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ORIGINAL RESEARCH

Consequences of peritonism in an emergency department setting

This article was published in the following Dove Press journal:
Open Access Emergency Medicine
20 December 2013
Number of times this article has been viewed

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Background: In patients who were referred to the emergency department (ED) with abdominal pain, it is crucial to determine the presence of peritonism to allow for appropriate handling and subsequent referral to stationary departments. We aimed to assess the incidence of perceived peritonism in a contemporary ED and to make a comparable characterization on specified endpoints, including hospital stay, performed acute surgery, and ordered imaging.

Methods: A single-center study was performed during 2010 in a contemporary Danish ED. We evaluated 1,270 patients consecutively admitted to the ED and focused on the patients with abdominal pain. Following a physical examination, the patients with abdominal pain were divided into those who had clinical signs of peritonism and those who did not.

Results: Among the 1,270 patients admitted to the ED, 10% had abdominal pain. In addition, 41% of these patients were found to have signs indicative of peritonism, and 90% were admitted to the Department of Surgery (DS). Also, 24% of those patients with signs of peritonism and admission to the DS underwent surgical intervention in terms of laparotomy/laparoscopy. Five of the patients without peritonism underwent surgery. The patients perceived to have peritonism were younger at 34±3.0 years (mean ± standard error of the mean) than the patients who were not perceived to have peritonism, 52±2.8 years ($P<0.05$). They also had a shorter length of stay of 38.2±6.0 hours at the DS versus 95.3±18.2 hours ($P<0.05$). No differences with statistical significance were found regarding a stay in the emergency room (ER) or ordered imaging from the ER.

Conclusion: Peritonism was a common finding in our setting. Peritonism did not require more acute surgery or imaging. The duration of the patient's stay in the ER was not influenced by a finding of peritonism. The evaluation of peritonism needs to be improved in the ED.

Keywords: peritonism, emergency department, abdominal pain

Introduction

Abdominal pain is a common complaint in the emergency department (ED). In US settings, abdominal pain is found to constitute 5%–7% of ED visits, of which 10% require acute surgery.[1,2] Acute appendicitis is the most common diagnosis among patients with a surgical condition of the abdomen.[3] Peritonism has previously been an indicator of acute surgery with some exceptions; for example, diverticulitis and pancreatitis. The decision to perform acute surgery is nowadays often supplemented by other modalities; for example, evolving imaging techniques. Unnecessary examinations in such patients could presumably be avoided in most cases in the hands of doctors with surgical experience. No scientific work exists to support this. On the other hand, good clinical skills in abdominal examination may prevent trivial admissions.

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We aimed to evaluate the incidence and consequences of peritonism in a contemporary ED on specified endpoints, including hospital stay, incidence of acute surgery, and ordered imaging.

Materials and methods

Study design and patients

The study was conducted in the ED at the Holbaek Hospital in eastern Denmark. The ED had 12 beds. The patients admitted to the ED were primarily attended by emergency residents. Before discharge or admittance to a specialized department, apart from the ED at the same hospital, or to a foreign department (department at another hospital), the patients' conditions were discussed with a more experienced doctor in the ED or at a stationary department. Occasionally, a more experienced doctor assessed the patients in the ED. The ED served a population of around 200,000 people, and approximately 17,000 patients were admitted to the ED annually.

We evaluated 1,270 patients who were consecutively admitted to the ED during 2010 and focused on the patients with abdominal pain. We included patients who were more than 3 years of age and excluded trauma patients.

Following the physical examination, the patients with abdominal pain were divided into those who had clinical signs of peritonism and those who did not. Subsequently, the handling of patients with abdominal pain was monitored by chart review.

To be included, patients presented themselves in the ED with abdominal pain without obvious medical, gynecological/obstetric, or urinary tract disease.

Any of the following clinical findings: 1) rebound tenderness; 2) percussion tenderness; 3) indirect tenderness; and 4) guarding or combinations hereof were regarded as indicative of peritonism.

Data on the personal security number and age were obtained from the local charts used for triage. Information on the duration of pain, former surgery, American Society of Anesthesiologists score, blood tests, duration of stay in the ED and the Department of Surgery (DS), surgical assistance in the ED, admittance to the DS, status on peritonism, histology, status on and type of surgical procedures, and imaging were obtained from electronic health records.

Institutional approval was obtained. Informed consent from the patients was not required. The study was approved by the Danish Data Protection Agency.

Statistical analysis

Values are given as the mean ± standard error of the mean. The univariate analyses were performed using the Student's *t*-test for continuous variables and the Fisher's exact test for categorical variables. Statistical tests were two-sided with a significance level of 5%.

Results

Patient selection, status on peritonism and acute surgery

Among the 1,270 patients admitted to the ED, 125 patients (10%) had abdominal pain (Figure 1). Following a physical examination, 51 of these patients (41%) were found to have signs indicative of peritonism, and 90% (N=46) were admitted to the DS. In addition, 24% (N=11) of patients with signs of peritonism and admission to the DS underwent surgical intervention in terms of laparotomy/laparoscopy. Five patients with perceived peritonism, but who were not admitted to the DS, were all discharged.

Of the patients who were not perceived to have signs of peritonism, 54% (40 of 74 patients) were referred to the DS. Five of these patients underwent surgery.

Characteristics and handling of patients admitted to the ED with abdominal pain grouped by peritonism

Table 1 shows patients with peritonism, on average, to be in their 30s and significantly younger than patients with no peritonism, who were found to be in their 50s. Significantly more patients with perceived peritonism had pain duration for less than 24 hours. Former abdominal surgery was more frequent in patients without peritonism than in patients with peritonism. As might be expected, by far, most patients with peritonism (90%) were admitted to the DS. However, patients with peritonism were found to be hospitalized at the DS for only 38.2±6.0 hours (N=46) over approximately 1.5 days, while patients without peritonism were hospitalized at the DS for 95.3±18.2 hours (N=40) to approximately 4 days ($P<0.05$). A numerically higher percentage of patients with peritonism underwent laparotomic/laparoscopic procedures when compared to patients without peritonism, ie, 24% versus 13%, although this difference does not meet the conventional level of statistical significance ($P\approx0.30$). No differences were seen between groups regarding a duration of stay at the ED or surgical supervision in the ED.

Type of surgery, diagnosis, and histology

In addition, 55 percent (six out of eleven) of the patients with peritonism were believed to have appendicitis, and 83% (N=5) had the diagnosis confirmed by histology (Table 2).

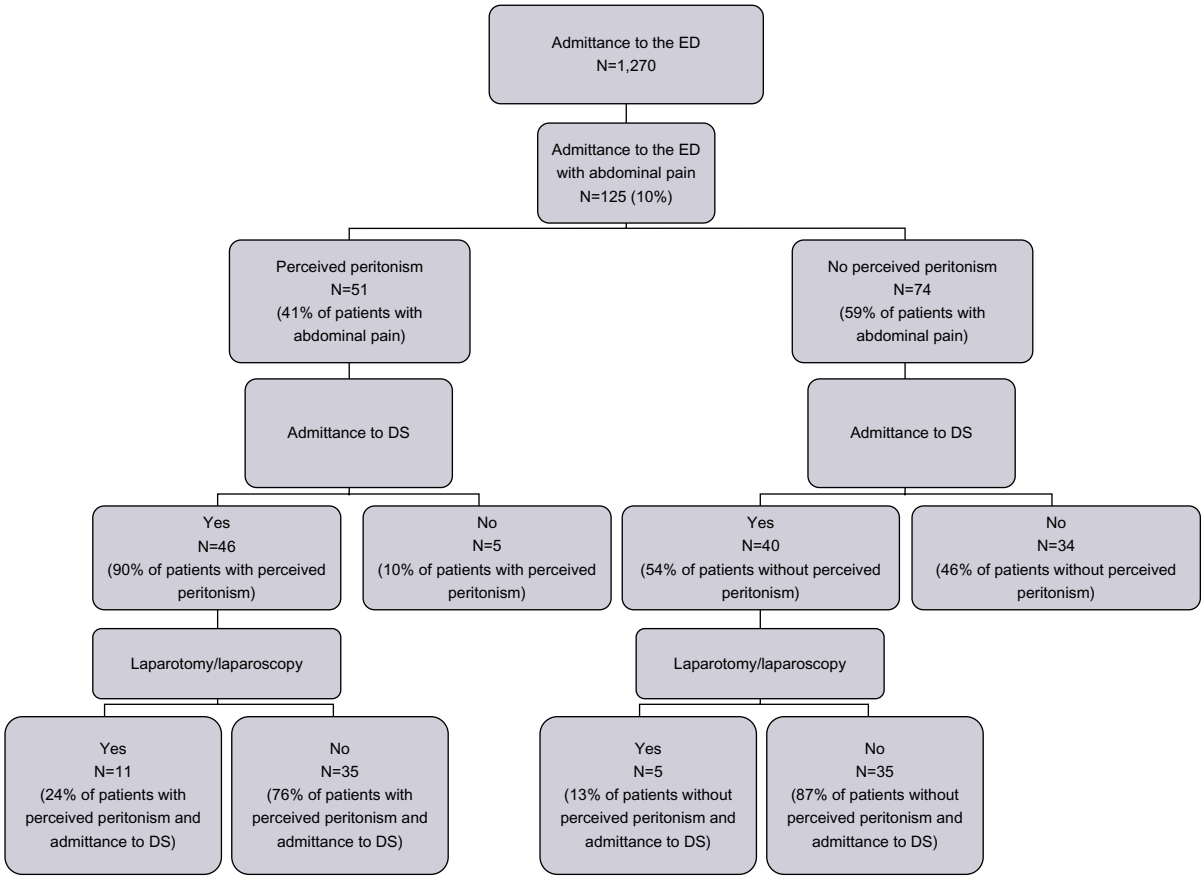

Figure 1 Patients admitted to ED with abdominal pain.
Abbreviations: ED, emergency department; DS, Department of Surgery.

In the group with no perceived peritonism in the ED, 13% who were admitted to the DS nevertheless underwent acute surgery for the causes mentioned in Table 3.

Imaging

Table 4 shows imaging modalities ordered from the ED. A tendency is seen toward more imaging ordered in patients without peritonism – although this was not at a significant level. One patient without peritonism had two imaging modalities ordered from the emergency room (ER). An X-ray of the chest and a computed tomography (CT) scan without contrast media of the abdomen were performed. Three CT scans without contrast media of the abdomen and one CT scan of the urinary tract were ordered in patients with peritonism and, later, laparotomy or laparoscopy. The diagnoses were mantle cell lymphoma; bowel ulcer; gallstones; and inflammation and kidney stones, respectively. In patients with no peritonism and laparotomy or laparoscopy, two CT scans without contrast media of the abdomen and one ultrasound were ordered. The diagnoses were bowel obstruction in one case and bowel obstruction and gallstones in the second.

Discussion

Abdominal pain is a common complaint in the ER. Our findings appear to be in accord with a previous US study – 10% of patients in our ED presented with abdominal pain versus 7%.[2] Following a physical examination of these patients, 41% were found to have signs indicative of peritonism. As expected in nearly all of them, 90% (N=46) were admitted to the DS. However, only 24% (N=11) of those patients with signs of peritonism and admission to the DS underwent surgical intervention in terms of laparotomy/laparoscopy. This would seem to indicate that peritonism is overestimated in the ED setting. Of the patients who were not perceived to have signs of peritonism, the majority of patients (54%) were nonetheless referred to the DS.

Overestimation of peritonism in the ED setting could be beneficial to address by providing ED physicians with abdominal simulators, for example.[4] Although no scientific work exists to support this, it is likely that focused training on abdominal examination would improve handling of patients with abdominal pain.

The patients perceived to have peritonism were younger (34 years) than the patients who were not perceived to have

Table 1 Characteristics and handling of patients admitted to the ED with abdominal pain grouped by peritonism

Parameter	Peritonism	No peritonism	*P*-value
	N=51	N=74	
Age, mean ± SEM (yrs)	34±3.0	52±2.8	<0.05
Female sex %	45 (23/51)	41 (30/74)	0.7
Former abdominal surgery %	24 (12/51)	42 (39/74)	<0.05
ASA-score >2%	8 (4/51)	19 (14/74)	0.1
Pain duration <24 hrs %	73 (35/48)	46 (32/70)	<0.05
Abnormal body temperature[a] %	22(11/51)	19 (14/74)	0.8
Blood samples			
Anemia[b] %	16 (8/51)	27 (17/64)	0.2
Abnormal WBC[c] %	56 (28/50)	48 (31/65)	0.5
Elevated CRP[d] %	50 (25/50)	48 (31/65)	0.9
Stay in the ED, mean ± SEM (hrs)	2.5±0.2	2.8±0.2	0.3
Surgical supervision in the ED %	8	14	0.4
Hospitalization at the DS %	90	54	<0.05
Stay at the DS, mean ± SEM (hrs)	38.2±6.0 (N=46)	95.3±18.2 (N=40)	<0.05
Laparotomy/laparoscopy %	24 (11/46)	13 (5/40)	0.3
Pathological histology %	64 (7/11)	60 (3/5)	1.0

Notes: [a]>37.7°C or below 36.0°C; [b]men: <8.3 mmol/L; women: <7.3, <15 years; both sexes: <6.6; [c]WBC: >15 years: >8.8 × 10^9/L or <3.5; 8–15 years: >13.5 or <5.5; 4–8 years: >13.5 or <4.5; [d]C-reactive protein >8.0 mg/L.
Abbreviations: ED, emergency department; yrs, years; SEM, standard error of the mean; ASA, American Society of Anesthesiologists; hrs, hours; WBC, white blood count; CRP, C-reactive protein; DS, department of surgery.

peritonism (52 years) ($P<0.05$). An average age of 34 years among patients with signs of peritonism is reasonable, according to the common presentation of appendicitis or observation for this in EDs, and the highest incidence of appendicitis that occurs is between 10–30 years of age.[5,6]

Table 2 List of presenting patients admitted to ED with abdominal pain, peritonism, and subjected to laparotomy/laparoscopy

Patient number	Peritonism	Type of surgery	Diagnosis	Histology
1	Yes	Laparotomy	Appendicitis	Inflammation
2	Yes	Laparotomy	Malignant lymphoma	Mantle cell lymphoma
3	Yes	Laparoscopy	Appendicitis	Inflammation
4	Yes	Laparotomy	Ulcer	None
5	Yes	Laparoscopy	Appendicitis	Inflammation
6	Yes	Laparotomy	Appendicitis	No Inflammation
7	Yes	Laparoscopy	Ovarian cysts	None
8	Yes	Laparoscopy	Cholecystitis	Inflammation and stones
9	Yes	Laparoscopy	Appendicitis	Inflammation
10	Yes	Laparoscopy	Appendicitis	Inflammation
11	Yes	Laparoscopy	Kidney stones	None

Abbreviation: ED, emergency department.

Table 3 List of presenting patients admitted to ED with abdominal pain, no peritonism, and subjected to laparotomy/laparoscopy

Patient number	Peritonism	Type of surgery	Diagnosis	Histology
1	No	Laparoscopy	Appendicitis	Inflammation
2	No	Laparotomy	Ileus	None
3	No	Laparotomy	Colonic obstruction	Adenocarcinoma in sigmoid colon
4	No	Laparoscopy	Gall bladder stones	Inflammation
5	No	Laparotomy	Septic shock	None

Abbreviation: ED, emergency department.

In significantly more patients without peritonism, abdominal surgery had previously been performed. It is reasonable to believe that patients with former abdominal surgery may experience abdominal symptoms because of the formation of intra-abdominal scar tissue which rarely induces peritonism. A longer pain duration before admission to the ED is also expected when peritonism is not present.

The patients with perceived peritonism had a shorter length of stay at the DS than those without perceived peritonism, approximately 1.5 days versus approximately 4 days ($P<0.05$). A shorter length of stay at the DS in the group with peritonism may be partly explained by conditions that are easily treatable – either by minor surgical procedures or a short period of observation before discharge. Patients with true peritonism often require acute surgical intervention, and a lack of statistical significance in the numbers of laparotomy/laparoscopy among the group with signs indicative of peritonism is misleading. One explanation may be the signs of peritonism that were chosen in the current setting. Many signs have been suggested as indicative of peritonism, especially regarding appendicitis. One meta-analysis by Andersson[7] found that the isolated clinical features have weak diagnostic value for acute appendicitis, confirmed by a multicenter study by Laméris et al.[8] The reproducibility of physical

Table 4 Ordered imaging modalities from the ED

Imaging	Peritonism	No peritonism	*P*-value
	N=51	N=74	
CT of abdomen without contrast media	N=9	N=13	1.0
CT of abdomen with contrast media	N=1	N=5	0.4
Ultrasonography	N=2	N=7	0.3
CT of urinary tract	N=1	N=2	1.0
Chest X-ray	–	N=3	–
Chest CT with contrast media	N=1	N=1	1.0
All	N=14	N=31	0.1

Abbreviations: ED, emergency department; CT, computed tomography.

examination in patients with abdominal pain is limited. It has been shown that the agreement of emergency physicians on the presence of abdominal tenderness and guarding is only moderate.[9] Furthermore, it is essential to remember that peritonism is a dynamic process, meaning that the lack of peritonism in the ED may proceed to peritonism in the stationary department.

Imaging techniques to evaluate abdominal pain have been widely studied. We mostly perform acute CT scans if either a perforation or a bowel obstruction is suspected. Neither a CT scan nor an ultrasound are routinely used if appendicitis is suspected. Kessler et al found a diameter of the appendix with ultrasound above 6 mm to have a positive predictive value of 98%.[10] Ultrasound, as well as CT scans, have been established as important imaging techniques in an evaluation of the acute abdomen.[11,12] More use of imaging in our setting may prevent trivial admissions.

Our study has limitations. The retrospective design was a main limitation. A relatively small number of patients being subjected to acute surgery enhances the risk of a type II error. Several emergency residents performed abdominal examination in our setting without systematic supervision. Therefore, abdominal examinations are expected to differ markedly in structure and interpretation. On the other hand, we also believe multiple examiners to be an advantage. We aimed to evaluate the consequences of peritonism in clinical practice, not the skills of an individual emergency resident.

Conclusion

Signs of peritonism were a common finding in our settings. Only 24% of patients who were admitted to the DS underwent acute surgery. Signs of peritonism did not influence a duration of stay in the ER or ordered imaging from the ER at a statistically significant level. Peritonism remains difficult to assess and requires perhaps years of focused surgical training. To improve clinical skills in recognition of the surgically acute abdomen, we recommend more focus on the education of emergency residents. Good clinical skills in abdominal examination among emergency residents are important for the appropriate handling of patients. We suggest simulator training as a means to accomplish this.

Author contributions

TBM collected data and performed data analysis. TBM and TAS both made substantial contributions to the conception, design, and interpretation of the data. TBM and TAS were both involved in drafting the article, revising it critically for important intellectual content, and the final approval of the version to be published.

Disclosure

The authors report no conflicts of interest in this work.

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