

Non-traumatic abdominal emergencies and pregnancy, difficult and high-risk situations

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Abstract

Introduction: non gynecological abdominal emergencies are rare and serious during pregnancy. The seriousness is related to the delay of the diagnosis because of polymorphic and often misleading symptomatology during pregnancy. Materiel and foetal prognosis are very serious because of the therapeutic delay. The aim of our study is to evaluate therapeutic methods dealing with non-gynecological abdominal emergencies during pregnancy.

Material and methods: an analysis of a series of 47 women patients whom have been taken in care for non-gynecological abdominal emergencies during pregnancy. The study was carried out in our university hospital between 2004 and 2014.

Results: Twenty-seven (27) of our patients had acute appendicitis, two had appendicitis peritonitis, six were hospitalized for occlusive syndrome on the bridle, one for volvulus of small bowel, three for herniation of the strangulated groin (2 inguinal hernias and 1 femoral hernia), another for strangulated umbilical hernia. One patient had mesenteric infarction and another had ulcerative colitis. Five patients were hospitalized for acute biliary pancreatitis (ABP). Two patients presented with syndrome of threat of preterm delivery with fever. The age of pregnancy ranged from 7 to 36 weeks of amenorrhea. Forty-two (42) of our patients were operated on. Two cases of premature delivery, two cases of abortion and one death have been reported

Discussion: Non-gynecological abdominal emergencies are dominated by appendicular and hepatobiliary pathology. The diagnostic difficulty lies in the non-specificity of clinical signs during pregnancy. Nausea, vomiting and transit disorders are the usual clinical signs during pregnancy.

Conclusion: Non-gynecological abdominal emergencies during pregnancy are a difficult and delicate situation, requiring multidisciplinary and early management, in order to avoid fetal and maternal complications.

Keys words: non gynecological abdominal emergencies, pregnancy, surgery, laparoscopy

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I. Introduction

Non-gynecological abdominal emergencies are rare during pregnancy. This is a serious association that involves maternal and fetal prognosis. The seriousness is related to the delay of the diagnosis because of polymorphic and often misleading symptomatology during pregnancy. Clinical presentations may be atypical and ambiguous because of pregnancy is associated with anatomical and physiological changes. These patients should be referred to specialized centers where surgical, obstetrical and neonatal cares are available, particularly because surgical intervention increases the risk of premature labor. The most common abdominal emergencies are acute appendicitis, acute calculous cholecystitis, intestinal obstruction and acute pancreatitis. The aim of our study is to evaluate the therapeutic modalities of non-gynecological abdominal emergencies in pregnant women.

II. Material et methods

Between January 2004 and December 2014, forty-seven pregnant patients with non-gynecological abdominal emergencies were enrolled in the general surgery department (Table I). The average age of our patients was 27.5 years [20 - 45 years]. Twenty-nine (29) of our patients had acute appendicitis, two of which had appendicular peritonitis; six were hospitalized for occlusive syndrome due to adhesion, one for volvulus of small bowel, three for herniation of the strangulated groin (2 inguinal hernias and 1 femoral hernia), and another for strangulated umbilical hernia. One patient had mesenteric infarction and another had ulcerative colitis. Five patients were hospitalized for acute pancreatitis. Fourteen patients (30%) were in the first trimester, twenty-three (49%) in the second trimester and ten (21%) patients in the third trimester. The mean age of pregnancy was 20 weeks \pm 3 days [7-36 weeks]. All our patients were symptomatic. The consultation time ranged from 10 to 8

days for patients with acute appendicitis, 2 to 4 days for patients with acute intestinal obstruction and 3 to 5 days for patients with acute pancreatitis. The clinical picture was dominated by abdominal pain and fever, present in patients who had acute appendicitis, diffuse abdominal pain with occlusive syndrome in patients with intestinal obstruction and pain of the right upper quadrant (RUQ) in patients with acute pancreatitis. Abdominal ultrasound was done in patients with a clinical picture of acute appendicitis. it shown an acute appendicitis appearance in 17 patients, was not conclusive in 7 patients and diffuse peritonitis in 5 cases. Moreover, the abdominal ultrasound had found gallbladder stone in patients with acute pancreatitis.

Table I: Distribution of non-gynecological abdominal emergencies in pregnant women

Digestive Emergencies	NUMBER
Acute appendicitis and its complications	29
Acute intestinal obstruction (bridle, volvulus)	7
Strangulated hernia (inguinal, femoral, umbilical)	4
Acute Pancreatitis	5
Mesenteric infarction	1
Ulcerative colitis	1
Total	47

Best management of women presenting with acute abdominal pain during pregnancy requires a handy collaboration between surgeons, obstetricians and radiologists. In the 1st trimester of pregnancy, the uterus remains within the pelvis but it becomes intra-abdominal thereafter as the uterus enlarges [1]. Physiologic changes during pregnancy allow for the development and evolution of the fetus adaptation of the mother to pregnancy and her preparation for labor and delivery. A detailed understanding of the normal physiology of the pregnant woman is necessary in order to appreciate any eventual pathological modifications [2, 3].

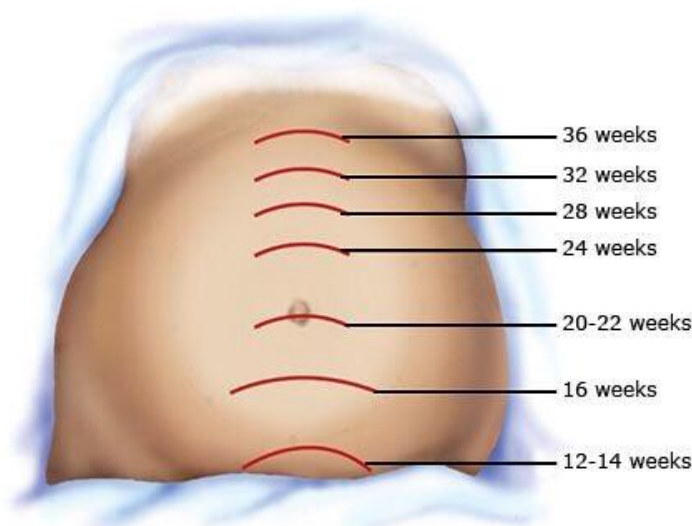


Figure 1. Uterine height as a function of gestational age (From a geek in white coat journal)

III. Results:

Abdominal pain during pregnancy is a common cause for consultation, though with unpredictable degrees of firmness. The diagnostic suggestions should be ordered, without forgetting the patient's medical history and the term of pregnancy. Gynecological and obstetrical conditions that may potentially cause abdominal pain must be considered and rapidly diagnosed to allow prompt suitable care. The physician taking care of a pregnant woman must consider the gynecological and obstetrical etiologies of acute abdominal pain. These causes apart, the main causes of abdominal emergency during pregnancy are acute appendicitis, acute cholecystitis, bowel obstruction, acute pancreatitis.

Acute appendicitis

Acute appendicitis is the most common surgical emergency during pregnancy with an estimated incidence of 0.5—2 per 1000 pregnant women, i.e., 25% of all non-obstetrical surgical emergencies [4]

All patients with clinical presentation of acute appendicitis were operated (29 patients) and received intravenous Amoxicillin (3 g / 24h) for the first 48 hours, followed by oral antibiotic therapy with Amoxicillin (3 g / 24 h) for one week. Only patients in the second and third trimesters of pregnancy were tocolated (tocolytics) with salbutamol. The patients were operated with a delay of 6 to 72 hours. Twenty-four were treated by Mac Burney's incision and five by the median line incision. The per-operative exploration had found in all our patients an aspect of acute appendicitis. They all had appendectomy, with drainage in both patients with appendicular peritonitis. Histologically, it was phlegmonous appendicitis in twenty-one patients, catarrhal appendicitis in four cases and gangrenous appendicitis in two cases and finally perforated appendicitis in two other cases.

Intestinal obstruction

The seven patients with clinical presentation of acute intestinal obstruction were all operated by median laparotomy, with a delay of 1 to 5 days. Intra-operative exploration found fluids in peritoneal cavity in six patients and volvulus of small bowel in one patient. All six patients underwent resection and distortion of volvulated intestinal loop. The four patients with strangulated hernia were all operated after 3-6 hours of admission. Three of them benefited from raphie according to the technique of Mac Vay and another of simple herniorrhaphy procedure by separated points using the non-absorbable thread. The 34-year-old patient with 17-week pregnancy and history of heart disease (Arrhythmia) was operated 2 hours after hospitalization in a clinical picture of acute intestinal obstruction. Intra-operative exploration found a very extensive mesenteric infarction. No surgical procedure was performed. The patient died immediately postoperatively. The other patient with a history of ulcerative colitis, with a pregnancy of 37 weeks was operated in emergency for colectasia after giving birth. Subtotal colectomy was performed with restoration of digestive continuity. The evolution was good

Acute cholecystitis

Estimates of occurrence of acute cholecystitis vary widely. The case-to-delivery ratio ranges from 1:1130 to 1:12,890 [5, 6]. Asymptomatic gallbladder disease is more common, occurring in 3-4% of pregnant women. Gallstones are present in more than 95% of patients with acute cholecystitis. Chronic hemolytic conditions, such as sickle cell disease, increase the risk for gallstone formation. [7]

Acute biliary pancreatitis

Finally for the five patients with acute biliary pancreatitis, the evolution under medical treatment was satisfactory. Laparoscopic cholecystectomy was performed after delivery

IV. Discussion

Acute abdomen is "any serious acute intra-abdominal condition attended by pain, tenderness, and muscular rigidity, and for which emergency surgery must be considered.. Abdominal pain during pregnancy presents unique clinical challenges. First, the differential diagnosis during pregnancy is extensive, in that the abdominal pain may be caused by obstetric or gynecologic disorders related to pregnancy, as well as by intraabdominal diseases incidental to pregnancy [8]

Any cause for acute abdomen can occur coincident with pregnancy. Some clinical conditions are more likely to occur in pregnancy. Other conditions are specific to pregnancy. Thus, a wide range of possible differential diagnoses should be considered.

The approach to pregnant patients with severe abdominal pain is very similar to that for non-pregnant patients with acute abdomen. However, the physiologic changes associated with pregnancy must be considered when interpreting findings from the history and physical examination. Appendicitis is the most common nonobstetric cause of surgical emergency in pregnancy. The case-to-delivery ratio ranges from 1:2000 to 1:6000. [9, 10, 11, 12] Pregnancy does not affect the overall incidence of appendicitis, but the severity may be increased in pregnancy. The incidence of perforation is 25% in pregnancy. If surgery is delayed for more than 24 hours, the incidence of perforation increases to 66%. [13] Appendicitis seems to be more common in the second trimester. [14, 15, 16]

In this study, acute appendicitis represents the most common non-obstetric and non-traumatic surgical emergency during pregnancy with a frequency of 62%. Most authors have made the same observation and report equivalent frequencies ranging from 33.3% to 66.5% [17, 18]. Its incidence is 0.02 to 0.05% in Western series [19]. It is around 0.2% in our series. Pregnancy does not change the overall incidence of appendicitis, but the severity of this surgical condition can be increased in pregnancy. Appendicitis appears to be more common in the second trimester [20, 21]. In pregnancy, the WBC count is often as high as 15,000/ μ L. However, the wide reference range limits the usefulness of WBC counts during pregnancy [12]. Severe disease can occur with a normal count. Polymorph nuclear leukocytes are often greater than 80% when appendicitis is present..

Appendicitis appears to be more common in the second trimester [20, 23]. The difficulty diagnosis of Acute Appendicitis (AA) in pregnancy depends on the gestational age. Thus, in the first trimester, the clinical picture is that of a classical AA [24]. Abdominal pain is the most consistent sign. It has been found in all patients of this series. This pain may lead to the discussion of a threat of early abortion or urinary tract infection, hence the value of an obstetric examination [19, 25]. In the second and third trimesters, the diagnosis is more difficult, because of the high situation of the cecum and, on the other hand, because of the presence of uterine contractions evoking a threat of childbirth premature and may delay or even mislead the diagnosis [26,27].

The contribution of the pelvic & abdominal ultrasound is certain in these situations of difficult diagnosis. Thus, it has a double interest:

- Diagnostic value: to show ultrasound images suggestive of acute appendicitis, and to eliminate other surgical and obstetrical emergencies;

- Prognostic interest: information on fetal vitality.

In our patients, ultrasonography examination was an excellent contribution in confirming the diagnosis of acute appendicitis in the first trimester in all cases. In the first trimester, the sensitivity of the ultrasound is about 100% and its specificity of 95%. In the second and third trimesters, it is hampered by uterine volume [28, 29].
“Fig 2”

Treatment of appendicitis is surgical. Achieve appendectomy, either open or laparoscopic, as soon as the diagnosis is seriously considered. (Laparoscopic appendectomy is the gold standard method preferred by most surgeons.) Laparoscopic surgery can be used until the 20th week of amenorrhea. It has several advantages: it reduces uterine manipulation, reduces doses of anesthetic products, reduces the length of hospital stay and does not modify morbidity [30]. Even if the appendix appears normal, there are two reasons to remove it. First, early disease may be present despite the grossly normal appearance; and second, diagnostic confusion can be avoided if the condition recurs [31, 32]. The effectiveness of tocolysis has not been demonstrated. Some authors advocate it from the end of the first trimester to the end of the 34th week of amenorrhea. Antibiotic therapy is always indicated as soon as the diagnosis of appendicitis is strongly higher. It is a broad spectrum antibiotic, active on GNB and anaerobes [33, 34]



Fig 2:Ultrasound Examination of a 27 year old woman with acute appendicitis and pregnancy of 19 weeks showing:

- 1 -Latérocaecal swollen Appendix measuring 10 mm with thick periappendicular fat with no intraperitoneal fluid
- 2- Singleton ongoing pregnancy with positive fetal cardiac activity

Perforation and abscess formation are more likely to occur in pregnant patients with appendicitis than in non-pregnant patients with appendicitis [35]. Some researchers have reported increasing severity in the third trimester, [14]. Whereas others have not. [12, 22]. Any increase in severity later in pregnancy may be due to a delay in diagnosis. The rate of generalized peritonitis relates directly to the interval of time from symptom onset to diagnosis. Maternal and fetal morbidity and mortality increase once perforation occurs [22].

Intestinal occlusion rarely complicates the course of a pregnancy. It represent the third digestive cause of laparotomy during pregnancy. The case-to-delivery ratio ranges from 1:3600 to 1:5700 [36]. The frequency of this condition is increasing due to a higher incidence of intra-abdominal surgery. Intestinal obstruction rarely occurs during the first trimester and occurs with equal frequency in the second and third trimester and the puerperium. Simple obstruction is the most common type of intestinal obstruction and is most likely due to prior surgery and adhesions. Volvulus is the second most common etiology and is also predominantly due to

adhesions. [37]. Small intestinal and cecal or sigmoid volvulus has been reported in the absence of prior adhesions. Increased mobility of the bowel and displacement of the bowel into the upper abdomen by the growing uterus are implicated in these cases. Intussusception is less common, and incarcerated inguinal or femoral hernia and carcinoma are extremely rare.

In our study, acute intestinal obstruction accounts for 15%. Its actual incidence is not known and varies considerably from one series to another. The distribution during pregnancy is as follows: 6% in the first trimester, 27% in the second, 44% in the third and 21% during the postpartum period. The obstruction due to adhesions is the main cause with a frequency close to that of the general population (55-60% against 64 and 79%). They represent n about 85% of cases. Other etiologies include: colon volvulus (25%) with a majority of sigmoid involvement, acute intestinal intussusceptions (5%), hernias (1.4%), appendicitis (0.5%), and cancer (3.7%). Diagnosis of intestinal obstruction is still difficult to establish early in pregnancy, and clinical signs are often attributed to a threat of preterm labor. Biological signs are nonspecific and the positive diagnosis is based, in 50% of cases, on abdominal x-ray [38, 39].

Abdominal pain is observed in 90% of patients and may be constant or periodic, mimicking labor. Pain may radiate to the flank, imitating pyelonephritis. The severity of pain may not reflect the severity of disease. Vomiting is a highly variable symptom. If the obstruction is more proximal, vomiting occurs earlier in the course. Severe obstruction can be present with no vomiting. Constipation is different from the usual constipation in pregnancy. Patients experience a complete cessation of stool and flatus. [40]. Dilated small bowel loops with dynamic air-fluid levels are present on plain abdominal X-ray in 82% of patients with an obstructive syndrome [41]. Abdominal X-ray can make the diagnosis of cecal volvulus with a sensitivity of 95%. If bowel obstruction is still suspected despite the absence of typical findings on plain X-ray, contrast-enhanced imaging (abdominal X-ray after oral Gastrografin or CT with IV contrast) may be necessary. The potential risks of fetal irradiation are largely offset by potential risks of maternal and fetal morbidity and mortality. Obstetrical USE and monitoring usually eliminate an associated obstetric or gynecological pathology. The CT scan is a gold standard exam in the exploration of occlusive syndromes in pregnant woman (Figure 3). Regarding its radiating character, it should be substituted, whenever possible, by a non-ionizing imaging technique. This is essential during the period of organogenesis. [21, 22].

Treatment is surgical, just as it is for patients who are not pregnant. Management of the obstruction includes the following:

- Correction of fluid and electrolyte imbalances - Fluid management is critical during pregnancy because uterine blood flow depends on normal maternal blood volume
- Decompression of the bowel
- Aid in relief of the obstruction
- Resection of nonviable tissue
- A midline abdominal incision is optimal

Intestinal obstruction is a serious complication in pregnancy, with maternal mortality in the range of 10-20%. Perinatal mortality is in the range of 20-30%. [42].



Figure 3 showing: Small bowel obstruction due to an adhesion in pregnant women at the second trimester.

Gallbladder disease, particularly acute cholecystitis, is the second leading cause of non-obstetrical abdominal emergency after appendicitis. Its incidence is one per 1600–10,000 pregnancies. Biliary stones are more common during pregnancy (16%) than in non-pregnant women (1.6% to 2%). This high incidence is explained by a decrease in bile flow, which is responsible for an increase in cholesterol levels and a decrease in the rate of chenodeoxycholic acid; the biliary stasis is itself aggravated by the mechanical factor represented by the biliary compression by the uterus [43]. Asymptomatic gallbladder disease is more common, occurring in 3-4% of pregnant women. Gallstones are present in more than 95% of patients with acute cholecystitis. Chronic hemolytic conditions, such as sickle cell disease, increase the risk for gallstone formation. [44]. Patients may have a history of previous episodes. Right upper quadrant pain is the most reliable symptom; pain may radiate to the back. Vomiting occurs in approximately 50% of cases, whereas fever occurs in very few instances. Direct tenderness is usually present in the right upper quadrant; rebound tenderness is rare. Cholecystitis can mimic appendicitis in the third trimester. However, Murphy's sign is less relevant in advanced-stage pregnancy. The differential diagnosis includes numerous conditions and one must consider obstetric pathology such as gestational acute fatty liver, either *denovo* or due to HELLP syndrome complicating pre-eclampsia. The differential diagnosis also includes acute appendicitis, preeclampsia, acute hepatitis, acute pancreatitis, peptic ulcer, acute right-sided pyelonephritis, or right basilar pneumonia. When interpreting laboratory findings, it is important to remember that an elevated alkaline phosphatase level is physiological during pregnancy. Ultrasound is the diagnostic modality of choice because it is non-invasive, non-irradiating, readily available, and has 95–

98% sensitivity for detection of gallstones [44]. Conventional criteria for ultrasound diagnosis of acute cholecystitis include sonographic Murphy's sign, presence of cholelithiasis, increased gallbladder size (>4cm), gallbladder sludge, thickening of the gallbladder wall (>4mm), and fluid around gallbladder. Dilatation of the intra- or extrahepatic bile ducts suggest the diagnosis of choledocholithiasis. [45].

Management of symptomatic cholelithiasis is controversial. Some recommend initial non-operative treatment, while others favor early surgical treatment. [13]. Initial non-operative treatment, as follows, is supportive in nature: Intravenous fluids, nasogastric suction - This may be necessary if vomiting has been significant, analgesia - Demerol is preferred over morphine; morphine may produce spasm of the sphincter of Oddi and antibiotics - If symptoms persist or if systemic or local signs are prominent, initiate broad-spectrum antibiotics [46]. Surgery is the first-line of treatment. It reduces the use of medications and avoids recurrent bouts of cholecystitis that occur in 44–92% of medically treated patients depending on the pregnancy stage and length of time to term. Surgery reduces the length of stay and avoids the onset of serious complications such as sepsis or perforation with peritonitis. Furthermore, symptomatic cholelithiasis is associated with a 10% risk of acute gallstone pancreatitis and a 10–20% risk of miscarriage [47]. Non-surgical management is also associated with a higher incidence of spontaneous abortion, threatened abortion, and premature birth when compared to patients who underwent cholecystectomy [48]. Laparoscopy is the recommended approach up to the beginning of the 3rd trimester. Maternal mortality with laparoscopic cholecystectomy is not increased by the pregnancy [49].

Acute biliary pancreatitis: Acute pancreatitis occurs more often in the third trimester of pregnancy, with 53% of biliary acute pancreatitis (BAP) diagnosed after the 28th week of amenorrhea, versus 26% in the second trimester and 19% in the first trimester [43]. The incidence of acute pancreatitis during pregnancy is approximately 0.3–1 per 1000 pregnant women. In the general population, 80% of acute pancreatitis is due to gallstones, during pregnancy, cholelithiasis is by far the most common etiology, accounting for 67–100% of cases [43]. The diagnosis of acute pancreatitis in pregnancy is also difficult to make because the typical symptoms including sudden severe epigastric pain irradiating to the back, with nausea and post-prandial vomiting, ± fever can also evoke a serious obstetric complication such as retro-placental hematoma, or a complication of preeclampsia or HELLP syndrome that warrants an emergency cesarean section. Elevation of lipase level to three times normal strongly supports the diagnosis. Ultrasound is the “Gold standard” imaging study and should be complemented by MRI to assess severity according to the usual criteria; antibiotic prophylaxis must be considered for severe forms assessed by the SIRS “systemic inflammatory response syndrome”. Management is the same as for non-pregnant patients (NPO), with IV fluids, electrolyte, and vitamin replacement in an intensive care unit, with monitoring of the fetal heart rate.

Most patients respond to medical treatment within a few days and cautious feeding can be allowed by the fourth day. Management decisions following resolution of an acute episode are more delicate and depend on the stage of pregnancy, particularly because the recurrence rate of acute gallstone pancreatitis in pregnant women is 70% (90% during the initial) versus 20–30% for the general population [50]. Surgery should be avoided during the 1st trimester, while laparoscopic cholecystectomy should be considered in the 2nd trimester. In the 3rd trimester, endoscopic retrograde cholangiopancreatography (ERCP) with sphincterotomy is a safe and effective alternative that allows deferral of cholecystectomy until after childbirth

[51]. Indeed, the rate of premature birth is almost zero when cholecystectomy is performed in the 2nd trimester, but approaches 40% in the 3rd trimester. In the 1970s, the fetal mortality rate was 37%; nowadays, thanks to earlier diagnosis and better neonatal care, perinatal mortality is less than 5% [52, 53]. In 1973, the prognosis of ABP was still very severe, with fetal & maternal mortality estimated at 37%. With a reduction in diagnostic delay and progress in neonatal resuscitation, mortality is currently significantly lower. The mortality of acute pancreatitis is also related to its cause, that of alcoholic pancreatitis being three times higher. [54]. In our series, all the patients evolved well under medical treatment and were all operated after their deliveries. In non-emergency situations, the second trimester is the ideal time to perform cholecystectomy. Indeed, the risk of miscarriage is reduced by half, from 12% (in the first trimester) to 5.6%; likewise, the rate of premature delivery is 0%, compared to 40% when the intervention is in the third trimester. The various considerations (mainly the very high risk of recurrence) should lead to prefer an attitude adapted to the clinical and morphological situation, also taking into account the term of recurrence of this complication. [23].

V. Conclusion

Non-gynecological abdominal emergencies during pregnancy are difficult with high risk situation requiring multidisciplinary and early management, to avoid fetal and maternal complications. Abdominal pain is a common cause of consultation during pregnancy and constitute the main complain symptom. Clinical presentations may be atypical and ambiguous because of pregnancy is associated with anatomical and physiological changes. Laparoscopy is usually a real approach. The risk of spontaneous or induced premature delivery should be anticipated as much as possible with the implementation of a management strategy to reduce antenatal complications.

References

- [1]. Kamina P. Anatomie clinique: thorax abdomen pelvis. Vol. 3. 2nd ed. Paris: Maloine; 2009.
- [2]. Cabrol D, Pons J, Goffinet F. Traité d'obstétrique. Paris, France: Médecine-Sciences Flammarion; 2003 [ISBN 2-257-12429-4].
- [3]. Fournier A, Laffitte A, Parant O, et al. Modifications de l'organisme maternel au cours de la grossesse. In: EMC Gynécologie-obstétrique; 1999 [5-008-A-10].
- [4]. Miloudi N, Brahem M, Ben Abid S, Z. Mzoughi, N. Arfa, M.T. Khalfallah. Acute appendicitis in pregnancy: specific features of diagnosis and treatment. *J Visc Surg* 2012; 149(4):e275-9.
- [5]. Hill LM, Johnson CE, Lee RA. Cholecystectomy in pregnancy. *Obstet Gynecol*. 1975 Sep. 46(3):291-3.
- [6]. Landers D, Carmona R, Crombleholme W, Lim R. Acute cholecystitis in pregnancy. *Obstet Gynecol*. 1987 Jan. 69(1):131-3.
- [7]. Ko CW, Beresford SA, Schulte SJ, et al. Incidence, natural history, and risk factors for biliary sludge and stones during pregnancy. *Hepatology*. 2005 Feb. 41(2):359-65
- [8]. Powers RD, Guertler AT. Abdominal pain in the ED: stability and change over 20 years. *Am J Emerg Med*. 1995; 13:301-3
- [9]. Sivanesaratnam V. The acute abdomen and the obstetrician. *Baillieres Best Pract Res Clin Obstet Gynaecol*. 2000 Feb. 14(1):89-102
- [10]. Gomez A, Wood M. Acute appendicitis during pregnancy. *Am J Surg*. 1979 Feb. 137(2):180-3.
- [11]. Horowitz MD, Gomez GA, Santiesteban R, Burkett G. Acute appendicitis during pregnancy. Diagnosis and management. *Arch Surg*. 1985 Dec. 120(12):1362-7.
- [12]. Bailey LE, Finley RK Jr, Miller SF, Jones LM. Acute appendicitis during pregnancy. *Am Surg*. 1986 Apr. 52(4):218-21.
- [13]. Jackson H, Granger S, Price R, Rollins M, Earle D, Richardson W. Diagnosis and laparoscopic treatment of surgical diseases during pregnancy: an evidence-based review. *Surg Endosc*. 2008 Jun 14.
- [14]. Cunningham FG, McCubbin JH. Appendicitis complicating pregnancy. *Obstet Gynecol*. 1975 Apr. 45(4):415-20
- [15]. Ankouz A, Ousadden A, Majdoub KI, Chouaib A, Maazaz K, Taleb KA. Simultaneous acute appendicitis and ectopic pregnancy. *J Emerg Trauma Shock*. 2009 Jan. 2(1):46-7.
- [16]. EJ, Boonstra O, van der Harst E. Concurrent tubal ectopic pregnancy and acute appendicitis. *J Minim Invasive Gynecol*. 2008 Jan-Feb. 15(1):97-8.
- [17]. Marret H, Laffron H, De Calan L, Bourlier LP, Lansac J. Urgences chirurgicales au cours de la grossesse. *Encycl Med Chir, Gynécologie Obstétrique*, 5-049-D10, 2000, 13P.
- [18]. Chambon JP, Quandalle P. les urgences abdominales non gynécologique durant la grossesse. *Ann Chir* 1986 ; 4 ; 455-61.
- [19]. Leroy JL. L'appendicite aiguë au cours de la gravidité: les difficultés du diagnostic et du traitement. *Med Chir Dig* 1981 ; 10 : 143-7.
- [20]. Eryilmaz R, Sahin M, Bas G, et al (2002) Acute appendicitis during pregnancy. *Dig Surg* 19(1):40-4
- [21]. Andersen B, Nielsen TF (1999) Appendicitis in pregnancy: diagnosis, management and complications. *Acta Obstet Gynecol Scand* 78(9):758-62
- [22]. Babaknia A, Parsa H, Woodruff JD. Appendicitis during pregnancy. *Obstet Gynecol*. 1977 Jul. 50(1):40-4
- [23]. Andersen B, Nielsen TF (1999) Appendicitis in pregnancy: diagnosis, management and complications. *Acta Obstet Gynecol Scand* 78(9):758-62.
- [24]. Lemine M, Collet M, Brettes JP. Urgences abdominales et grossesse. *Rev Fr Gynecol Obstet* 1994 ; 89 : 553-9.
- [25]. Duffour P, Delebercq T, Vinatier D, Haentjens Verbeke K, Tordjeman N, Monnier C et al. Appendicite et grossesse à propos de 7 observations. *J Gynecol Obstet Biol Reprod* 1996 ; 25 : 411-5.
- [26]. Sakhri J, Youssef S, Ben Letaifa D, et al (2001) Acute appendicitis during pregnancy. *Tunis Med* 79 (10):521-5.
- [27]. Kazim SF, Pal KM (2009) Appendicitis in pregnancy: experience of thirty-eight patients diagnosed and managed at a tertiary care hospital in Karachi. *Int J Surg* 7(4):365-7. Epub 2009 Jun 13.
- [28]. Lim HK, Bae SH, Seo GS (1992) Diagnosis of acute appendicitis in pregnant women: value of sonography. *AJR Am J Roentgenol* 159(3):539-42.
- [29]. Maslovitz S, Gutman G, Lessing JB, et al (2003) The significance of clinical signs and blood indices for the diagnosis of appendicitis during pregnancy. *Gynecol Obstet Invest* 56(4):188-91. Epub 2003 Oct 23.

- [30]. Chloptsios C, Stamatou K, Kavouras N, et al (2007) Appendicitis in pregnancy: a case report and a review of the current literature. *ClinExpObstetGynecol* 34(2):115–6.
- [31]. Lau WY, Fan ST, Yiu TF, et al. The clinical significance of routine histopathologic study of the resected appendix and safety of appendiceal inversion. *SurgGynecol Obstet.* 1986 Mar. 162(3):256-8.32- Wu JM, Chen KH, Lin HF, et al. Laparoscopic appendectomy in pregnancy. *J LaparoendoscAdvSurg Tech A.* 2005 Oct. 15(5):447-50
- [32]. Kruszka PS, Kruszka SJ (2010) Evaluation of acute pelvic pain in women. *AmFam Physician* 82(2):141–7.
- [33]. Borst AR (2007) Acute appendicitis: pregnancy complicates this diagnosis. *JAAPA* 20(12):36–8, 41.
- [34]. Finch DR, Lee E. Acute appendicitis complicating pregnancy in the Oxford region. *Br J Surg.* 1974 Feb. 61(2):129-32.
- [35]. Goldthorp WO. Intestinal obstruction during pregnancy and the puerperium. *Br J ClinPract.* 1966 Jul. 20(7):367-76
- [36]. Gaikwad A, Ghongade D, Kittad P. Fatal midgut volvulus: a rare cause of gestational intestinal obstruction. *Abdom Imaging.* 2009 May 7..
- [37]. Watanabe S, Otsubo Y, Shinagawa T, Araki T. Small bowel obstruction in early pregnancy treated by jejunotomy and total parenteral nutrition. *ObstetGynecol* 2000;96:812–3.
- [38]. Connolly M, Unti JA, Nora PF. Bowel obstruction in pregnancy. *SurgClin North Am* 1995; 75:101–13.
- [39]. Davis MR, Bohon CJ. Intestinal obstruction in pregnancy. *ClinObstet Gynecol.* 1983 Dec. 26(4):832-42.
- [40]. PerduePW, JohnsonJrHW, StaffordPW. Intestinal obstruction complicating pregnancy. *AmJSurg* 1992;164(4):384–8.
- [41]. Beck WW Jr. Intestinal obstruction in pregnancy. *Obstet Gynecol.* 1974 Mar. 43(3):374-8.
- [42]. Ramin KD, Ramin SM, Richey SD, et al. Acute pancreatitis in pregnancy. *Am J ObstetGynecol* 1995; 173: 187-91.
- [43]. Ko CW, Beresford SA, Schulte SJ, et al. Incidence, natural history, and risk factors for biliary sludge and stones during pregnancy. *Hepatology.* 2005 Feb. 41(2):359-65.
- [44]. J.BouyouS, Gaujoux L, Marcellin M, Leconte F, Goffinet C, Chapron B, Dousset M. Abdominal emergencies during pregnancy. *Journal of Visceral Surgery* (2015) 152, S105–S115
- [45]. Hiatt JR, Hiatt JC, Williams RA, Klein SR. Biliary disease in pregnancy: strategy for surgical management. *Am J Surg.* 1986 Feb. 151(2):263-5
- [46]. Scott LD. Gallstone disease and pancreatitis in pregnancy. *Gastroenterol Clin North Am* 1992;21(4):803–15.
- [47]. Curet MJ. Special problems in laparoscopic abdominal surgery, obesity, and pregnancy. *Surg Clin North Am* 2000;80(4):1093–110. surgery. Previous
- [48]. Cosenza CA, Saffari B, Jabbour N, et al. Surgical management of biliary gallstone disease during pregnancy. *AmJSurg* 1999;178(6):545–8.
- [49]. Swisher SG, Schmit PJ, Hunt KK, et al. Biliary disease during pregnancy. *AmJSurg* 1994;168(6):576–9 [discussion 580–1].
- [50]. Jamidar PA, Beck GJ, Hoffman BJ, et al. Endoscopic retrograde cholangiopancreatography in pregnancy. *AmJ Gastroenterol* 1995;90(8):1263–7.
- [51]. Stimac D, Stimac T. Acute pancreatitis during pregnancy. *Eur J Gastroenterol Hepatol* 2011;23(10):839–44.
- [52]. Ducarme G, Maire F, Chatel P, et al. Acute pancreatitis during pregnancy: a review. *J Perinatol* 2014;34(2):87–94.
- [53]. Wilkinson EJ. Acute pancreatitis in pregnancy: a review of 98 cases and report of 8 new cases. *ObstetGynecolSurv* 1973 ; 28 : 281-303.

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