be a possible differential diagnosis for all of these patients during surgical clinical examination [7]. Of these, approximately 270000 underwent appendectomies [8]. Most of them are performed in emergency, to avoid the complication of perforated appendicitis. Unfortunately, the symptoms of appendicitis are not always consistent and misdiagnosis is common, which is a frequent cause of medical negligence claims. In a study of Kacprzyk *et al.*, acute appendicitis is the second cause of readmission in the Emergency Department for abdominal pain after cholelithiasis and 30% of patients with proven appendicitis are misdiagnosed and discharged by a physician before the correct diagnosis is made [9].

MATERIALS AND METHODS

The paper is a comprehensive review regarding the cases of successful litigation in cases of delayed diagnosis of acute appendicitis. A search was performed on PubMed/Medline, Web of Science and Google Scholar by the terms “acute appendicitis” AND “malpractice” OR “malpraxis” OR “medico-legal claims”. After duplication removal, all articles available in English language were analyzed. Furthermore, a hand search was performed on the websites of the law firms dealing with medical malpractice, documenting the information regarding the possible claims for negligence in acute appendicitis and the cases won in trials. By this approach, we aimed to analyze the current practical guidelines and general approach to cases with abdominal pain possible due to acute appendicitis versus the patients’ expectations regarding the standard of care, resulting in possible legal claims.

RESULTS AND DISCUSSION

Emergency surgery is vulnerable to a substantial number of malpraxis claims, of which many are successful in trials. According to the statistics, 7-17 claims are registered for every 100 physicians each year [10]. Acute appendicitis is among the most common causes

of successful litigation against emergency physicians worldwide, occupying the 5th place in the United States and being associated for 5-15% of all dollars paid in emergency departments malpractice claims, with almost half of the claims were resolved in favor of the plaintiff, either by settlement or by trial [8,11].

In United States and Western European countries, many law-firms dealing with medical malpractice provide on their web-page general information regarding the diagnosis and treatment of acute appendicitis and encourage unsatisfied patients of their relatives to submit claims in case of [12-15]:

- Misdiagnosis and late diagnosis of appendicitis
- Failure to carry out appropriate diagnostic procedures
- Failure to correctly interpret test results
- Failure to provide appropriate treatment for appendicitis
- Failure to notice deterioration in the patient’s condition
- Surgical errors during appendix removal
- Insufficient pain relief during hospitalization
- Pre- and post-surgical infections
- The need for a reintervention in the following days .

If delayed diagnosis is a major cause for malpractice litigation in acute appendicitis, removal of a normal appendix is not considered a medical error. Due to the polymorph clinical features in appendicitis, is it a general practice to better overdiagnoses and overtreat, rather than ignore the signs until perforation and peritonitis develop [12-14].

Definition of malpractice

Generally, for a malpractice claim to be admitted, several elements have to be analyzed and proved: duty; breach of duty; harm; and causation [10,16]. Firstly, the doctor has to have a duty of care over the patient, which may be a duty of diagnosis, of investigation or of treatment. Although acute appendicitis is a surgical disease, the related malpractice claims may not affect only the surgeon, but also the general practitioner, the emergency medicine specialist on duty, internal medicine specialist, gynecologist or the radiologist performing imagistic investigations. In a review of Sosner *et al.* [16], acute appendicitis was cited as the third cause of malpractice claims against radiologists in gastrointestinal diseases, for missed diagnosis, after pneumoperitoneum and cancer. In a study on 241 claims regarding appendicitis in Germany of Vinz and Neu [17], one third of the claims were directed against non-surgical specialties, including

primary care outpatient facilities.

Secondly, the patient has to prove the standard of care has been breached in the respective case. However, the standard of care varies from one country to another and is not always well defined. The concept of “the standard of care” is often discussed among physicians, and yet the legal definition of this term is frequently not understood [10,16]. While the concept is still evolving and will continue to change through the years, as the legal theory develops in the area, presently, the “standard of care” may be described as the minimally competent care that is expected to be delivered. It is the decision of the judge whether the doctor’s negligence breached the standard of care and whether it was so significant as to cause harm to the plaintiff [10].

The standard of care is different to the current practical guidelines (CPGs), which have debatable significance in a malpractice trial. CPGs may be used to explain the opinion of an expert witness, to defend or to suggest the deviance of a physician from the standard of care. However, CPGs are not per se valid documents in trials. When one side uses a CPG in a court case, it is up to the opposing side to ensure that the jury is given adequate explanation as to why this may or may not actually represent the standard of care [10].

Frequent causes of malpractice claims in acute appendicitis

The leading cause of successful malpractice claims related to acute appendicitis is the delay of failure to diagnose acute appendicitis before perforation occurred, accounting for 65-90% in various studies [16-18]. The mortality in acute appendicitis varies between 0.1% in non-perforated cases to up to 5% in perforated cases with peritonitis [19]. On the other hand, perforated appendicitis is associated with prolonged hospitalisation, increased incidence of wound infection, intraabdominal abscess and reintervention, all these aspects being a significant source of distress for the patients, as well as inability to return to work and, financial losses. In a study of von Titte *et al.*, delayed diagnosis after 72 hours was associated in 60% with major postoperative complications [20].

Clinical studies showed that there is an increased risk of appendiceal perforation in males rather than females, and at extreme ages, namely in children and elderly [21-23]. The incidence of perforation in elderly is estimated around 60-70%, due to multiple causes, such as decreased immunity, attenuated, non-specific symptomatology, delayed presentation and associated comorbidities which need to be addressed prior to surgery

[22]. In preschooler, the perforation rate is estimated to be even higher, so it is difficult to say if the diagnosis of acute appendicitis before perforation occurs should be the “standard of care” [21,22].

Time lapsed from the onset of symptoms is well correlated with the incidence of perforation. Clinical studies showed an increased risk of 15% after 36-48 hours, and a probability of 90% of perforation after 72 hours [20]. A careful anamnesis is important to document the onset and evolution of symptomatology and it should be one of the decision factors in therapeutic management of the patients suspected of acute appendicitis.

Mahajan *et al.* report in a recent study that the diagnosis of appendicitis is missed in 3.8% to 15.0% of children and in 5.9% to 23.5% of adults during emergency department (ED) visits [24-27]. The causes of delayed diagnosis are related mostly to the polymorphic symptomatology of the acute appendicitis, which can mimic a wide variety of surgical or non-surgical abdominal diseases. Constipation in combination with abdominal pain was more frequent in the potentially missed appendicitis group compared with the same-day diagnosis group among adults [24]. Another frequent reported diagnostic error is to be considered as gastroenteritis, based on the signs of nausea, vomiting and non-specific abdominal pain, especially when associated with diarrhea. Other possible causes of misdiagnosis were reported to be urinary infection and gynecological disorders in women.

In a comprehensive study of Vinz *et al.* [18], upon 447 claims registered in North Germany, failure or delay in the diagnosis of acute appendicitis were careless history-taking, no or incomplete physical examination, no follow-up investigations, incorrect interpretation of the patient’s complaints and clinical findings, no or incomplete documentation [18].

The lack of digital rectal examination was cited as proof of incomplete clinical examination in some malpractice claims [10]. However, if right lateral rectal tenderness is evocative for inflamed peritoneum or right iliac fossa pus collection, a recent systematic review of Takada *et al.* proved that digital rectal examination (DRE) cannot neither exclude, or confirm the diagnosis of acute appendicitis, especially in early phase [28]. On the other hand, patients as well as physicians often feel uncomfortable with this breach of privacy involving a DRE [29].

Another challenging issue is the lack of a specific paraclinical test with high diagnostic value for acute appendicitis. The most common lab tests performed are white blood count (WBC) and urinalysis, the latter to

exclude a urinary pathology. However, if an increased WBC is a strong argument for patient admission in the hospital and further exploration, there are strong evidences that acute appendicitis may be associated initially with a normal WBC. An interesting opinion was formulated by Jonathan Glauser [8], that besides the data provided by WBC, the value of paraclinical lab tests are that allow a prolonged observation period upon the patient. In his opinion, time is the main decisional factor and observing the evolution of the symptoms in dynamic is extremely useful. However, lawyers and patients tend to consider that WBC may be part of the standard of care in appendicitis and that the patient's signs were not taken seriously in no blood tests were considered [8,12-15].

Although there is no consensus regarding the role of imagistic in diagnosis of acute appendicitis, there were successful claims regarding the lack of a computed tomography in the initial presentation, which led to delay and perforation [8]. Moreover, there was a \$1,500,000 verdict in February 2018 in Virginia, for a patient who underwent CT exam at first admission, but the radiologist failed to put the diagnosis of acute appendicitis, resulting in delay of treatment and further complications [12].

Delayed diagnosis and peritonitis was claimed to be a potential cause for future infertility, due to peritoneal and Fallopian tube inflammation [8,10]. Postoperative adhesions after abdominal or pelvic surgery remain an important clinical problem causing infertility, pain and bowel obstruction [30]. Large clinical studies failed to confirm the hypothesis, however Elraiyah *et al.* found an increased risk of ectopic pregnancy following ruptured appendicitis [31-34].

In a comprehensive evaluation of the decisions of the Norddeutsche Schlichtungsstelle (Expert Panel for Extrajudicial Claims Resolution of the Medical Associations in Northern Germany), between 2000 and 2004, the most serious errors documented in these cases of appendicitis included: failure to conduct a follow-up examination within 12-24 hours, delayed re-intervention for peritonitis or peritoneal abscess [18].

Current practical guidelines in acute appendicitis

Acute appendicitis captures the evolution of inflammation in the digestive tract and also allows a diagnostic and paraclinical exploration in constant update. The World Society of Emergency Surgery organized in 2015, in Jerusalem, the first consensus conference on the diagnosis and treatment of acute appendicitis in adult patients, which was updated

in Nijmegen, in 2019, with solid evidence-based statements, based on GRADE Quality of evidence and strength of recommendations [19]. Clinical diagnosis is often challenging and it requires often a synthesis of clinical, paraclinical and imagistic tests. Several scoring systems, such as Alvarado, Appendicitis Inflammatory Response (AIR), RIPASA (Raja Isteri Pengiran Anak Saleha Appendicitis) and new Adult Appendicitis Score (AAS), were proposed to improve the diagnostic ability in emergency, with significant power to discriminate between low-risk patients who can be safely discharged without diagnostic imaging, as long as they have appropriate safety-netting and intermediate risk patients needing imaging diagnosis. Currently, the AIR and AAS are the most recommended as clinical predictors for acute appendicitis, and may be useful to decrease the rate of negative appendectomies and the number of patients needing imaging tests for confirmation [19] (Tables 1, 2).

Currently, the diagnosis of acute appendicitis relies on clinical examination, and there is no paraclinical test to confirm or infirm the diagnosis. Leukocytosis correlates well with the intensity of inflammation in the preoperative stage, but is a weak indicator for appendicular perforation, a very important aspect in surgical practice due to high mortality in these cases and the need for prompt emergency surgery. Elevated bilirubin levels have been found in gangrenous and perforated appendicitis. Hyperbilirubinemia in acute abdominal infections is caused either by excessive production of bilirubin or by altered clearance. Both mechanisms lead to the accumulation of bilirubin and play a role in the hyperbilirubinemia observed in patients with appendicular perforation [38], stages in which they were identified.

Biochemical markers represent a promising reliable diagnostic tool for the identification of both negative cases or complicated acute appendicitis in

Table 1. Appendicitis Inflammatory Response (AIR) score [35]

Vomiting	1 point
Pain in right inferior fossa	1 point light = 1 point; medium = 2 points; strong = 3 points.
Rebound tenderness	1 point
Body temperature ≥ 38.5	1 point
Polymorphonuclear leukocytes:	70% to 84% = 1 point; $\geq 85\%$ = 2 points.
WBC count	10.0 to $14.9 \times 10^9/L$ = 1 point; $\geq 15.0 \times 10^9/L$ = 2 points.
CRP concentration:	10 mg/L to 49 mg/L = 1 point; ≥ 50 = 2 points.

Interpretation: 0-4: low probability; 5-8: indeterminate group; 9-12: high probability.

Table 2. Adult Appendicitis Score (AAS) [36, 37]

Pain in right lower quadrant	2 points
Pain relocation	2 points
Right lower quadrant tenderness	- Women, aged 16-49 years = 1 point. - All other patients = 3 points.
Guarding	- Mild = 2 points. - Moderate or severe = 4 points.
WBC count ($\times 10^9/L$)	- ≥ 7.2 and < 10.9 = 1 point. - ≥ 10.9 and < 14.0 = 2 points. - ≥ 14.0 = 3 points.
Proportion of neutrophils %	- ≥ 62 and < 75 = 2 points. - ≥ 75 and < 83 = 3 points. - ≥ 83 = 4 points.
CRP (mg/L), symptoms < 24 hours	- ≥ 4 and < 11 = 2 points. - ≥ 11 and < 25 = 3 points. - ≥ 25 and < 83 = 5 points. - ≥ 83 = 1 point.
CRP (mg/L), symptoms > 24 hours	- ≥ 12 and < 53 = 2 points. - ≥ 53 and < 152 = 2 points. - ≥ 152 = 1 point.

Interpretation: 0-10: low risk; 11-15: intermediate risk; ≥ 16 : high risk.

adults. However, further high-quality evidence is needed, but the level of evidence is low, and there is no recommendation for any biomarkers in diagnosis acute appendicitis [19].

The best practice regarding imaging in patients suspects of appendicitis with intermediate risk according to clinical and paraclinical data is to use abdominal ultrasound, followed, in case of negative or inconsistent results by abdominal CT scan, or MRI if available in case of pregnant women [19]. In a systematic review of Mikayla Hwang, the pooled values of sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) for ultrasound examination were 86%, 94%, 100%, and 92%, respectively and of 95%, 94%, 95%, and 99%, respectively for CT examination [39]. However, cases with acute appendicitis non-diagnosed by CT exam are not uncommon in malpractice claims.

Risk management in acute appendicitis

Risk factors for late diagnosis are extreme age, pregnancy, patients with atypical symptoms, association with constipation or diarrhea. Administration of opioid pain medication mitigates the clinical signs and increases the risk of delayed diagnosis [40]. Females, more than man are at risk of misdiagnosis due to the more complex anatomy of the right iliac fossa [41].

A careful anamnesis is extremely important to document the time from the onset of the symptoms, the characteristics of the abdominal pain, and the medication administrated [42]. WBC count and if, available CRP, are useful tools. Having in mind that normal values cannot exclude appendicitis, raised values are significant red

flag for further need of investigations. While imagistic investigations cannot be available to all patients with abdominal pain presenting to the emergency department, clinical judgement and scoring systems should select those patients with intermediate risk. A report by Rusnak *et al.* [38] lists the diagnosis of gastroenteritis as a risk for malpractice suits for appendicitis. A more appropriate attitude would be to avoid putting a diagnosis when there are missing criteria. Non-specific abdominal pain is more to reflect the clinical picture in challenging situations. The evolution of the symptoms in time is extremely important. When patients are considered at low risk and send home, providing specific instructions to the patient for further presentation in the next 12-14 hours is crucial to prevent further medico-legal issues.

In conclusion, under the pressure of time, costs and resources, the medical staff in emergency department are exposed to malpractice claims. In many cases, the plaintiff claims superficial attitude and insufficient exploration. Moreover, surgeons should be aware that clinical practical guidelines are not documents with legal value in court, when a specific case of possible malpractice claim, but may help to justify if the provided care fails or not below the standard of care. Understanding the causes of malpractice ligation in acute appendicitis resolved successfully in favor of the plaintiff is important to understand how these faults can be avoided in the future.

Conflict of interest

The authors declare that they have no conflict of interest.

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