

The Significance of Clinical Signs and Blood Indices for the Diagnosis of Appendicitis during Pregnancy

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Key Words

Appendicitis · Diagnosis · Pregnancy

Abstract

Objective: To evaluate the significance of clinical signs and blood indices for the diagnosis of appendicitis during pregnancy. **Sample:** Of the 40,112 women delivering at our institution (January 1995 to June 2002), 38 women (0.094%) were operated due to the suspicion of appendicitis during pregnancy. **Methods:** Body temperature, clinical examination, white blood cell counts and lag time from arrival to operation were obtained for each patient. All women were operated with the clinical diagnosis of appendicitis, and their appendices were removed and examined by a pathologist. **Results:** Inflammatory appendix was discovered in 19 (0.047%) of the pregnancies with subsequent deliveries while a normal appendix was found in 19 of the 38 (50%) appendices removed. The group with normal appendix did not significantly differ from women with inflamed appendix with regard to gestational age at presentation, signs of peritoneal irritation, body temperature, leukocyte count, time elapsed between arrival and surgery, gestational age at delivery and birth weight. **Conclusions:** The accurate diagnosis of appendicitis during pregnancy is a difficult task requiring a very high level of suspicion and clinical skills and not merely relying upon laboratory and classic signs.

Introduction

Acute appendicitis is the most common non-obstetric surgical complication occurring during pregnancy [1–4], with an incidence similar to that in non-pregnant women [5, 6], mostly during the second and third decades. The rate of perforated appendix is higher during pregnancy compared to non-pregnant cases (43 vs. 15%) [7], and it is associated with a considerable maternal morbidity and mortality, as well as significant fetal loss [1, 5–10].

Diagnosing appendicitis during pregnancy is a difficult task due to the altered appendix position, increased abdominal laxity, gestational symptoms (e.g. nausea and vomiting) and the inflammatory response in pregnancy, which may mimic acute appendicitis. Thus, in previous studies, diagnostic accuracy of appendicitis during pregnancy ranged from 53 to 86% [1, 2, 4].

Horowitz et al. [7] have emphasized the diversity of clinical presentation and difficulty in the diagnosis of acute appendicitis during pregnancy, especially near term. The most important symptom in their review was abdominal pain, which became less characteristic regarding its location and general description as pregnancy progresses. Other symptoms (nausea and vomiting), signs (body temperature and tachycardia) and laboratory tests (leukocytosis) failed to supply sufficient and specific diagnostic tools in the hands of the physician. They concluded that if there is a reasonable possibility of appendicitis during pregnancy, then early surgical intervention is indi-

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cated, taking into account few normal appendices removed (17%).

Andersen and Nielsen [11] investigated 56 case records of appendectomy during pregnancy, of which 75% had an inflamed appendix. Again, abdominal pain was the most consistent symptom, and no laboratory finding was found to be diagnostic. The authors stressed the importance of clinical judgment in deciding which patient needs operation, considering the paucity of diagnostic aids in diagnosing appendicitis during pregnancy. Tracy and Fletcher in their review of 19 cases of proven appendicitis during pregnancy re-emphasized the importance of the patient's history and physical examination in the decision-making regarding surgery.

The general agreement in the literature related to the lack of diagnostic tools on the one hand and to the severity of complications following delayed diagnosis on the other hand [3] prompted us to publish our experience in diagnosing acute appendicitis during pregnancy, in quest of the most valuable means for diagnosing this potentially detrimental condition.

The aim of this study was to evaluate the significance of several clinical signs, parameters and blood indices in the diagnosis of acute appendicitis during pregnancy.

Patients and Methods

Of the 40,112 women delivering at our institution between January 1995 and June 2002, we reviewed the medical charts of 38 consecutive women who were operated and had their appendix removed due to suspected acute appendicitis. All appendices removed were examined by a pathologist for signs of inflammation.

All women were admitted for evaluation at the pregnancy care unit. Each patient underwent a thorough physical examination performed by a surgeon, serial measurement of vital signs, blood studies (blood count and coagulation profile), 1-hour tocographs and fetal cardiac monitoring (from 25 weeks of gestation on), as well as ultrasonography.

Decision-making regarding surgery by the surgeon was based on the following features: considerable abdominal tenderness, signs of peritonitis, fever and white blood cell count. Retrospective data concerning gestational age, temperature, signs of peritonitis on admission, lag time between arrival and surgery and pregnancy outcome were obtained and compared between normal and inflamed appendices.

Patients suspected of having acute appendicitis are either operated on during the first few hours after admission (84%) or during the next day (16%). Women operated on immediately after admission were not given prophylactic antibiotics, whereas 3 of 6 women operated more than 24 h after admission received a combination of intravenous ampicillin, gentamycin and metronidazole.

Perinatal and neonatal outcomes were obtained for all women (and newborns) enrolled in the study. For 12 women, information on delivery was unavailable from our hospital, thus, data were collected

by telephone interviews according to a structured questionnaire. The data were analyzed by two tailed non-paired t test and Fisher's exact test where appropriate. All data were processed using the SPSS package (version 9.0; SPSS, Chicago, Ill., USA).

Results

In the 40,112 women delivering at our institution between January 1995 and June 2002, 38 appendectomies were performed during pregnancy. 19 of the 38 appendices removed had a pathology report consistent with acute inflammation (50%). The incidence of acute appendicitis during pregnancy was 1 in 2,111 women (0.047%). Women with appendicitis or normal appendix had the same age (27.4 ± 5.3 and 26.9 ± 3.7 years, respectively). Gestational age on the day of admission to the hospital was 18 ± 3.7 weeks, which did not significantly differ from that in women with a normal pathology report (14 ± 4.72 weeks). Most of the cases (66%) presented during the first half of pregnancy.

Table 1 depicts the symptoms and signs on admission and perinatal outcomes according to the existence of an inflamed appendix at laparotomy. In the few patients operated while having no signs of peritoneal irritation (3 of 38), appendicitis was suspected based on a typical history or laboratory results, and 2 of them had an inflamed appendix pathologically. There was no clinical sign or symptom indicating acute appendicitis and discerning it from other causes of apparently acute abdomen. The temperature exceeded 38°C at only two occasions of acute appendicitis and at two incidents of normal appendix. Elevation of the leukocyte count also failed to discriminate those having appendicitis, and furthermore, of the 2 cases with a leukocyte count $>30,000$, none had an inflamed appendix pathologically.

Pregnancy loss, preterm delivery and growth restriction were not more prevalent in the appendicitis group. Gestational age at delivery and birth weight (average: 3,302 g) as well as 5-min Apgar scores were similar between the two groups and comparable to the general population, suggesting a minor effect (if any) of the disease and operation on pregnancy outcome.

The lag time between arrival to the emergency room and laparotomy was significantly higher in the second half of pregnancy compared to the first half, being 11.6 and 7.7 h, respectively. Cases with inflamed appendices were operated within 9 ± 3.9 h, which is comparable to those with a normal appendix (8 ± 5.2 h).

Table 1. Symptoms and signs on admission and perinatal outcomes according to the existence of an inflamed appendix during laparotomy

| | Inflamed appendix (n = 19) | Normal appendix (n = 19) | Significance |
|------------------------------------|----------------------------|--------------------------|--------------|
| Right lower quadrant pain | 8 (42%) | 10 (52%) | NS |
| Nausea/vomiting | 14 (73%) | 15 (79%) | NS |
| Diffuse abdominal pain | 6 (31%) | 7 (37%) | NS |
| Peritoneal irritation | 17 (89%) | 18 (94%) | NS |
| PR temperature, °C | 37.5 ± 0.58 | 37.5 ± 0.75 | NS |
| WBC count, × 1,000/μl | 14.6 ± 4.43 | 15.26 ± 4.89 | NS |
| Gestational age at delivery, weeks | 38.9 ± 2.53 | 38.7 ± 2.04 | NS |
| Birth weight, g | 3,310 ± 604 | 3,296 ± 403 | NS |
| 5-min Apgar score | 9.1 ± 1.3 | 9.3 ± 1.2 | NS |

NS = Nonsignificant; WBC = white blood cell count; PR = per rectum. In the general population, gestational age at delivery is 39.1 weeks, birth weight 3,302 g and the 5-min Apgar score 9.15.

Discussion

Acute appendicitis is the most common non-obstetric surgical complication during pregnancy and is a diagnostic challenge for the physician. The incidence of acute appendicitis in our report is 1 in 2,111 deliveries, being consistent with previous reports by Andersen and Nielsen [11] (1 in 766) and Babaknia et al. [9] (1 in 2,700). Horowitz et al. [7] reported the lowest rate of 1 in 6,600. Most articles mention the well-established equal distribution of the disease throughout pregnancy [9, 13], but most studies in the English literature report a higher incidence during the first and second trimester [1, 3, 4, 10]. In our study, 66% of the surgical interventions due to suspected appendicitis were performed during the first half of pregnancy, and 60% of the inflamed appendices were removed during that period. The diagnostic accuracy of the primary diagnosis in our report (50% of appendices removed were actually inflamed) is not significantly lower than that (53–85% accuracy) reported earlier [7, 11, 14–16]. Discrepancies between accuracy rates may be attributable to the use of diagnostic laparoscopy (60%, 23 of 38, of the operative intervention in our study) compared to previous studies [10]. Diagnostic laparoscopy made the decision to turn to exploration much easier.

The diagnosis of acute appendicitis during pregnancy is challenging due to numerous compounding signs and symptoms common to both pregnancy and appendicitis, e.g. nausea, vomiting, loss of appetite and abdominal discomfort [1, 6, 13, 17–19]. Furthermore, the displacement of the appendix from the second trimester of pregnancy renders localization of referred pain from the inflamed

organ a difficult task by means of physical examination. The abdominal wall is lifted away from the appendix by the enlarged uterus, adding to the muscular laxity characteristic of pregnancy and leading to diminished irritation of the parietal peritoneum [1, 15, 19, 20]. Most authors agree that the most important symptom is abdominal pain [7, 17], turning less distinctive as pregnancy progresses in terms of localization and features of the pain. In our study, nearly all patients had abdominal pain or signs of peritoneal irritation whether their appendices were inflamed or normal. Nausea and vomiting are unreliable complaints during pregnancy, but the occurrence of vomiting and nausea after the first trimester warrants a thorough investigation [7, 17]. In our report, 73% of the patients with pathologically proven acute appendicitis had nausea and vomiting at presentation, but 79% of the patients whose appendices turned out to be normal after exploration had the same complaints. Anorexia which is considered by some [17] to be the pathognomonic symptom for acute appendicitis in the non-gravid is not so helpful during pregnancy, occurring in only 67% [21], and in a substantial number of pregnancies uncomplicated by appendicitis.

Signs of peritoneal irritation (e.g. rebound tenderness and muscle guarding) were the major determinants considered for an operative intervention, but they appeared in 94% of pregnant women having other causes of acute abdomen (normal appendices by pathology) and were absent in 11% of the patients with appendicitis who were operated due to abdominal pain with high fever and leukocytosis, lacking the classic signs of peritoneal irritation, probably due to the above-mentioned laxity of the ab-

dominal wall. Other studies report even lower percentages of rebound tenderness: 55 [21] and 70%, and guarding: 60% [17]. Interestingly, Kurtz et al. [22] found that the most reliable sign for the diagnosis of acute appendicitis is a positive Bryan's sign – abdominal pain produced by shifting the gravid uterus to the right. The elevation in body temperature is not considered helpful in diagnosing acute appendicitis, but may predict perforation [9, 13, 23]. In our study, the average temperature was 37.5°C for patients from both groups while only 2 patients in each group had a temperature exceeding 38°C, reinforcing previous publications.

Normal leukocyte counts range from 6,000 to 16,000 during pregnancy, rendering leukocytosis an unreliable predictor of appendicitis. The differential diagnosis of acute appendicitis during pregnancy includes numerous inflammatory conditions, all of which are characterized by an increased leukocyte count. In our report, the leukocyte count of patients with inflamed appendices (average: 15,260) was similar to that of patients with normal appendices (average: 14,600), while 8 patients in each group (42%) had a count above 16,000, once considered a predictor of acute appendicitis [1, 7].

Pregnancy complications are not uncommon after appendectomies, especially in the first trimester and when the organ is perforated or gangrenous [6, 11, 14]. The most encountered complication is spontaneous abortion, with a high rate of 33% reported by Andersen and Nielsen [11]. Few complications are reported after second- and

third-trimester appendectomies. The overall fetal loss after appendectomy for appendicitis was reported to be 7.1–8.7% [1, 9], and preterm delivery in the range of 15–45% [7, 21, 24], most of the complications occurring after an operation for perforated appendix, with no antibiotic treatment given at the time of diagnosis. In our report, no differences were encountered regarding gestational age at delivery, the number of deliveries prior to 36 weeks, birth weights and Apgar scores (the latter two parameters were compared to the general population). The lack of difference was not surprising considering only one perforated appendix, improved anesthetic techniques and the use of diagnostic laparoscopy, replacing explorative laparotomy.

Conclusion

Appendicitis, the most common non-obstetric surgical complication during pregnancy, has no single diagnostic symptom, sign or laboratory finding. The combination of symptoms (mainly abdominal pain, nausea and vomiting) with signs (mainly rebound tenderness) and the clinical judgment of the physician are vital in evaluating the possibility of acute appendicitis. Once a patient is considered for surgical intervention due to the suspicion of acute appendicitis, prophylactic antibiotics should be started immediately and exploration must not be delayed for fear of an adverse pregnancy outcome.

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