Appendicitis as a rare cause of mechanical small-bowel obstruction: A literature review of case reports

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ABSTRACT

INTRODUCTION: Although bowel paralysis accompanying acute appendicitis is well known, mechanical bowel obstruction as a direct consequence of appendicitis remains a rare, but potentially life-threatening, acute abdomen. The aim of our literature review was to find all documented cases of this particular complication and compare them with our own case study.

METHODS: We searched the PubMed database for relevant articles published from 1963 to 2015. The study included patients for whom direct links between appendicitis and strangulation of the terminal ileum were found, and for which the disease course had been documented in detail. The study also included our own case report since it met the inclusion criteria. A total of 190 articles were examined with a final yield of 17 case reports from 13 articles.

RESULTS: 17 patients (11 men and 6 women), with a mean age of 48 ± 23.9 years, met the inclusion criteria. The average period between symptom onset and surgery was 3.4 ± 3.7 days. Symptoms of the disease were consistent with small-bowel obstruction. Treatment included simple appendectomy (n = 7), possibly supplemented by segmental resection (n = 5), followed by ileocecal resection (n = 4), and one case that required a right-sided hemicolectomy (n = 1).

CONCLUSION: We found mechanical bowel obstruction directly related to appendiceal inflammation to be extremely rare, and relatively few individual cases involving this potentially life-threatening complication have been documented in the literature. Clinical signs of the disease are variable, non-uniform, and consistent with symptoms of small-bowel obstruction during their progression.

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1. Introduction

Intestinal obstruction is a common acute abdomen that can have multiple causes. Although bowel paralysis accompanying acute appendicitis is well-known, mechanical obstruction that is directly caused by chronic or acute appendiceal inflammation is an extremely rare acute abdomen, and only isolated cases have been described in the literature (see Table 1). Although individual case studies have been described in the literature since as early as 1901, very few literature reviews exist on the subject [1, 2].

Mechanical obstruction, with or without strangulation, can result from loops of the small bowel becoming entangled and pinched by the inflamed appendix, or adhesion of the distal end of the appendix to loops of the small bowel, cecum, or retroperitoneum [3]. This creates conditions wherein the small bowel can herniate through the ring-like structure formed by the inflamed appendix; herniation can occur with or without strangulation (Fig. 1).

Mechanical obstruction is also very difficult to diagnose preoperatively; a conclusive diagnosis usually has to wait until surgery. Treatment depends upon the severity and extent of bowel loop involvement (see Table 1) and varies from a simple appendectomy, to ileocecal and segmental resection, to a right-sided hemicolectomy. Thus, mechanical bowel obstruction as a direct consequence of appendiceal inflammation remains a rare, but potentially life-threatening, acute abdomen that requires early diagnosis and surgical management. The aim of our literature review was to find all documented cases of this disease in the literature and compare them with observations from our own case study.

2. Case study

A 62-year-old female patient was examined at the Emergency Department of our University Hospital. She complained of 3 days of upper abdominal cramping pain, described as intermittent and non-radiating. In the morning prior to admission, the patient had repeatedly vomited dark brown contents. On admission, she was

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Table 1
Epidemiological data from all published patients with mechanical blockage due to appendiceal strangulation/constriction of the small bowel.

| No. | Author          | Year | Sex | Age (ys) | Symptom duration (days) | Symptoms                                    | Intraoperative findings                           | Surgical procedure                          |
|-----|----------------|------|-----|----------|-------------------------|---------------------------------------------|------------------------------------------------|-----------------------------------------------|
| 1   | Naumov [5]     | 1963 | M   | 58       | 1                       | Epigastric pain, vomiting, constipation      | Strangulated small bowel                       | Appendectomy, segmental resection             |
| 2   | Naumov [5]     | 1963 | M   | 45       | 1                       | Lower abdominal pain, fever                 | Strangulated small bowel                       | Appendectomy                                 |
| 3   | Srinivasan [8] | 1964 | F   | 40       | 12                      | Abdominal colic, vomiting, constipation      | Strangulated terminal ileum due to appendiceal constriction | Right-sided hemicolecotomy                     |
| 4   | Gupta [9]      | 1969 | M   | 15       | 2                       | Abdominal pain, vomiting, constipation       | Strangulated terminal ileum due to appendiceal constriction | Ileocecal resection                           |
| 5   | Gupta [9]      | 1969 | M   | 65       | 13                      | Diffuse peritonitis, dehydration, vomiting, oliguria | Strangulated ileum due to appendiceal constriction | Retrograde appendectomy, segmental resection  |
| 6   | Bose [10]      | 1973 | M   | 50       | 1                       | Abdominal colic, vomiting, constipation      | Strangulated ileum due to appendiceal constriction | Retrograde appendectomy                       |
| 7   | Bose [10]      | 1973 | M   | 35       | 1                       | Right-sided abdominal pain, vomiting         | Strangulated ileum due to appendiceal constriction | Retrograde appendectomy, segmental resection  |
| 8   | Ivoulsou [11]  | 1996 | M   | 22       | 2                       | Severe abdominal pain, vomiting, constipation | Strangulated ileum due to appendiceal constriction, bloody effusion | Retrograde appendectomy, segmental resection  |
| 9   | Yang [12]      | 2002 | M   | 19 mos.  | Sudden onset             | Abdominal pain, vomiting, atomic fluid       | Strangulated terminal ileum due to appendiceal constriction | Retrograde appendectomy                       |
| 10  | Assenza [1]    | 2004 | F   | 78       | 1                       | Crampy abdominal pain, vomiting, diarrhea    | Volvulus of ileum due to appendiceal constriction, bloody effusion | Ileocecal resection                           |
| 11  | O'Donnell [2]  | 2006 | F   | 83       | 3                       | Diffuse abdominal pain, vomiting             | Strangulation of bowel with chronically changing appendix | Retrograde appendectomy, segmental resection  |
| 12  | Bhandari [4]   | 2009 | M   | 24       | 7                       | Diffuse abdominal pain, intermittent temperatures, vomiting, constipation | Strangulated ileum due to appendiceal constriction, hemorrhagic effusion, loops were not necrotic | Retrograde appendectomy                       |
| 13  | Harrison [13]  | 2009 | F   | 62       | 4                       | Abdominal pain, nausea, vomiting            | Strangulated terminal ileum due to appendiceal constriction | Retrograde appendectomy                       |
| 14  | Harrison [13]  | 2009 | M   | 83       | 4                       | Right-sided abdominal pain, vomiting, constipation | Strangulated terminal ileum due to appendiceal constriction | Retrograde appendectomy                       |
| 15  | Chatterjee [3] | 2013 | M   | 26       | 2                       | Diffuse abdominal pain, vomiting, constipation | Strangulated terminal ileum due to appendiceal constriction, hemorrhagic effusion, gangrenous ileum | Ileocecal resection                           |
| 16  | Soriano [14]   | 2013 | F   | 66       | 1                       | LRQ abdominal pain, vomiting                | Strangulated terminal ileum due to appendiceal constriction | Retrograde appendectomy                       |
| 17  | Malý (current study) | 2013 | F   | 62       | 3                       | Crampy abdominal pain, vomiting, atomic fluids, constipation | Strangulated terminal ileum due to appendiceal constriction, incidental discovery of asymptomatic Meckel’s diverticulum | Retrograde appendectomy, prophylactic resection of Meckel’s diverticulum |

*a* Mos., months.

*b* LRQ, lower right quadrant.

*c* Ys, years.
unable to pass flatus and her last bowel movement had occurred five days prior. The patient’s past medical history included a hysterectomy, adnexectomy, and omentectomy for ovarian cancer 20 years prior; oncological follow-ups found no signs of disease recurrence. The patient was not taking any long-term medications, reported no allergies, and had a BMI of 23.7.

The patient was clinically afebrile with a bloated abdomen and upper abdominal pain expressed without signs of peritoneal irritation. A lower midline laparotomy scar was unremarkable and digital rectal examination findings were normal. Laboratory results showed no leukocytosis; however, C-reactive protein (CRP) was elevated (23 mg/L). X-ray imaging of the small-bowel ileum showed loop distention in the midline mesogastrium and fluid in the right epigastrium. Unclear clinical findings were supplemented with abdominal computed tomography (CT) imaging using an intravenous contrast medium, the results of which showed fluid-filled small-bowel loops dilated to 4.5 cm, ascites in the lesser pelvis, an evacuated colon and ileum, and a transition zone in the right hypogastrium (Fig. 2).

The patient was admitted to the Surgical Clinic and was indicated for immediate surgical intervention. Laparotomy revealed strangulation of the distal ileum by a fibrous band extending from the distal end of the appendix to the abdominal cavity wall (Fig. 3). The patient underwent adhesiolysis and ablation of an approximately 14 cm long appendix, as well as prophylactic resection for the incidental discovery of Meckel’s diverticulum. The strangulated ileum was vital and, thus, was not resected. Amoksiklav (amoxicillin/clavulanic acid) 1.2 g and Metronidazole 500 mg were administered intravenously during the procedure.

The postoperative course of hospitalization was uneventful; after 7 days the patient was discharged in good condition to home care. Histological findings showed signs of chronic appendicitis.

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Fig. 1. Mechanical bowel obstruction due to appendiceal constriction around terminal ileum loops.

Fig. 2. Computed tomography (CT) images of mechanical small-bowel obstruction.

Fig. 3. Intraoperative findings of strangulated ileum due to adhesions extending from the distal end of the appendix to the retroperitoneum and incidental discovery of asymptomatic Meckel’s diverticulum.
3. Methods

The keywords “(obstruction OR strangulation) AND (appendix OR appendicitis OR appendiceal)” were used to search the PubMed database for relevant studies that were published from 1963 to 2015. Additional relevant articles were obtained by searching the citations of the articles that were found initially.

All articles for which the abstract described a direct correlation between appendiceal inflammation and strangulation of the terminal ileum, and which also had availability of the full-text article; basic demographic data (patient sex and age); disease symptoms and length of duration; and intraoperative findings and type of surgical procedure, were included in the study. Our review also included a patient who underwent surgery at our department (see the Case Study section) since the case met all of the above-mentioned inclusion criteria.

Exclusion criteria included bowel obstruction caused by conditions other than acute or chronic appendiceal inflammation (e.g. appendiceal mucocele, Crohn’s disease, malignant diseases, concrements, or foreign bodies).

The original literature search found 190 articles; of these, we reviewed a total of 17 case studies from 13 articles (see Table 1).

4. Results

This retrospective literature review of the years 1963–2015 included a total of 17 patients (11 men and 6 women) with a mean age of 48 ± 23.9 years. The average period of time from symptom onset to surgery was 3.4 ± 3.7 days. Symptoms were variable, non-uniform, and consistent with small-bowel obstruction. Of the 17 patients, 7 patients underwent a simple appendectomy without bowel resection, 5 patients underwent segmental resection of the terminal ileum, 4 patients underwent ileocecal resection, and 1 patient underwent a right-sided hemicolectomy. One patient from the study group died from postoperative complications; the aforementioned patients had uneventful hospitalizations with no complications. None of the patients underwent long-term monitoring.

5. Discussion

Bowel obstruction is a common acute abdomen with multiple causes and it requires immediate intervention. An acute appendicitis is normally accompanied by varying degrees of bowel loop distention. Generally, this distention is the result of bowel paralysis; although, in rare cases it may even be caused by simple mechanical obstruction or ileal strangulation. Adhesive ileus, which is caused by adhesions during acute appendicitis, is also quite well-known [1,4]. However, very few cases of acute or chronic appendicitis directly causing mechanical bowel obstruction have been described in the literature (see Table 1), and our case report is one such case.

Appendicitis as a cause of bowel obstruction was first described in the literature in 1901, when Lucius Hotchkiss reported on 3 successful operations for bowel obstruction due to appendicitis at a New York Surgical Society Congress. In 1908, Forbes Hawks further divided these cases on the basis of mechanical obstruction, bowel paralysis, or a combination of the two. The first cases of bowel obstruction due to appendiceal strangulation or constriction were described in detail by Naumov [5] in 1963. Since that time, very few isolated cases of appendiceal strangulation or constriction have been published. Mechanical obstruction, with or without strangulation, results from the involved appendix pinching tightly around loops of the bowel, or adhesion of the distal end of the appendix to loops of the small bowel, cecum, or retroperitoneum. These formations create the circumstances for loops of the small bowel to herniate through the resultant ring-like structures, with or without strangulation [3].

Our case study confirmed that this complication is quite difficult to diagnose preoperatively. Initially, clinical symptoms were non-specific and variable, while disease progression was marked by symptoms of small-bowel obstruction. The role of abdominal computed tomography (CT) scans in patients with bowel obstruction has already been extensively described in the literature [6]. However, a conclusive diagnosis is most often determined during surgery.

An acute appendicitis is not exclusively a disease of young people; it is the second most common acute abdomen in patients ≥50 years of age, giving the disease a typical bimodal incidence distribution (Fig. 4) with a maximum peak in adolescence and a second, smaller peak in the elderly [7]. In the elderly, delayed treatment is the primary aggravating factor that impacts treatment outcome. Delayed diagnosis is caused by delayed patient admittance to the Emergency Department and stems from variable perceptions of pain in the elderly, difficulties in obtaining a complete patient history, or atypical symptoms.

Surgical management varies from simple appendectomy, to segmental and ileocecal resection, to a right-sided hemicolectomy, and is dependent upon the severity and extent of bowel loop involvement (see Table 1).

Mechanical bowel obstruction as a direct consequence of appendiceal inflammation remains a rare, but potentially life-threatening, acute abdomen that requires early diagnosis and surgical management.

6. Conclusion

We found that mechanical bowel obstruction in direct connection with appendiceal inflammation is an extremely rare, but potentially life-threatening, complication; and very few isolated cases have been documented in the literature. Clinical signs of the disease are variable and inconsistent, although symptoms during its progression are consistent with symptoms of small-bowel obstruction. Even though abdominal computed tomography (CT) scans can provide valuable information when a clinical examination is uncertain, a conclusive diagnosis typically has to wait until visualization during the surgical intervention.

Disclosures

The authors declare that they have no conflict of interest.
Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Authorship statement

All persons who meet authorship criteria are listed as authors, and all authors certify that they have participated sufficiently in the work to take public responsibility for the content, including participation in the concept, design, analysis, writing, or revision of the manuscript.

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Author contribution

Ondřej Malý – writing the paper, data collection and analysis, data interpretation.

Jiří Páral – study concept, data interpretation, revision of article.

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