Pancreatic and Biliary Emergencies

9

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9.1 Acute Cholecystitis in Obese Patients

Acute cholecystitis is a high-prevalence disease in Westernized societies: 10–20% of the US population suffers from gallstones and about one-third of them develop acute cholecystitis [1]. Obesity is currently recognized as an important risk factor for the development of gallbladder pathologies: a recent analysis found that 75% of patients who underwent cholecystectomy were overweight or obese, and >20% of all cholecystectomies were performed with a diagnosis of acute cholecystitis [2].

Multiple factors may contribute to the increased risk of cholesterol gallstones in obese patients: increased hepatic secretion of cholesterol in obese patients [3] and, consequently, bile saturated with excess cholesterol [4]; impaired gallbladder motility [5]; enhanced mobilization of cholesterol [6]; reduced hepatic secretion of bile salts due to decreased hepatic bile acid pool [6]; reduced gallbladder contractility [6]; increased secretion of biliary calcium [6].

In obese patients, as in the normal population, cholecystectomy followed by antibiotic therapy is the gold standard treatment for acute cholecystitis. However, some concerns have to be carefully evaluated:

1. Is a laparoscopic approach feasible in obese patients?
2. Is obesity a risk factor for conversion from laparoscopic to open cholecystectomy for acute cholecystitis?
3. Does obesity increase the risk of postoperative complications after laparoscopic cholecystectomy for acute cholecystitis?

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Since the early 1990s, the laparoscopic approach to gallbladder disease has been the procedure of choice. Traditionally, obesity has been considered a relative contraindication to laparoscopic cholecystectomy for symptomatic cholelithiasis [7]. Potential difficulties related to laparoscopic cholecystectomy in obese patients can include excess abdominal wall fat, excess intra-abdominal fat, difficulty accessing the abdomen, and problems with establishing and maintaining pneumoperitoneum [8]. With increasing experience in laparoscopic surgery and the development of better instruments, the routine performance of laparoscopic cholecystectomy in obese patients is rapidly growing and, currently, obesity is not considered an absolute contraindication for a laparoscopic approach. However, a recent study utilizing the National Surgical Quality Improvement Project (NSQIP) database demonstrated that the super-obese (BMI > 50) had a lesser percentage of attempted laparoscopic cholecystectomies (81% in the super-obese vs. 87% in the overall cohort; $p < 0.001$) [9].

Some techniques to combat the potential pitfalls for laparoscopic cholecystectomy in obese patients include: using extended or extra-long trocars [8]; increasing the insufflation pressure to >15 mmHg in order to maintain adequate working room in the peritoneal cavity [10]; using a Veress needle in the left upper quadrant and placing the camera port in a supraumbilical position to decrease the distance between the port site and the operating field [8].

Robotic single-site cholecystectomy is a relatively novel approach and an alternative to the laparoscopic approach for gallbladder removal [11]. Svoboda et al. recently reported their experience with 112 cholecystectomies (of which 23.3% performed for acute cholecystitis) successfully performed with the robotic approach in patients with BMI > 30 without conversion to open, laparoscopic or multiport procedures [12]. Total mean operative time was 69.8 min for obese patients compared to 59.2 min in the non-obese ($p = 0.0012$). There were no major complications recorded, including bile leak, hematoma, or ductal injury [12].

The effect of obesity as an independent risk factor for conversion from laparoscopic to open cholecystectomy has been debated during the last decade and still remains controversial. Several studies found that obesity was a risk factor for conversion [9, 13, 14], whereas other studies did not [15–17]. Despite these controversies, on the other hand, it has been clearly demonstrated that total operative time was significantly longer in obese patients, if compared with the normal population [8, 15].

It is more difficult to evaluate whether obesity must be considered an independent risk factor for the development of complications after cholecystectomy, because conflicting results have been reported. In a large Swiss national study [18], intraoperative complications were significantly higher in those patients with a body weight >90 kg, if compared with those with weights from 60 to 69 kg (OR 1.25), 70 to 90 kg (OR 1.24), and <60 kg (OR 1.34). Moreover, local postoperative complications were also significantly higher in patients with a body weight >90 kg compared with those with a body weight <60 kg (OR 1.53) or 60–69 kg (OR 1.46) [18]. These results were confirmed by another study [19]: obese patients undergoing laparoscopic cholecystectomy for cholecystitis had higher complication rates than non-obese patients (19.2% vs. 15.7%, respectively; $p < 0.0001$), particularly more infectious complications. However, other studies did not confirm these results [8,

14]. Farkas et al. [14], for example, found that the complication rate was not different across the spectrum of BMI values (overall complication rates of obesity class I, II and III patients were 6%, 8.1% and 4.5%, respectively; $p > 0.05$). In confirmation of these data, several studies demonstrated that the postoperative length of stay was not significantly affected by BMI [8, 11, 13]. However, it must be noted that only 15–20% of the patients reported in the previously mentioned studies had acute cholecystitis [12, 15]. A study utilizing the NSQIP database and evaluating outcomes after cholecystectomy for acute cholecystitis in obese patients has been recently published [9]. This study demonstrated that BMI class was not associated with increased risk of death/serious complications and that there was no significant difference in terms of morbidity and mortality between the intended open and laparoscopic converted to open groups, even at the highest BMI classes [9]; on the other hand, open cholecystectomies were associated with an increased risk of mortality and morbidity, independent of BMI class [9]. These results demonstrated that starting with a laparoscopic approach did not seem to put the patient at risk (even if the laparoscopic approach was converted to an open procedure) and that an initial attempt at laparoscopy may benefit patients (even those with very high BMI).

In conclusion, we can summarize that:

- Laparoscopic cholecystectomy is feasible also in obese and super-obese patients.
- It is not clearly demonstrated that obesity is an independent risk for conversion to open surgery. Moreover, studies demonstrated that an initial attempt at laparoscopy should be performed.
- Even though the results of published studies are conflicting, obesity seems to be an important risk factor for developing postoperative complications after cholecystectomy for acute cholecystitis.

9.2 Acute Pancreatitis in Obese Patients

Acute pancreatitis is an acute inflammatory process that involves the pancreas, the peripancreatic tissues and remote organ systems [20]. The incidence of this disease is increasing and ranges from 13 to 45 per 100,000 [21]. The clinical course of acute pancreatitis is extremely variable, ranging from interstitial edematous to severe acute pancreatitis. Approximately 20% of all cases of acute pancreatitis are severe [22], requiring treatment in hospital for several months and with a mortality rate up to 20% [23]. Gallstones are the most common cause of acute pancreatitis, representing close to 60% of all cases [24]; several other risk factors include alcohol, drug consumption, toxins, smoking, and metabolic and/or endocrine disorders [25].

Obesity is recognized as an important risk factor for the occurrence of acute pancreatitis [26]; moreover, not only BMI but also abdominal adiposity and visceral adipose tissue seem to be related to a higher incidence of acute pancreatitis [27]: a nationwide Swedish study, evaluating 68,158 individuals for a period of 12 years, demonstrated that the risk of acute pancreatitis among those with a waist circumference of >105 cm was twofold increased (RR 2.37; 95% CI 1.50–3.74) compared with those with a waist circumference of 75.1–85.0 cm [27].

Multiple local and systemic factors have been implicated in the occurrence and severity of acute pancreatitis in obesity:

- Patients with a high BMI have an increase of pancreatic fat [28], which has a direct toxic effect on the parenchyma of the pancreas [29]. It has also been demonstrated that deposits of intra-abdominal peripancreatic fat in obese patients undergo necrosis during acute pancreatitis, contributing to the developing of necrotizing pancreatitis [30].
- Fat composition in obesity is predominantly unsaturated, and lipolysis, determining an increased release of cytokines, worsens local and systemic injury [31, 32].
- Obesity in itself constitutes a low-grade proinflammatory state: a higher level of proinflammatory cytokines, such as TNF-α, IL-10. IL-6, IL-1β, and plasminogen activator inhibitor-1 have been described [31, 32]. Hence, the inflammatory response is increased and there is an up-regulation of the proinflammatory cytokines that leads to a larger inflammatory response.
- During acute pancreatitis, there is a restriction of chest wall and diaphragmatic movements that leads to a decrease in inspiratory capacity: this determines an increase of physiologic pulmonary arteriovenous shunting, thus leading to hypoxemia. Hypoxemia produces an oxygen deficit and exacerbates the underlying cellular damage from the inflammatory response, which subsequently increases the rate of multiorgan failure and death [32].

The treatment of acute pancreatitis in obese patients follows the same rules as in non-obese patients. Surgery is necessary only in cases of pancreatic infected necrosis and of failure of conservative treatments (antibiotics, endoscopic or radiological procedures). However, in the case of acute pancreatitis in obese patients, two aspects have to be kept in mind:

- these patients have a higher risk of developing a severe form of acute pancreatitis and thus of developing complications;
- consequently, in obese patients a careful attention in the first phase of the inflammatory disease is of great importance.

Several epidemiologic studies suggested that obesity or increased intra-abdominal fat is associated with severe acute pancreatitis, including organ dysfunction, infection, pancreatic necrosis, length of hospital stay, and use of intensive care [33–35]. For example, Krishna et al. in a nationwide inpatient study evaluated the impact of morbid obesity on acute pancreatitis-related clinical outcomes and healthcare utilization [33]. The authors demonstrated that morbid obesity was associated with increased mortality (OR 1.6; 95% CI 1.3–1.9), prolonged hospitalization (0.4 days; $p < 0.001$) and higher hospitalization charges; moreover, performing a propensity score-matched analysis, they demonstrated that acute kidney failure (10.8% vs. 8.2%; $p < 0.001$), respiratory failure (7.9% vs. 6.4%; $p < 0.001$) and mortality (OR 1.6; 95% CI 1.2–2.1) were more frequent in morbid obesity [33]. De Waele et al. investigated the occurrence of complications in different classes of overweight in a group of patients with gallstone pancreatitis [35]. When compared

with normal-weight patients (BMI 18.5–24.9), all categories with BMI ≥ 25 had an increased risk of developing the "severe" form of acute pancreatitis (OR 3.55; 95% CI 1.50–8.40): patients with class I obesity (BMI 30–34.9) developed significantly more organ failure and local complications (OR 3.469; 95% CI 1.15–10.43); patients with class II and III obesity (BMI 35–49.9) had also more metabolic complications (OR 7.33; 95% CI 1.62–33.24), needed more frequently intensive care and had a longer hospital stay than did their normal-weight counterparts [35]. The increasing risk of severe pancreatitis in obese patients has been confirmed by four meta-analyses published within the past 10 years [32, 36–38]. In the most recent of them [32], including 12 clinical studies, obese subjects had an increased risk of developing severe acute pancreatitis (RR 2.20; 95% CI 1.82–2.66), a higher risk of local (RR 2.68; 95% CI 2.09–3.43) and systemic complications (RR 2.14; 95% CI 1.42–3.21) and a higher risk of in-hospital mortality (RR 2.59; 95% CI 1.66–4.03) when compared with non-obese patients [32].

According to these reports, it is clear that prediction of severe acute pancreatitis in obese patients is important for clinical decisions involving triage, admission vs. transfer, and specific treatment of patients. For these reasons, during the last decade several studies have suggested including BMI in scoring systems for prediction of the severity of acute pancreatitis. Among several studies [39–41] evaluating the addition of obesity to the APACHE-II scoring system, only one study successfully demonstrated that APACHE-O was predictably better than APACHE-II [40]. In this study, the authors prospectively evaluated 186 consecutive patients with acute pancreatitis, to allow calculation of the APACHE-II score and BMI (categorized as normal (score = 0), overweight (BMI 26–30, score = 1), or obese (BMI > 30, score = 2)): the addition of the score for obesity to the APACHE-II score gave a composite score (APACHE-O) with greater predictive accuracy. At cut-off >8, APACHE-O had 82% sensitivity, 86% specificity, 74% positive predictive value, 91% negative predictive value and 85% overall accuracy. Although most experts believe that current methods for prediction of severity have limitations for individualized assessments, the consensus is that more studies are needed before including obesity in determining severity [42].

In conclusion:

- Obesity is a well-recognized risk factor for the occurrence of acute pancreatitis.
- In the obese population, it is more frequent to see the development of severe forms of acute pancreatitis, with a significant increase in terms of morbidity and mortality. An early diagnosis and treatment of the disease is therefore mandatory in this subset of patients.

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