



Review Article

Surgical emergencies in pregnancy in the era of modern diagnostics and treatment

Ramanuj Mukherjee ^{a,*}, Sudipta Samanta ^b^a Department of Surgery, R.G.Kar Medical College and Hospital, India^b R.G.Kar Medical College and Hospital, India

ARTICLE INFO

Article history:

Accepted 21 November 2018

Keywords:

Appendicitis
Ectopic pregnancy
Pregnancy
Surgical emergency

ABSTRACT

Pregnancy can be complicated with different surgical emergencies which may potentially endanger the mother as well as foetus. In the modern era of advanced diagnostics and treatments, neither of them in response to a surgical emergency in a pregnant woman should be delayed. Appropriate early intervention is essential to decrease the morbidity and mortality. Following article encompasses common surgical emergencies that can arise in a pregnant woman and tries to suggest the approach that may be taken to reduce the burden of morbidity and mortality.

© 2019 Taiwan Association of Obstetrics & Gynecology. Publishing services by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Introduction

Surgical emergency is described as any condition requiring a nonelective surgical procedure 'without any delay' to manage an acute threat to life, organ, limb or tissue caused by any external or internal trauma, disease process or other surgical interventions [1]. The term 'surgical emergency' is usually addressed for the severity of symptoms rather than the need of a non-elective surgical intervention. No exact time frame has been provided to define 'without any delay'. Though, usually a surgical emergency requires intervention within 24 h [1], some surgical emergencies could be delayed beyond this by conservative management for an elective surgery later on.

Incidence and indications

Incidence of emergency non-obstetrical abdominal surgeries in gynaecological practice is 1 in 635 during pregnancy [2].

The indications can be categorised as (Table 1).

1. Non-Gynaecological and Non-Obstetric
2. Gynaecological and Non-obstetric
3. Obstetric

Clinical spectrum of the patients

Common symptoms

- ❖ In one hospital-based descriptive study on 314 women [4], pain abdomen was the commonest complain (75.8%) requiring non-elective surgical intervention. This data well corresponds with the fact that almost all above mentioned indications present with a pain abdomen in addition to specific clinical symptoms.
- ❖ In the same study, second most common complain was vaginal bleeding which was far less in frequency compared to pain abdomen (21.0%). Vaginal bleeding points towards ectopic pregnancy especially in early pregnancy where abdominal pain co-exists [14].

Uncommon symptoms

- ❖ 10.8% patient had history of vomiting in the study [4]. More common differential diagnosis of vaginal bleeding in pregnancy is abortion and often incomplete or inevitable abortion presents with coexisting abdominal pain but usually do not demand emergency surgical intervention. A special variety of abortion, septic abortion, may need a laparotomy to evacuate the product of conception but it is more often because of peritonitis due to uterine perforation and gut injury [14].
- ❖ Hemoperitoneum has been shown in 10.8% of study subjects [4]. Spontaneous Hemoperitoneum in Pregnancy (SHiP) has been shown to occur in 50.8% patients during third trimester in a

* Corresponding author. 152/A Gopal Lal Tagore Road, Kolkata, 700108, India.
E-mail address: docramu77@gmail.com (R. Mukherjee).

Table 1
Incidence of possible indications of nonelective surgical intervention in pregnancy.

Category	Indications	Incidence
Non-Gynaecological and Non-obstetric	<ul style="list-style-type: none"> • Acute appendicitis • Symptomatic Cholelithiasis • Intestinal Obstruction • Cholangitis • Acute Pancreatitis • Peptic Ulcer Perforation 	<ul style="list-style-type: none"> • 1 in 1000 Pregnancy [3] • 1 in 2000 pregnancy [3] • 1 in 1500 pregnancy [5] • 1 in 1200 pregnancy [6] • 3 in 10,000 pregnancy [7]
Gynaecological Non-obstetric	<ul style="list-style-type: none"> • Twisted or ruptured ovarian cyst • Torsion of pedunculated sub-serous fibroid 	<ul style="list-style-type: none"> • Very rare^a [3] • 5 in 10,000 pregnancy [8] • Very Rare^a [9]
Obstetric	<ul style="list-style-type: none"> • Acute Ectopic pregnancy • Ruptured Uterus (spontaneous) • Ruptured uterus (with risk factor) 	<ul style="list-style-type: none"> • 19.7 in 1000 pregnancy [10] • 1 in 8000 to 1 in 15,000 deliveries [11] • 1 in 1633 deliveries [12]

^a The term ‘Very Rare’ denotes the incidence of these conditions in pregnancy are too low in literatures to provide actual numerical values.

systemic review [15]. In the same review, it was shown that 94.9% patients had subacute abdominal pain, 47.5% had hypovolemic shock, 62.7% had decreased haemoglobin level. In this review, 76.3% patients required a surgical intervention and out of them only 15.6% successfully continued the pregnancy. They also reported foetal distress in 40.7% cases. During surgery the source of bleeding was endometriotic implant (21.6%), ruptured utero-ovarian vessel (56.8%), haemorrhagic nodules of decidualised cells (2%) and combination (19.6%) of these [15].

Rare symptoms

- ❖ Rare complaints in the study group [4] were loss of consciousness (8.9%), abdominal distension (4.5%), fever (4.5%), mass per abdomen (1.9%), shock (1.9%), chest pain (0.6%).
 - Abdominal distension in pregnancy may be due to intestinal obstruction or collection of blood (hemoperitoneum) or fluid (ascites) or twisted ovarian cyst or sub-serous fibroid. Ascites in pregnancy in an emergency scenario may result from a perforated peptic ulcer or acute pancreatitis and not from portal hypertension. Intestinal obstruction, twisted ovarian cyst or twisted sub-serous fibroid results due to pressure and contraction of gradual enlargement of pregnant uterus with predisposing intrinsic factors being present. Consequently, pregnancy is a risk factor for twisted ovarian cyst [16].
 - Chest pain is very rare complaint. It may point towards multiple medical emergencies though only Aortic dissection warrants an emergency surgical intervention [17]. It is more common in third trimester in presence of multiple risk factors like trauma, Marfan syndrome, aortitis etc [17].
 - Shock can be present due to massive third space fluid loss e.g. acute pancreatitis or due to large volume bleeding and hemoperitoneum formation e.g. ruptured uterus or ruptured ectopic pregnancy.
 - Mass per abdomen is difficult to assess clinically because of the enlarged uterus and mostly are ovarian cyst or a sub-serous myoma.
 - Fever can be present in acute appendicitis, cholangitis, pancreatitis. Though appendicitis is the most common cause of surgical emergency, the lower incidence of fever shown in the study [4] is probably because the author considered obstetric and gynaecological indications of emergency surgical intervention in their study excluding non-obstetric indications.

Diagnostic dilemma

- Difficulties in Clinical Assessment:

- a Common disease with rare presentation: In a case report of a 36-year-old female patient complaining substernal sudden pleuritic and pressure type of chest pain, it was found due to irritation of her diaphragm by the hemoperitoneum around liver and spleen resulting from a ruptured right fallopian tube ectopic pregnancy [18]. Similar presentation has been also reported by Bildik et al. [19], where a ruptured left fallopian tube ectopic pregnancy presented a left sided acute chest pain. Thus, it may sometime be difficult to diagnose ectopic pregnancy based only on clinical presentation despite being most common obstetric emergency.
- b Rare disease with common presentation: Without abdominal pain, isolated vaginal bleeding does not usually point towards a surgical emergency. An invasive mole may present with a history of vaginal bleeding without abdominal pain and in this scenario, a history of excessive nausea and vomiting in first trimester along with passage of grape like vesicle per vagina co-exists [14].

On the other hand, peptic perforation or cholangitis, comparatively rare conditions can present as abdominal pain with signs of peritonitis mimicking perforated appendicitis. Due to growing uterus it may be difficult sometime to localise the pain properly associated with the conditions.

- Difficulties in Investigations:
 - a Role of X-Ray: The risk of adverse foetal outcome due to X-ray depends on the gestational age during exposure and the dose of exposure. Extremely high dose radiation exposure (>1 Gy) is associated with adverse foetal outcome. It has been estimated that to prevent IUGR or congenital anomalies during organogenesis 200–250 mGy is the threshold dose of exposure and less than 250–280 mGy is required to prevent intellectual deficit in 16–25 weeks [20]. Fortunately, even multiple diagnostic procedures rarely exceed this. Risk of carcinogenesis after in-utero exposure to ionising radiation is unclear; however, it is recommended to calculate the total ionising radiation dose in case of multiple exposure to X-Ray.
 - b Role of CT scan: Use of CT scan in a pregnancy should not be withheld if indicated clinically and in evaluation of an acute process, maternal benefit from early diagnosis and treatment outweighs the theoretical foetal risks [20]. Regarding the contrasts, it is safer to use an oral contrast since it is not absorbed by the patient and thus does not produce any theoretical or real harm [20]. However, the use of iodinated intravenous contrast can cross placenta and can be secreted in the amniotic fluid but animal studies fail to demonstrate any teratogenic or mutagenic effect of its use [20]. Despite this lack of harm, the use of contrast is recommended to be

postponed till there is an absolute need for its use which may alter the care of the mother and the fetus [20].

- c Role of Ultrasonography: USG is widely accepted diagnostic modality in pregnancy because it doesn't utilise any ionising radiation. However, the disadvantage is that it is operator-dependant and incidences of non-visualisation are reported. It has no documented foetal adverse outcome even with duplex doppler [20].
- d Role of MRI: MRI does not utilise any ionising radiation and is not operator-dependant. Addition to these, greater visualisation makes it superior to both USG and CT to delineate soft tissue in abdomen. Role of MRI in evaluating the cause from symptoms could be done if facility is available. In many literature, ideally, MRI has been suggested to investigate the cause before a CT scan.

Diagnosis and treatment

Non-obstetric and non-gynaecological indications

- Acute appendicitis: Begins with poorly localised colicky abdominal pain at first at the periumbilical region which later localises in the right ileac fossa. Atypical presentation of appendicitis can be a suprapubic discomfort or tenesmus [36]. USG should be first investigation of choice [13]. MRI should be next investigation and if not available, a CT scan should be done [13]. Sensitivity of USG is 20–36% [13] whereas MRI has a sensitivity and specificity of 91% and 98% respectively [25]. However, there is paucity of data supporting the adequacy of CT scan to diagnose appendicitis in pregnant female compared to non-pregnant female. Diagnosis of appendicitis in pregnancy can be challenging as symptoms are poorly localised and poorly points towards appendicitis. The growing uterus makes palpation of abdomen difficult. However, outcome of appendicitis in pregnancy can be disastrous and is associated with 3%–5% chance of foetal loss without perforation and 36% with perforation. Delayed diagnosis increases chance of perforation as well as maternal mortality (Fig. 1).
- ❖ Treatment

Treatment options are expectant management or surgical intervention. Among the surgical modalities laparoscopic appendectomy can be attempted but depends on the surgeon's skill and

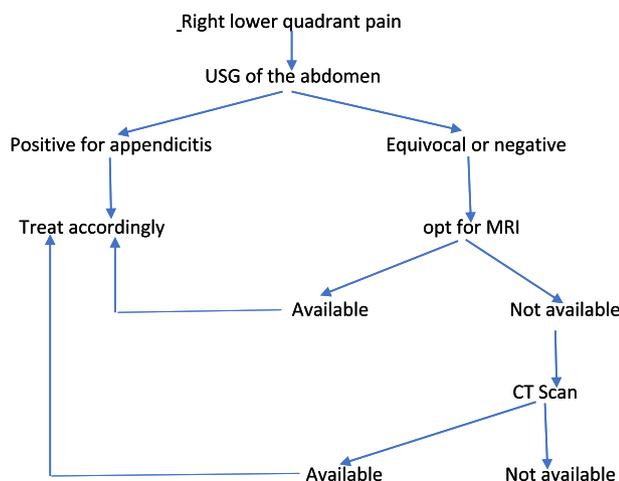


Fig. 1. Protocol suggested in appendicitis in pregnancy.

comfort level regarding the patient's body habitus and degree of pregnancy.

- Symptomatic Cholelithiasis: Biliary colic is typically present. Patients may present with distressing symptoms of acute cholecystitis, obstructive jaundice and gall stone pancreatitis. Acute Cholecystitis presents with positive murphy's sign and distressing pain in right upper quadrant of abdomen. USG is the first investigation to demonstrate stones or oedematous mucosa of the gallbladder. Empyema of gallbladder can also be identified. If obstructive jaundice is present, liver function test should be done demonstrating elevated total and conjugated bilirubin and ALP. Pregnancy particularly favours gallstone formation primarily because oestrogen is lithogenic. In a suitable environment of increasing weight oestrogen favours stone formation. Adverse outcomes include spontaneous abortion and preterm labour [13].
- ❖ Treatment: Symptomatic cholelithiasis should undergo surgical intervention if associated with obstructive jaundice, acute cholecystitis, gallstone pancreatitis [13]. Non-operative management of symptomatic cholelithiasis is associated with increased chance of gallstone pancreatitis upto 15% and 20–40% chances of recurrence in the late trimesters with increased severity [33]. Thus, one should undergo elective cholecystectomy preferably in second trimester in case of symptomatic cholelithiasis.
- Acute Pancreatitis: Sudden onset, dull aching, rapidly progressive pain in epigastrium with radiation towards back, refractory to usual doses of analgesics [24] is the cardinal symptom. It improves with stooping forward. Batra et al. showed 84% of their study subjects had both amylase and lipase levels raised whereas selectively raised lipase but normal amylase was raised in 16% of cases [22]. Their study subjects all had proven acute pancreatitis and 100% of them had lipase level raised [22]. Consequently, serum lipase is concluded to be more specific than amylase for pancreatitis which is well supported by the guidelines proposed by British Society of Gastroenterology for management of acute pancreatitis [23]. But it is customary to do both assay in suspected acute pancreatitis. USG helps to exclude possible differential diagnoses and to diagnose gallstone pancreatitis; but doesn't establish diagnosis [24]. CT is reserved for particular indications. Acute pancreatitis should always be diagnosed with both the clinical features and serum biochemical studies. One case report [26] showed a ruptured ectopic pregnancy mimicking pancreatitis and was diagnosed during laparotomy. Again, in different literature, serum amylase is said to be raised in many cases of ectopic pregnancy. These facts necessitate the need of thorough clinical and radiological investigations pre-operatively and points that serum amylase is not specific for pancreatitis. There is one evidence of hyperlipasemia in a tubo-ovarian disorder too [27]. Thus the diagnosis should be based on both clinical and laboratory parameters as these are complementary to each other (Fig. 2).
- ❖ Treatment: Initially should be managed conservatively after resuscitation, preferably in Intensive care unit. Prognosis is assessed by APACHE-II or CTSI (CT scan severity index). Necrosectomy can be done in laparoscopic approach.
- Intestinal Obstruction: Characterised by colicky abdominal pain, vomiting, constipation, abdominal distension. However, the clinical presentations are confusing since vomiting, constipation both can be present due to physiological changes of pregnancy. Abdominal distention and visible peristalsis are difficult to assess because of the growing uterus. Unlike non-pregnant cases, there is no clear-cut protocol of investigations. Ideally, in pregnancy, MRI should be the investigation of choice [28]. But

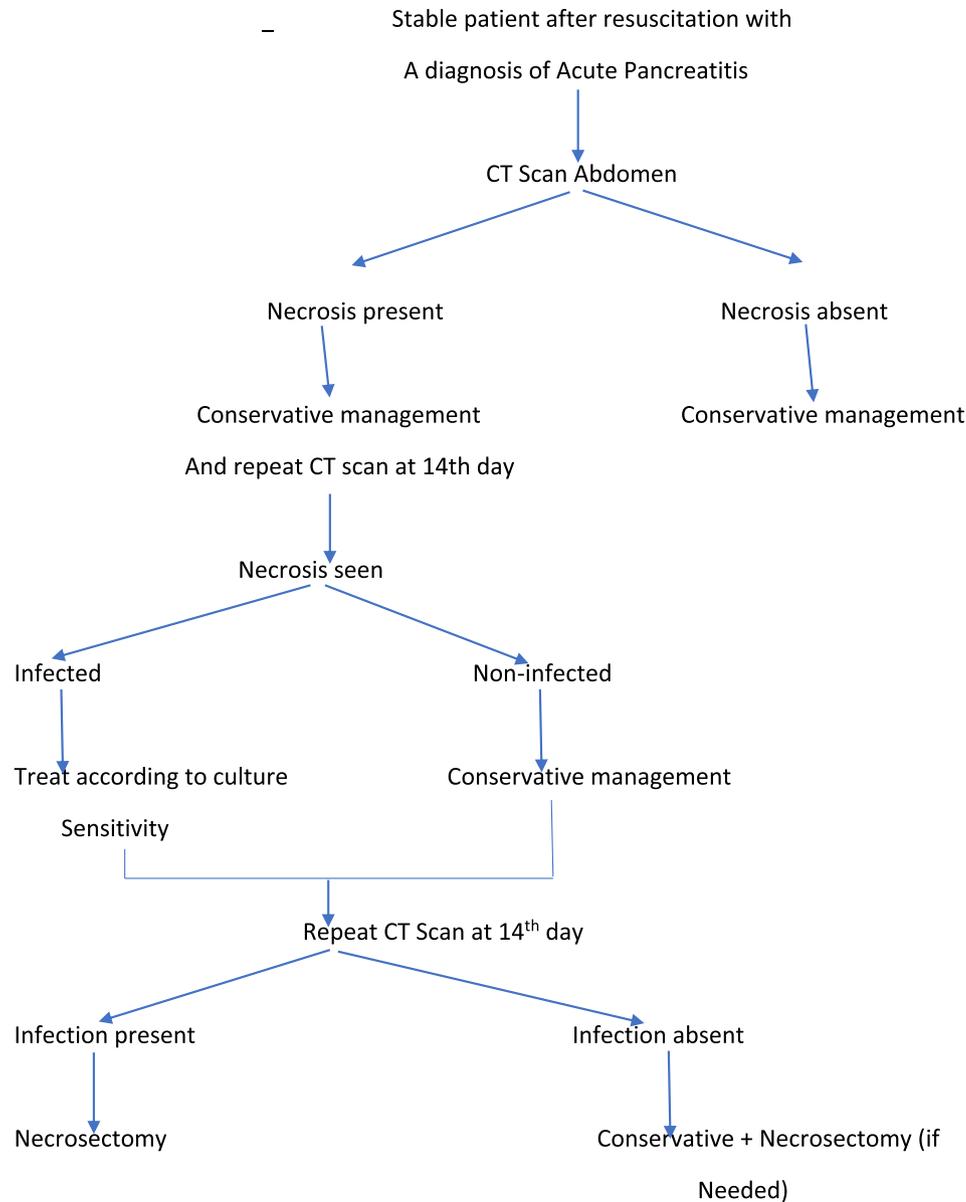


Fig. 2. Protocol for acute pancreatitis in pregnancy.

if unavailable, X-ray abdomen can be done [28]. Supine X-ray abdomen is better than erect posture [35]. However due to superimposed images of foetal skeleton identification of dilated bowel-loops can be difficult. Diagnosing intestinal obstruction in pregnancy is challenging. The clinical symptoms mimic 'morning sickness' in first trimester. Again, X-ray during the organogenesis should be done with caution. The decision should be taken after assessing the risk and benefit. Fortunately, intestinal obstruction is rare in pregnancy.

❖ Treatment: Majority improves with resuscitation. No improvement of symptoms should be managed by laparoscopic or open surgical approach. Uterus manipulation should be minimum. Resection of non-viable gut followed by stoma formation or primary anastomosis can be attempted.

- Cholangitis: Cholangitis usually presents as an intermittent spiking pyrexia with chills and rigour, intermittent jaundice and intermittent pain abdomen. Commonly, this is known as Charcot's Triad. When associated with mental confusion and

hypotension it dictates worse outcome. Charcot's triad is 95% specific and 26% sensitive for cholangitis [13]. Investigations are same as in case of non-pregnant female and consists of USG and MRCP with liver function test demonstrating obstructive jaundice pattern. USG has a sensitivity of 30%. MRCP is excellent diagnostic modality in pregnancy and is not associated with adverse foetal outcome [29]. Though rare, Cholangitis, almost always requires a surgical intervention. This necessitates a proper diagnosis (Fig. 3).

❖ Treatment: This often requires a surgical intervention. Intravenous antibiotics and proper resuscitation should be done. Treatment of choice is ERCP if facilities and surgeon's expertise are available. Alternatively, laparoscopic CBD exploration can be attempted. Open CBD exploration should be considered as a last resort and when surgeon's expertise is lacking.

- Peptic Perforation: Peptic perforation is very rare in pregnancy because of the inverse relationship between gastric acid secretion and oestrogen. The exact mechanism is probably the

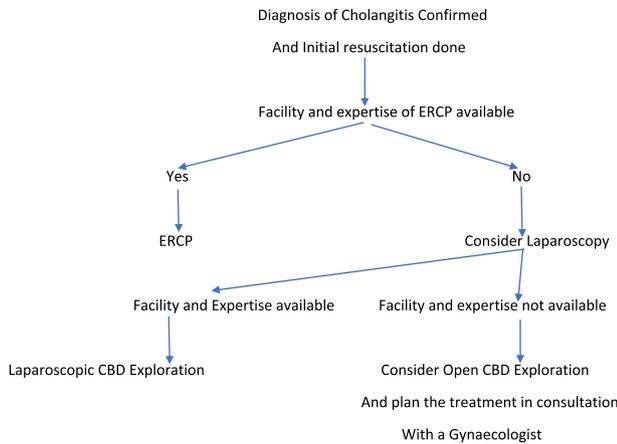


Fig. 3. Protocol for management of cholangitis in pregnancy.

inhibition of acid secretion by reducing histamine as oestrogen promotes histaminase activity [30]. Adequate rest, abstinence from smoking and alcoholism and nutritious diet also helps in this regard. However, peptic perforation presents as nausea, vomiting and upper abdominal pain. The pain is dull aching in nature, present in the epigastrium, sudden onset. There is history of Peptic Ulcer Disease. Presence of gravid uterus makes it quite difficult to localise the pain [30]. The symptoms usually worsen nocturnally and a history of upper gastro-intestinal bleeding is often present. These features help differentiating the symptoms of peptic perforation especially nausea and vomiting from that of 'morning sickness' [30]. Diagnosis requires an USG which rules out possible aetiologies of upper abdominal pain and if required upper gastro-intestinal endoscopy should be done. Abdominal X-ray though is not a preferred investigation but is done to assess the presence of pneumoperitoneum [30].

❖ Treatment: Resuscitation should be followed by exploratory laparotomy. The perforation is closed by Graham's Patch closure [30].

Non-obstetric gynaecological indications

- **Twisted Ovarian Cyst:** It presents with a pain in the lower abdomen. Degree of pain is directly proportional to the extent of the twist round its pedicle [16]. The complication during pregnancy is very difficult to assess because of the uterus. However, in most cases torsion of pedicle occurs in 8–10 weeks of pregnancy as the growth begins to come outside pelvis [16]. The only clue to the diagnosis clinically is the previous knowledge of the presence of a large ovarian cyst. Diagnosis should be confirmed by USG lower abdomen. Unless indicated specifically, CT scan has limited role.
 - ❖ Treatment: Remove the tumour irrespective of period of gestation if torsion present and diagnosis is confirmed [16].
- **Torsion of sub-serous myoma:** Torsion of sub-serous myoma presents with pain in the lower abdomen which is directly proportional to the extent of the torsion. Here also, the clue to the diagnosis is prior knowledge of the presence of the myoma. Clinically, a large sub-serous myoma may present with abdominal distension but during pregnancy it is very difficult to assess clinically. Diagnosis is confirmed by USG.
 - ❖ Treatment: Diagnosis should be confirmed prior any operative steps are undertaken. Myomectomy, unless absolutely indicated, should be deferred due to haemorrhage possibilities.

However, if laparotomy has been done in a mistaken diagnosis, abdomen should be closed intact. In case laparotomy shows a pedunculated sub-serous myoma one may consider to remove it depending on patient's condition. Initially resuscitation and conservative management is indicated.

Obstetric indications

- **Ectopic pregnancy:** Ruptured Ectopic pregnancy is one of the common causes of acute abdomen in pregnancy. It commonly presents with abdominal pain associated with per vaginal bleeding. The triad of ectopic pregnancy is abdominal pain, amenorrhea, per vaginal bleeding. However, as previously mentioned, it can present in varieties. There are 2 case reports mentioned where an ectopic pregnancy after rupture presented with acute chest pain. Similarly, it may present like other non-obstetrical non-gynaecological abdominal emergencies also like acute pancreatitis. In one prospective study they showed 9% patients had painless symptoms [31]. Physical examination shows peritoneal signs like tenderness, rigidity, rebound tenderness of abdomen along with cervical motion tenderness and unilateral or bilateral abdominal and pelvic tenderness [32]. Diagnosis of ectopic pregnancy is confirmed by USG and estimation of beta hCG levels. For detecting ectopic pregnancy, USG is 69% sensitive and 99% specific whereas a single estimation of beta hCG value 1000 mIU/ml or lower shows a fourfold higher risk of detection of ectopic pregnancy [31]. There are other different biomarkers also as stated in different literature but as a single marker they do not demonstrate consistently good discriminatory values.
 - ❖ Treatment: Principle of management is to resuscitate and laparotomy simultaneously [37].
- **Ruptured Uterus:** Ruptured uterus can be spontaneous or due to presence of scar. Spontaneous rupture in pregnancy rarely happens in grand multipara due to thin uterine wall or bicornuate variety or couvelarine uterus [34]. Scar rupture is comparatively more common and it is because of increasing rate of caesarean section and myomectomy [34]. Patient complains of dull aching pain in the lower abdomen and followed by a sensation of giving away and reduced severity of pain. In case of complete scar rupture the foetus comes outside the uterus and feta parts become more superficially palpable. On examination the abdomen is tender and the patients is dehydrated and exhausted. USG is the investigation of choice. In incomplete scar rupture the sac is visualised through the gaping uterine wound.
 - ❖ Treatment: Initial resuscitation should be done followed by laparotomy. Following laparotomy decision of hysterectomy or repair should be taken. Hysterectomy is preferred surgery provided patient is not desirous of child. In odd scenarios where childbirth is desired repair is done despite having immediate and remote complications [34].

Conclusion

Surgical emergency in pregnancy, overall, is a controversial issue in terms of management and diagnosis which is partly for the limitations of safer investigations available and partly for the safer manoeuvres available to treat the condition. But if not treated this can significantly contribute to maternal and foetal morbidity and mortality. The article summarises the possible modalities of investigation and intervention available in the current era with their pros and cons. However, these scenarios always should be treated in conjunction with consulting experienced obstetric recommendations and before considering the definite treatment

approach, the possible maternal and foetal health hazards must be taken count for in terms of potential risks and benefits.

Conflict of interest statement

None declared.

References

- [1] Section of Surgery and European Board of Surgery. Emergency Surgery. Available from <https://uemssurg.org/divisions/emergency-surgery> Accessed on 6.10.2018.
- [2] Kort B, Katz VL, Watson WJ. Effects of non-obstetric operations in pregnancy. *Surg Gynecol Obstet* 1993;177(4):371–6. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/8211581?dopt=Abstract>. [Accessed 6 October 2018].
- [3] Dutta DC. Medical and surgical illness complicating pregnancy. In: Konar H, editor. *DC dutta's textbook of obstetrics*. 8th ed. New Delhi: Jaypee Brothers Medical Publishers (P) Ltd.; 2015. p. 353–5.
- [4] Pokharel HP, Dahal P, Rai R, Budhathoki SS. Surgical emergencies in obstetrics and gynecology in a tertiary care hospital. *J Nepal Med Assoc* 2013;52(189): 213–6. Available from: https://www.researchgate.net/publication/236205810_Surgical_Emergencies_in_Obstetrics_and_Gynaecology_in_a_Tertiary_Care_Hospital. [Accessed 6 October 2018].
- [5] Dietrich CS, Hill CC, Hueman M. Surgical diseases presenting in pregnancy. *Surg Clin N Am* 2008;88:403–19. <https://doi.org/10.1016/j.suc.2007.12.003>.
- [6] Daas AY, Agha A, Pinkas H, Mamel J, Brady PG. ERCP in pregnancy: is it safe? *Gastroenterol Hepatol* 2009;5:851–5. Google Scholar.
- [7] Pitchumoni CS, Yegneswaran B. Acute pancreatitis in pregnancy. *World J Gastroenterol* 2009;15:5641–6. <https://doi.org/10.3748/wjg.15.5641>.
- [8] Ventolini G, Hunter L, Drollinger D, Hurd WW. Ovarian Torsion during Pregnancy. *MD Magazine*. Available at https://www.mdmag.com/journals/resident-and-staff/2005/2005-09/2005-09_04 Accessed on 6.10.2018.
- [9] Kim HG, Song YJ, Na YJ, Choi OH. A case of torsion of a subserosal leiomyoma. *J Menopausal Med* 2013;19(3):147–50. <https://doi.org/10.6118/jmm.2013.19.3.147>.
- [10] Tenore JL. Ectopic pregnancy. *Am Fam Physician* 2000;61(4):1080–8. Available from: <https://www.aafp.org/afp/2000/0215/p1080.html>. [Accessed 6 October 2018].
- [11] Miller DA, Goodwin TM, Gherman RB, Paul RH. Intrapartum rupture of the unscarred uterus. *Obstet Gynecol* 1997;89:671–3.
- [12] Sinha M, Gupta R, Gupta P, Rani R, Kaur R, Singh R. Uterine Rupture: a seven year review at a tertiary care hospital in New Delhi, India. *Indian J Community Med* 2016;41(1):45–9. <https://doi.org/10.4103/0970-0218.170966>.
- [13] Skubic JJ, Salim A. Emergency general surgery in pregnancy. *Trauma Surg Acute Care Open* 2017;2:1–5. <https://doi.org/10.1136/tsaco-2017-000125>.
- [14] Vardhan S, Bhattacharyya TK, Kochar SPS, Sodhi B. Bleeding in early pregnancy. *Med J Armed Forces India* 2007;63(1):64–6. [https://doi.org/10.1016/S0377-1237\(07\)80114-6](https://doi.org/10.1016/S0377-1237(07)80114-6).
- [15] Lier MCI, Malik RF, Ket JCF, Lambalk CB, Brosens IA, Mijatovic V. Spontaneous Hemoperitoneum in Pregnancy (SHiP) and endometriosis- A systematic review of review of the recent literature. *Eur J Obstet Gynecol Reprod Biol* 2017;219:57–65. <https://doi.org/10.1016/j.ejogrb.2017.10.012>.
- [16] Dutta DC. Benign lesion of ovary. In: Konar H, editor. *DC dutta's textbook of gynecology*. 7th ed. New Delhi: Jaypee Brothers Medical Publishers (P) Ltd.; 2016. p. 243–5.
- [17] Isiadinso I, Wenger NK. A pregnant woman is presenting with chest pain. How should I approach treatment?. Available at <https://www.healio.com/cardiology/curbside-consultation/%7Bc5d6b25c-c73e-4330-ac62-bbc936fe02f5%7D/a-pregnant-woman-is-pres> Accessed 6.10.2018.
- [18] Dichter E, Espinosa J, Baird J, Lucerna A. An unusual emergency department case: ruptured ectopic pregnancy presenting as chest pain. *World J Emerg Med* 2017;8(1):71–3. <https://doi.org/10.5847/wjem.j.1920-8642.2017.01.014>.
- [19] Bildik F, Demircan A, Keles A, Pamukcu G, Biri A, Bildik E. Heterotopic pregnancy presenting with acute left chest pain. *Am J Emerg Med* 2008;26(7): 835.e1–2 [PubMed].
- [20] The American College of Obstetricians and Gynecologists. ACOG Committee Opinion Interim. Guidelines for diagnostic imaging during pregnancy and lactation. Update Number 723. October 2017. Available at: <https://www.acog.org/Clinical-Guidance-and-Publications/Committee-Opinions/Committee-on-Obstetric-Practice/Guidelines-for-Diagnostic-Imaging-During-Pregnancy-and-Lactation>. [Accessed 6 October 2018].
- [22] Batra HS, Kumar A, Saha TK, Misra P, Ambade V. Comparative study of serum amylase and lipase in acute pancreatitis patients. *Indian J Clin Biochem* 2015;30(2):230–3. <https://doi.org/10.1007/s12291-013-0416-y>.
- [23] Johnson CD. UK guidelines for the management of acute pancreatitis. *Gut* 2005;54(Suppl. III):iii1–9. <https://doi.org/10.1136/gut.2004.057026> [PMC free article][PubMed].
- [24] Bailey HH, Love MRJ. The pancreas. In: Williams N, O'Connell RP, McCaskie AW, editors. *Bailey and love's short practice of surgery*. 27th ed., vol. 2. NW: CRC Press Taylor and Francis Group; 2018. p. 1222–3.
- [25] Long SS, Long C, Lai H, Macura KJ. Imaging strategies for right lower quadrant pain in pregnancy. *Am J Roentgenol* 2011;196(1):4–12. <https://doi.org/10.2214/AJR.10.4323> CrossRefPubMedGoogle Scholar.
- [26] Mitura K, Romanczuk M. Ruptured ectopic pregnancy mimicking acute pancreatitis. *Ginekol Pol* 2009;80(5):383–5. Available From, <https://www.ncbi.nlm.nih.gov/pubmed/19548460>. [Accessed 6 October 2018].
- [27] Sinha S, Khan H, Timms P, Olagbaiye OA. Pancreatic-type hyperamylasemia and hyperlipasemia secondary to ruptured ovarian cyst: a case report and review of the literature. *J Emerg Med* 2010;38(4):463–6. <https://doi.org/10.1016/j.jemermed.2008.04.042>.
- [28] Johri R, Sharma A, Shenoy KR. Acute intestinal obstruction during pregnancy. *Int J Med Res Rev* 2016;4(1):126–8. <https://doi.org/10.17511/ijmrr.2016.i01.020>.
- [29] Ray JG, Vermeulen MJ, Bharatha A, Montanera WJ, Park AL. Association between MRI exposure during pregnancy and fetal and childhood outcomes. *JAMA* 2016;316:952–61. <https://doi.org/10.1001/jama.2016.12126>.
- [30] Amdeaslafie F, Berhe Y, Gebremariam TT. Perforated duodenal ulcer in third trimester of pregnancy. *Saudi J Med Med Sci* 2015;3(2):164–6. <https://doi.org/10.4103/1658-631X.156435>.
- [31] Kaplan BC, Dart RG, Moskos M, Kuligowska E, Chun B, Adel HM, et al. Ectopic Pregnancy: prospective study with improved diagnostic accuracy. *Ann Emerg Med* 1996;28(1):10–7. Available from: <https://reference.medscape.com/medline/abstract/8669724>. [Accessed 6 October 2018].
- [32] Sepilian VP, Wood E. Ectopic pregnancy clinical presentation. Available from <https://emedicine.medscape.com/article/2041923-clinical#b3> Accessed on 6.10.2018.
- [33] Lu EJ, Curet MJ, El-Sayed YY, Kirkwood KS. Medical versus surgical management of biliary tract disease in pregnancy. *Am J Surg* 2004;188:755–9. <https://doi.org/10.1016/j.amjsurg.2004.09.002>.
- [34] Dutta DC. Injuries to the birth canal. In: Konar H, editor. *DC dutta's textbook of obstetrics*. 8th ed. New Delhi: Jaypee Brothers Medical Publishers (P) Ltd.; 2015. p. 493–8.
- [35] Bailey HH, Love MRJ. Intestinal obstruction. In: Williams N, O'Connell RP, McCaskie AW, editors. *Bailey and love's short practice of surgery*. 27th ed., vol. 2. NW: CRC Press Taylor and Francis Group; 2018. p. 1288.
- [36] Bailey HH, Love MRJ. The Vermiform appendix. In: Williams N, O'Connell RP, McCaskie AW, editors. *Bailey and love's short practice of surgery*. 27th ed., vol. 2. NW: CRC Press Taylor and Francis Group; 2018. p. 1302–3.
- [37] Dutta DC. Hemorrhage in early pregnancy. In: Konar H, editor. *DC dutta's textbook of obstetrics*. 8th ed. New Delhi: Jaypee Brothers Medical Publishers (P) Ltd.; 2015. p. 215.