

Clinical and Surgical Challenges of Cholecystectomy in Pregnant and Obese Patients: A Review of Current Evidence

Julia Ana-Elena Zaharia, Adamantia Vasilaki, Fadi Zoghieb, Amir Rbaibi and Naeem Hamza*

Iuliu Hatieaganu University of Medicine and Pharmacy, Romania

***Corresponding author:** Naeem Hamza, Iuliu Hatieaganu University of Medicine and Pharmacy, Cluj Napoca, Romania

ARTICLE INFO

Received: 📅 July 01, 2025

Published: 📅 July 09, 2025

Citation: Julia Ana-Elena Zaharia, Adamantia Vasilaki, Fadi Zoghieb, Amir Rbaibi and Naeem Hamza. Clinical and Surgical Challenges of Cholecystectomy in Pregnant and Obese Patients: A Review of Current Evidence. Biomed J Sci & Tech Res 62(4)-2025. BJSTR. MS.ID.009769.

ABSTRACT

A common gastrointestinal disorder in pregnant and obese patients is gallbladder disease. These high-risk groups have overlapping risk factors and symptoms. Hormonal changes in pregnancy, like increased estrogen and progesterone levels, have been found to interfere with normal gallbladder contraction and changes in bile composition, which increases the risk of gallstone formation. The disruption of lipid metabolism and presence of bile stasis in obesity increase the risk of gallstone-related complications. These are some of the many factors making these two groups high risk when dealing with gallbladder disease and cholecystectomy. While laparoscopic cholecystectomy remains the gold standard of treatment due to its lower complication rates for the mother and fetus, certain barriers remain, such as surgical timing, limited imaging accuracy in certain stages of pregnancy or obesity, and inequitable access to care are some of many. This review touches on the underlying mechanisms that lead to increased risk of gallbladder disease as well as the diagnostic and therapeutic approaches for gallbladder disorders in obese and pregnant patients. Improving patient outcomes for these groups requires early diagnosis, quick surgical intervention, and updated clinical protocols geared to specific risks.

Keywords: Gallbladder Disease; Cholecystectomy; Laparoscopic Surgery; Obesity; Pregnancy

Abbreviations: IVC: Inferior Vena Cava; PTD: Preterm Delivery; LMWH: Low Molecular Weight Heparin

Introduction

Gallbladder and biliary tract diseases are among the most prevalent medical disorders of the digestive system [1]. The most common conditions affecting the gallbladder are acute cholecystitis, adenomyomatosis, gallstones (cholelithiasis), and, more rarely, gallbladder carcinoma. The incidence of gallbladder disease has increased in recent decades, influenced by factors such as diet, sedentary lifestyle, and obesity. Hormonal changes, particularly in women and during pregnancy, also play a significant role in the pathophysiology and risk of gallbladder disease [2]. Various diagnostic methods and techniques have been developed to diagnose these diseases, the main method being through imaging. The two most efficient imaging techniques are transabdominal ultrasonography, which is usually a first-line approach due to its sensitivity, and endoscopic ultrasonography, due to its superior resolution [3]. Cholecystectomy—the surgical removal of the gallbladder—remains the gold standard of treatment for symp-

tomatic gallbladder disease. The surgical approaches to a cholecystectomy are laparoscopic, now considered the gold standard, and open and subtotal cholecystectomies that are reserved for specific clinical situations or in the case of complications [4,5]. The following literature review focuses on cholecystectomy in two high-risk patient populations: pregnant individuals and patients with obesity. These groups present unique challenges in diagnosis, surgical decision-making, and perioperative management. Understanding cholecystectomies in these populations is essential for improving patient outcomes and modifying clinical practice.

Gallbladder Disease in Special Populations

Incidence

During pregnancy, gallbladder disease usually manifests with advanced symptoms. A retrospective analysis done in Iraq has shown that out of 2814 pregnancies, 126 showed symptoms of gallstones; 67

of them were in the first trimester and 29 were in their second trimester. The most diagnosed gallbladder disease in that study was acute cholecystitis, which made up 84 of the 126 symptomatic patients [6]. A study based on information taken from the Global Burden of Disease revealed that an increased rate of gallbladder and biliary disease patients from 585.35/100,000 in 1990 to 634.32/100,000 in 2019, and this incidence increase had a positive correlation with the rise in high BMI values within recent years [7]. A systematic review done on groups divided based on health status and obesity into 1. Metabolically unhealthy obese patients, 2. Metabolically healthy obese, 3. metabolically unhealthy not obese, 4. Metabolically healthy not obese has outlined that obese people have shown a higher prevalence of gallbladder polyps as compared to healthy individuals, with a prevalence of having polyps larger than or equal to 5mm of 4.0%, 3.7%, 3.1%, and 2.4% respectfully [8].

The Effects of Pregnancy on the Gallbladder

Gallbladder diseases are common during pregnancy, mainly due to changes in hormone levels and their effects on biliary function. Estrogen and progesterone are two hormones that increase significantly during gestation and have been closely linked to both acute and chronic forms of cholecystitis. This increase of hormones alter bile composition, reduce gallbladder motility, and impair normal bile drainage [9,10].

Hormone Influence on Biliary Function

As estrogen increases, the liver begins to secrete more cholesterol into the bile, making it more saturated. Progesterone decreases the ability of the gallbladder to contract by relaxing the smooth muscle in its walls [9,10]. Estrogen acts by binding to receptors in hepatocytes and the gallbladder wall, increasing cholesterol secretion while decreasing bile acid output. Progesterone, which is most elevated in the third trimester of pregnancy, interferes with the gallbladder's response to meals, causing bile retention for a prolonged period of time [10,11]. These effects contribute to both delayed gallbladder emptying and bile stasis, which creates unfavourable conditions that promote the development of gallstones and sludge. Studies show that up to 12% of patients in their second and third trimesters of pregnancy will develop either new cholelithiasis or biliary sludge [10,12]. These changes are often temporary and can resolve after delivery, but there are cases in which they may persist and cause complications later on [12].

Acute and Chronic Cholecystitis in Pregnancy

Acute cholecystitis commonly occurs due to obstruction of the cystic duct by gallstones, which leads to gallbladder distension, inflammation, ischemia, and infection. The inflammatory response is worsened by the retention of bile. The typical presentation of cholecystitis is present in both pregnant and non-pregnant patients. The common symptoms are right upper quadrant pain, fever, and elevated

white blood cells. The diagnosis of cholecystitis in pregnant patients can be delayed due to overlapping symptoms with normal pregnancy changes, which is why early recognition is crucial in this patient group [13]. Chronic cholecystitis arises from chronic irritation caused by gallstones. In pregnant patients, even minor recurring obstructions can lead to chronic inflammation and scarring of the gallbladder wall, which leads to reduced flexibility and function [10,12].

The Effects of Obesity on the Gallbladder

Obesity is a risk factor for gallbladder disease due to disruptions in lipid metabolism, hormonal regulation, and systemic inflammation. These changes lead to cholesterol supersaturation in bile, disruptions in gallbladder motility, and an increased risk of gallstone formation. In obese patients, increased dietary fat intake and elevated HMG-CoA reductase activity promote cholesterol synthesis, which increases hepatic secretion of cholesterol into bile. This creates ideal conditions for crystal nucleation and gallstone development [14]. Obesity also reduces bile salt synthesis and lowers the bile salt to cholesterol ratio, which compromises cholesterol solubility. Another consequence of obesity is insulin resistance, which decreases phospholipid secretion into bile. Since phospholipids help stabilize micelles, their reduction compromises bile stability and increases the lithogenic index [14,15]. Obese patients also face issues on a mechanical level, as gallbladder hypomotility is often present. Reduced contractility prolongs bile retention within the gallbladder, which allows more time for cholesterol crystals to aggregate into stones.

Cholecystectomy During Pregnancy

Pregnancy and Gallstone Disease

Pregnancy is described as a pro-lithogenic state due to its effects on gallbladder emptying and higher hormonal levels. Progesterone delays gallbladder emptying and decreases bile acid synthesis, while estrogen elevates cholesterol concentrations in bile. These physiological changes contribute to the high incidence of acute cholecystitis, making it the second most common cause of acute abdomen amongst pregnant women [16]. By the third trimester of pregnancy, approximately 8% of women have new gallstone formation, with only 1% of them being symptomatic. In cases of suspected gallstone disease, an abdominal ultrasound should be performed to confirm the diagnosis. Symptomatic cholelithiasis is typically managed with analgesics, dietary changes, and intravenous fluids following hospitalization. In severe cases with persistent or refractory symptoms, surgical removal of the gallbladder is recommended due to increased risk of cholangitis and pancreatitis. Such clinical symptoms include fever, vomiting, continuous and severe pain, dark urine, light-coloured stools, and/or jaundice. However, these severe cases represent less than 10% of all symptomatic cases [17]. Due to pregnancy's pro-lithogenic effects and the high prevalence of gallstone disease in the general population, cholecystectomy represents the second most common non-ob-

stetric procedure performed during pregnancy, accounting for 1-8 cases per 10000 pregnancies [18]. In cases where cholecystectomy is deemed necessary, the minimally invasive surgery is preferably performed during the second or early third trimester of pregnancy. However, surgical removal of the gallbladder is recommended regardless of trimester in the setting of severe complications [17].

Cholecystectomy and Gestational Periods

Surgical interventions in the first trimester of pregnancy are often approached with caution due to the potential risk of miscarriage and fetal toxicity associated with anesthesia [10]. According to Mazza et al. (2024), patients undergoing surgery in the first or late third trimesters showcased higher rates of sepsis and more severe maternal morbidity compared to those operated on in the second trimester. Notably, the highest incidence of sepsis was observed in the late third trimester group at 1.9%, followed by the first trimester group at 1.7%, indicating a significant association between trimester and the time of intervention ($P < .001$). Furthermore, patients in the third trimester exhibited higher Charlson Comorbidity Index scores and were more likely to experience premature uterine contractions induced by the gravid uterus, increasing the risk of preterm birth [16,19]. The second trimester is considered the optimal window for intervention, as organogenesis is complete and the gravid uterus has not yet expanded sufficiently to impair the surgical field [20]. Despite these considerations, however, the overall maternal and fetal complication rates remain low across all gestational ages.

Laparoscopy During Pregnancy

Cholecystectomy is widely performed using laparoscopy. Laparoscopic procedures during pregnancy present several challenges, including possible intraoperative limitations related to impaired visualization of the surgical field in advanced gestation, reduced venous return as a result of inferior vena cava (IVC) compression and pneumoperitoneum, and the potential risk of fetal injury during trocar insertion into the abdominal cavity. Despite these concerns, laparoscopic cholecystectomy remains the preferred approach over the traditional open technique, owing to its association with reduced rates of maternal and fetal postoperative complications, lower morbidity and mortality, decreased healthcare costs, and shorter hospital stays [20,21]. Moreover, it promotes faster mobilization, a critical factor in pregnancy given its prothrombotic state, fewer surgical wound complications, and less postoperative pain [20,22]. This minimally invasive procedure typically begins with palpation of the lower uterine segment to determine uterine position and facilitate the safe insertion of the first trocar usually at or above the umbilicus, which is typically introduced by an open (Hasson) technique. Intra-abdominal pressure must be maintained between 10 and 12 mmHg. Prophylactic ultrasonography should be performed both preoperatively and postoperatively in all patients to monitor for potential fetal complications [22]. In the event of intraoperative complications, laparoscopic procedures may be converted to an open approach. However, in a comparative

study conducted by Lukianova et al. (2024), no increased incidence of conversion was observed in pregnant patients compared to non-pregnant women undergoing the same procedure. In cases where conversion was necessary, the primary indications included the presence of common bile duct stones requiring open choledochotomy, intraoperative hemorrhage, and severe cholecystitis [18].

Perioperative Complication Prophylaxis

To prevent premature contractions, mainly in the third trimester, some surgeons incorporated the routine use of prophylactic tocolytics, a practice that has since come under scrutiny, as premature contractions have been reported despite their use [16]. Additionally, due to the risk of compromised placental perfusion resulting from reduced maternal blood flow, patients—especially those in the third trimester—were positioned in the left lateral decubitus position to minimize compression of the descending aorta and the IVC by the gravid uterus. Given the hypercoagulable state of pregnancy, as previously highlighted, sequential compression stockings were also routinely utilized to reduce the risk of thromboembolic events [16].

Maternal and Fetal Complications

Maternal complications following the surgery account for 4% of cases, irrespective of the trimester, while fetal complications, including threatened labour, fetal loss, and preterm delivery (PTD), are reported in about 5.8% of cases [21]. The predictive factors concerning maternal morbidity were found to be jaundice, biliary peritonitis, and maternal age over 34 years old [22].

Comparison with Conservative Management

The non-operative management of cholecystectomy in pregnant women typically includes intravenous fluids and antibiotics, fasting, analgesia, and spasmolytics, with cholecystectomy deferred until after delivery [22]. While conservative management of cholelithiasis may help prevent the formation of new gallstones, it has been shown to have minimal to no effect on the resolution of existing stones. Therefore, cholecystectomy remains the only definitive treatment for achieving a cure [17]. Pregnant patients who do not undergo surgical intervention face a higher risk of developing complications, including prolonged hospitalization and preterm delivery, with relapse rates being the most significant concern, reported to range as high as 40-70% [19]. Recent studies have documented high relapse rates even in cases of uncomplicated cholelithiasis managed non-operatively during the antepartum period, often resulting in recurrent symptoms, multiple hospital readmissions, and progression to complicated gallstone disease. Even in such cases, delayed surgical intervention has been associated with a greater risk of maternal and fetal complications, such as preterm labour and delivery, stillbirth from peritonitis, and miscarriage [19,21]. In the case of gallstone disease in the near term of pregnancy, conservative management may be safely implemented, with surgical intervention deferred until after delivery if the size of the gravid uterus renders the case technically inoperable [10].

Although, as previously noted, concerns have been raised regarding surgical intervention during the first and third trimesters, the risk-benefit ratio continues to favour operative management even during these periods of gestation in the presence of serious complications.

Cholecystectomy in Obese Patients

Surgical Risks and Intraoperative Challenges

Cholecystectomy in obese patients creates technical and physiological challenges. When it comes to the preferred approach of cholecystectomy in obese patients, a laparoscopic cholecystectomy has been the gold standard due to its low morbidity (5-10%) and mortality (0.1%) rates; however, using an open approach is sometimes necessary. Common reasons for this switch in surgical approaches are increased amounts of intraperitoneal fat covering Calot's triangle, difficulties in cannula insertion, insufficient space for proper liver retraction, and challenges handling instruments while operating due to thicker abdominal walls. Additional difficulties during surgery are limited penetration depth and problems with anaesthetic management [23]. Emergency laparoscopic cholecystectomy is particularly complex in obese patients and has demonstrated noticeably subpar outcomes for the group. A study conducted at UHNM categorized patients by BMI and found that those in the obese group (BMI > 30) experience higher rates of postoperative complications and higher rates of hospital readmission [24].

Intraoperative Management and Patient Safety

Proper patient positioning is crucial during surgery to avoid complications related to body mass. It is recommended that shoulder and left-sided support be used to prevent the patient from sliding during table rotation. Additionally, intraoperative calf compression and the postoperative administration of a dose of low molecular weight heparin (LMWH) are recommended to reduce the risk of venous thromboembolism, which is more common in obese patients [25].

Anaesthetic Considerations

Anesthesia management plays an important role in surgical outcomes. A study conducted in Egypt highlighted the different outcomes of using different types of anesthesia, specifically opioid-based and opioid-free anesthesia, on obese patients. Results revealed that opioid-free anesthesia had better general outcomes, greater perioperative hemodynamic stability, and fewer postoperative pain, post-

operative nausea, and vomiting incidences while still maintaining satisfactory sedation and reducing the need for postoperative analgesia consumption [26].

Obesity, Weight Loss, and Gallbladder Risk

While obesity increases the risk of gallstone formation, rapid weight loss has also been linked to a higher incidence of gallstone formation due to increased secretion of cholesterol into bile during this fast weight loss period [27]. Studies have demonstrated that weight loss by bariatric surgery has provided an indirect benefit in improving gallbladder health and decreasing gallbladder complication risks, which are correlated with obesity in general [28].

Overlapping Considerations

The combined impact of these disorders makes managing gallbladder disease especially difficult in obese pregnant patients. Obesity and pregnancy increase the likelihood of gallstone development and gallbladder inflammation by causing bile cholesterol supersaturation, decreased gallbladder motility, and hormonal changes. As a result, the risk of complications such as acute cholecystitis, biliary colic, and perioperative morbidity is much higher [29,30]. According to studies, obese pregnant women suffer severe gallbladder symptoms earlier in pregnancy, are more likely to be hospitalized and have a longer postoperative recovery time. Furthermore, physiological alterations such as increased intraabdominal pressure, delayed gastric emptying, and systemic inflammation impede gallbladder function and complicate diagnosis and treatment [30] (Table 1). The table summarizes clinical evidence from publications published between 2016 and 2025 that investigated cholecystectomy outcomes in pregnant and obese individuals. Studies suggest that maternal difficulties occur in 4% of pregnant patients and fetal issues in 5.8% of instances, with specific cohorts reporting no maternal death or fetal adverse events. The second trimester is often regarded as the optimal surgical window, with results remaining consistent across gestational periods. Conversion rates during laparoscopic surgeries are comparable to those in non-pregnant populations. Data show that obese patients face more technical problems, such as higher conversion rates, longer operational times, and increased postoperative consequences, especially in emergency settings. Opioid-free anesthesia causes fewer problems in morbidly obese people. Obesity, multiparity, and rapid weight gain have been identified as significant risk factors for gallstone formation during pregnancy.

Table 1.

Authors (Year)	Study Design	Population	Key Findings (Reported Data)
Nasioudis et al. [16]	Systematic Review	590 pregnant patients	Maternal complications: 4%; fetal complications: 5.8%
Hedström et al. [18]	Nationwide Register-Based Study	Swedish national registry data	Preterm birth incidence; cholecystectomy/ ERCP outcomes
Mazza et al. [19]	National Cohort Study	US pregnant patients undergoing cholecystectomy	Outcomes by trimester; maternal morbidity predictors
Marcos- Ramírez et al. [20]	Clinical Study	Mexican cohort (pregnant patients)	Complication rates after LC
Nan et al. [21]	Retrospective Study	Australian tertiary center (7-year data)	Maternal mortality: 0%; fetal loss: 0%
Itaimi et al. [22]	Clinical Study	Tunisian cohort (cholecystitis in pregnancy)	Fetal adverse events: 0%; conversion rates comparable to non- pregnant patients
Dagar et al. [23]	Comparative Study	Obese vs. non-obese patients	Higher conversion rates and longer operative times in obese patients
Davies et al. [24]	Clinical Analysis	Obese patients (emergency LC)	Higher postoperative complications and readmission rates in BMI >30
Elnahla et al. [26]	Randomized Trial	Morbidly obese patients	Fewer postoperative complications with opioid-free vs. opioid anesthesia
Belal et al. [29]	Risk Factor Analysis	Pregnant/postpartum women with cholelithiasis	Key risk factors: obesity, multiparity, rapid weight gain
Pantelis et al. [30]	Meta-Review (AMSTAR 2)	Laparoscopic surgery in pregnancy	Fetal/maternal outcomes from systematic reviews

Discussion

Cholecystectomy in pregnant and obese patients presents a set of clinical challenges that require specialized approaches and improved clinical awareness. The literature presented in this review touches on the increased risks of complications, the delays in diagnosis, and the surgical challenges in both patient groups. In cases where both these conditions coexist, the difficulty in treatment increases, which highlights the need for updated research in this field. Surgical timing in obese patients with gallbladder diseases is crucial due to the increased complications and risks that are associated with treatment delays. Laparoscopic cholecystectomy in obese patients is complicated due to inflammation and anatomical difficulties, which can make dissection more difficult and usually lead to conversion to other surgical techniques to reduce the risks of operative complications [31]. Pregnant patients face additional risks due to physiological changes that can mask symptoms and complicate imaging, which leads to delays and can harm the mother and fetus [32,33]. Diagnostic images of the gallbladder can be much more difficult in both obese and pregnant patients. In patients with obesity, excess subcutaneous and visceral fat often makes ultrasound images unclear, forcing alternative methods such as MRI or CT scans, which aren't always available quickly or at all in emergency situations [33].

During pregnancy, imaging options are limited because doctors must consider the baby's safety. Ultrasound is the ideal choice due to its safety and accessibility; however, its accuracy decreases in the later stages of pregnancy when the growing uterus and intestinal gasket are in the way. MRI can be used as an alternative, but its lack of accessibility and conflicting indications in pregnant patients may deter practitioners from ordering one despite research advocating its safety during pregnancy when used without contrast dye [33,34]. Beyond clinical challenges, there are also systemic barriers such as financial hardships, healthcare access in remote areas, and insurance problems, which can lead to poorer outcomes as delays in imaging, specialist referrals, or surgical treatment occur [35]. Obese patients may face stigmatization from some health care providers, while pregnant patients may encounter reluctance from hospitals to perform surgery due to concerns about risks to the baby, even though research shows that laparoscopic gallbladder removal during the second trimester is generally safe. Additionally, ethnic and racial minorities, who are more likely to experience obesity and have less access to prenatal care, are particularly vulnerable to delayed diagnosis and higher complication rates [35]. Improving patient outcomes for these groups relies on improving clinical practices and diagnostic accuracy and making sure that surgical intervention occurs in a timely manner. Future research should focus on specific anatomical and physiological challenges associated with obesity and pregnancy and on patient care.

Conclusion

Gallbladder disease in pregnant and obese patients arises from a combination of physiological, hormonal, and metabolic changes that disrupt biliary function and increase the risk of gallstone formation. These patient groups are at an increased risk of complications, delayed diagnosis, and surgical challenges, especially when both conditions coexist. Laparoscopic cholecystectomy remains the gold standard of treatment with the best outcomes in the second trimester of pregnancy. Despite the many advantages of laparoscopic surgery, several barriers delay quick treatment in these patient groups, such as difficulties in imaging, limited access to specialized care, and systemic health care. Addressing these issues requires a multidisciplinary approach involving many specialists, such as obstetricians, radiologists, anesthesiologists, and surgeons. It is important to conduct further research focused on these populations to develop evidence-based guidelines that improve patient outcomes. This is pertinent, seeing as the rate of obesity and high-risk pregnancies continues to rise globally. Addressing the needs of these vulnerable patient groups should be considered a public health priority.

References

- Li J, Jin X, Ren J, Li R, Du L, et al. (2022) Global burden of gallbladder and biliary diseases: A systematic analysis for the Global Burden of Disease Study 2019. *Journal of Gastroenterology and Hepatology* 37(7): 1389-1399.
- Kimura Y, Takada T, Kawarada Y, Nimura Y, Hirata K, et al. (2007) Definitions, pathophysiology, and epidemiology of acute cholangitis and cholecystitis: Tokyo Guidelines. *Journal of Hepato-Biliary-Pancreatic Surgery* 14(1): 15-26.
- Hashimoto S, Nakaoka K, Kawabe N, Kuzuya T, Funasaka K, et al. (2021) The Role of Endoscopic Ultrasound in the Diagnosis of Gallbladder Lesions. *Diagnostics* 11(10): 1789.
- Jones MW, Deppen JG (2023) Open Cholecystectomy. *Nih.gov. StatPearls Publishing*.
- Camilo Ramírez-Giraldo, Danny Conde Monroy, Andrés Isaza-Restrepo, Ayala D, González-Tamayo J, et al. (2024) Subtotal laparoscopic cholecystectomy versus conversion to open as a bailout procedure: a cohort study. *Surgical endoscopy/Surgical endoscopy and other interventional techniques* 38(9): 4965-4975.
- Sultan AI, Saadi RK, Habash MM, Ghareeb OA (2023) Outcomes of Symptomatic Gallstone Disease in Pregnant Women: A Retrospective Study. *Journal of Population Therapeutics and Clinical Pharmacology* 30(2).
- Liu S, Yi M, Qin J, Lei F, Lin L, et al. (2022) The increasing incidence and high body mass index-related burden of gallbladder and biliary diseases—A results from global burden of disease study 2019. *Frontiers in Medicine* 9: 1002325.
- Kim NH, Kang JH, Kim HJ (2023) Differences in the Impact of Obesity and Metabolic Unhealthiness on the Risk of Gallbladder Polyp. *Yonsei Med J* 64(11): 658-664.
- Salari N, Hasheminezhad R, Heidarisharaf P, Khaleghi AA, Azizi AH, et al. (2023) The global prevalence of gallstones in pregnancy: A systematic review and meta-analysis. *European Journal of Obstetrics & Gynecology and Reproductive Biology*: X 19: 100237.
- Mencarini L, Vestito A, Zagari RM, Montagnani M (2024) The Diagnosis and Treatment of Acute Cholecystitis: A Comprehensive Narrative Review for a Practical Approach. *Journal of Clinical Medicine* 13(9): 2695.
- Jacobs TH, Wayne CD, Sajankila N, Narayanan S (2024) Pancreatitis Secondary to Dyslipidemia: An Understudied Condition. *Lipidology* 1(2): 117-133.
- Muhammad Nabeel Saddique, Saleem S, Shahid I, Javid S, Khan MH, et al. (2024) The estrogen-gallstone connection: uncovering the pathways. *Deleted Journal* 21(1).
- Zhang W, Yi H, Cai M, Zhang J (2023) Management strategies for acute cholecystitis in late pregnancy: a multicenter retrospective study. *BMC surgery* 23(1).
- Shabanzadeh DM (2018) New determinants for gallstone disease?. *Danish Medical Journal* 65(2): B5438.
- Di Ciaula A, Garruti G, Frühbeck G, De Angelis M, de Bari O, et al. (2019) The Role of Diet in the Pathogenesis of Cholesterol Gallstones. *Current Medicinal Chemistry* 26(19): 3620-3638.
- Nasioudis D, Tsilimigras D, Economopoulos KP (2016) Laparoscopic cholecystectomy during pregnancy: A systematic review of 590 patients. *International Journal of Surgery (London, England)* 27: 165-175.
- Celaj S, Kourkoumpetis T (2021) Gallstones in Pregnancy. *JAMA* 325(23): 2410.
- Hedström J, Nilsson J, Andersson B (2023) Cholecystectomy and ERCP in pregnancy: A nationwide register-based study. *International Journal of Surgery* 110(1):324-331.
- Mazza GR, Youssefzadeh AC, Aberle LS, Anderson ZS, Mandelbaum RS, et al. (2024) Pregnant patients undergoing cholecystectomy: nationwide assessment of clinical characteristics and outcomes. *AJOG Global Reports* 4(1): 100310.
- Marcos-Ramírez ER, Karla Carolina Guerra-Leza, Téllez-Aguilera A, Benavides-Zavala TE, J.R. Fernández-Treviño, et al. (2022) Colectistomía laparoscópica durante el embarazo. *Cirugía Y Cirujanos* 90(1).
- Nan X, Chan E, Wong KS (Chloe), Ng J, Izwan S, et al. (2023) Laparoscopic Cholecystectomy in Pregnancy: A Seven-Year Retrospective Study From an Australian Tertiary Center. *Cureus* 15(12): e50034.
- Itaimi A, Abbassi I, Oussama Baraket, Kotti A, Wissem Triki, et al. (2023) Safety of Laparoscopic Cholecystectomy for Cholecystitis during Pregnancy. *Gynecology and minimally invasive therapy* 12(3): 166-169.
- Dagar A, Goel KS, Hurria N, Goel N, Sachdeva K, et al. (2025) Difficulties And Complications In Laparoscopic Cholecystectomy In Obese And Non-Obese Patients: A Comparative Study - Current Issue - IJSR [Internet]. *Worldwidejournals.com*.
- Davies S, Salman Bodla, Roy S, Pallister S, Fumi Olaifa, et al. (2024) ThP4.5 - The challenges of the emergency laparoscopic cholecystectomy in the obese patient. *British journal of surgery* 111(Supplement_8).
- Russell TB, Aroori S (2021) How we do it: Laparoscopic cholecystectomy in patients with severe obesity. *Turkish Journal of Surgery* 37(4): 413-416.
- Elnahla Mohammed RA, Al Bahar M, Elbakry AE, El Hennawy T (2022) A randomized trial with opioid-free versus opioid anesthesia in morbidly obese patients during laparoscopic cholecystectomy. *Menoufia Medical Journal* 35(2): 686.
- Finer N (2021) Weight loss interventions and NAFLD: optimising liver outcomes. *Diabetes, Obesity and Metabolism* 24(52): 44-54.
- Farid S, Bashir B, Hamad A, Dhage S, Ho JH, et al. (2024) Diabetes and mi-

- crovascular disease: the impact of weight loss. *British Journal of Diabetes* 24(1): 6-12.
29. Belal S, Hamed HM, Kamal A, Al-Sayed MAW, Hamid HMAE, et al. (2022) Risk Factors Associated with Cholelithiasis during Pregnancy and Postpartum. *Open Journal of Obstetrics and Gynecology* 12(11): 1166-1175.
 30. Pantelis AG, Nikolaos Machairiotis, Stavros S, Anastasios Potiris, Theodoros Karampitsakos, et al. (2024) Laparoscopic Surgery During Pregnancy: A Meta-Review and Quality Analysis Using the Assessment of Multiple Systematic Reviews (AMSTAR) 2 Instrument. *Cureus* 16(6): e63521
 31. Dominguez JL, Tariq N, Martins RS, Jawad G, Fisher AD, et al. (2024) Bail-out Surgery for Difficult Gallbladders: Surgical Approach and Outcomes. *The American Surgeon* 90(6): 1324-1329.
 32. Yesika Alejandra Guerra-Juarez, Mendez-Martinez JN, Alvarez-Lozada LA, Quiroga-Garza A, Jacobo-Baca G, et al. (2024) Gallbladder Perforation in a Pregnant Patient: A Case Report and Considerations of Surgical Approach. *Cureus* 16(11): e73679.
 33. Childs DD, Lalwani N, Craven T, Arif H, Morgan M, et al. (2023) A meta-analysis of the performance of ultrasound, hepatobiliary scintigraphy, CT and MRI in the diagnosis of acute cholecystitis. *Abdominal Radiology* 49(2): 384-398.
 34. Dempsey PJ, Delaney FT, Geoghegan T, Lawler L, Bolster F, et al. (2022) MR imaging of acute abdominal pain in pregnancy. *The British Journal of Radiology* 95(1136): 20211114.
 35. Howell E (2018) Reducing disparities in severe maternal morbidity and mortality. *Clinical Obstetrics and Gynecology* 61(2): 387-399.

ISSN: 2574-1241

DOI: 10.26717/BJSTR.2025.62.009769

Naeem Hamza. Biomed J Sci & Tech Res



This work is licensed under Creative Commons Attribution 4.0 License

Submission Link: <https://biomedres.us/submit-manuscript.php>



Assets of Publishing with us

- Global archiving of articles
- Immediate, unrestricted online access
- Rigorous Peer Review Process
- Authors Retain Copyrights
- Unique DOI for all articles

<https://biomedres.us/>