Clinical Case Report

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Robotic cholecystectomy for acute cholecystitis

Three case reports

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Abstract

Introduction: Nowadays laparoscopic cholecystectomy is considered as criterion standard for surgical treatment of acute calculous cholecystitis. During the last few years, there has been growing interest about the robotic approach. Several authors have reported the superiority of robotic cholecystectomy, associated with a lower percentage of conversion especially in patients with intraoperative diagnosis of acute or gangrenous cholecystitis. We report 3 case reports of moderate acute cholecystitis successfully treated by robotic cholecystectomy.

Patient Concerns: Three patients presented moderate acute calculous cholecystitis with leukocytosis, fever, nausea, vomiting, and pain.

Diagnosis: Three patients of our study population had clinical and laboratory suspicion of moderate acute calculous cholecystitis verified by abdominal ultrasound examination, which found out cholelitiasis in all 3 cases. Final diagnosis was confirmed by intraoperative findings and histopathological examination, with two empyematous cholecystitis and one perforated cholecystitis.

Interventions: All patients underwent robotic cholecystectomy with the da Vinci Robotic Surgical System. The entire procedure required a mean operation time of 128 minutes and the average blood loss was 60 mL, without any intraoperative complications.

Outcomes: In all 3 cases postoperative period was uneventfull. All the patients were discharged within 24 hours and no readmissions were reported during a 30 days' follow-up.

Conclusions: Robotic cholecystectomy for ACC is feasible and safe. Several studies have demonstrated that robotic approach reduces the risk of conversion to open surgery in case of acute or gangrenous cholecystitis. Our results are in line with current literature. In fact, we have successfully treated 2 patients with empyematous acute cholecystitis and 1 with gangrenous cholecystitis with a totally robotic approach, without any complications or need of conversion to open surgery. In conclusion, our results confirm that it is the time to include robotic surgery in the emergency setting.

Abbreviations: ACC = acute calculous cholecystitis, BMI = body mass index, CVS = critical view of safety, ERAS = enhanced recovery after surgery, Fr = French, LC = laparoscopic cholecystectomy, TC = Tokyo Guidelines.

Keywords: acute calculous cholecystitis, cholecystectomy, empyematous cholecystitis, robotic

1. Introduction

Acute calculous cholecystitis (ACC) is an inflammation of the gallbladder usually caused by cystic duct obstruction from stones or sludge and it occurs in 10 to 20% of untreated symptomatic patients.[1]

Although laparoscopic cholecystectomy (LC) has become the criterion standard for elective cholecystectomy, 48.7% of acute cholecystitis are nowadays still operated with the open technique.

ACC has to be considered a risk factor for open conversion, being the presence of inflammation, oedema, and necrosis evaluated as unfavorable conditions for safe dissection by most surgeons.[2]

Recently a robotic set of instrumentation to be used with the da Vinci Si Surgical System has been developed to reduce invasiveness of this procedure and to overcome some of the technical limitations of laparoscopy. Some advantages of robotic platform are the 3-dimensional view, better instrument dexterity, improved ergonomics for the surgeon, enhanced stability, magnification, and electronic implementations that provide microsurgical precision and safety.

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Ethical approval: I certify that this kind of manuscript does not require ethical approval by the Ethical Committee of Federico II University.

Consent to publish: written informed consent for publication of their clinical details and clinical images was obtained from the three patients. A copy of the consent form is available for review by the Editor of this journal on request.

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According to Giulianotti PC, these advantages may decrease the conversion rates during minimally invasive cholecystectomy for acute cholecystitis.[3]

However, although laparoscopic cholecystectomy for ACC was widely reported, less is known about the robotic approach.

We describe 3 case reports of moderate acute cholecystitis and adhesion syndrome successfully treated by robotic cholecystectomy.

2. Methods

2.1. Study population

After obtaining a written informed consent for publication of their clinical details, we retrospectively analyzed 3 patients who underwent robotic surgery for ACC (Tables 1–2).

2.2. Surgical technique

All patients were under general anesthesia and orotracheal intubation. An orogastric tube was inserted. Patients were placed on the operating table with legs closed and both thighs at the same level of the abdomen to enhance manoeuvrability of the robotic instruments.

The surgeon and the assistant on the patient's right side, with the scrub nurse to the right of the surgeon.

A 1 cm trans-umbilical vertical incision was made and the first 8-mm port was inserted into the intra-abdominal space. Pneumoperitoneum was created and maintained with insufflation of CO_2 at a 12-mmHg pressure (Table 3).

Abdominal cavity was inspected using a 8-mm robotic endoscope with a 30 degree angled view.

Patients were placed in anti-Trendelenburg position at 30 degree.

The second port was placed left lateral over the transverse umbilical line, 8 to 10 cm away from the first port. The 8-mm assistant port was positioned left lateral, at least 7 cm away from the first port. The third and the fourth 8-mm port were inserted over the transverse umbilical line right lateral to the first port, 8 to 10 cm away from each other.

The da Vinci robot was docked cranially with the arms hovering over the patients' upper abdomen. Robotic instrumentation included: permanent cautery hook, fenestrated bipolar forceps, cadiere forceps, and *ProGrasp* forceps.

We performed all the interventions according to Strasberg's "Critical View of Safety" procedure,[4] starting with adhesiolysis. The triangle of Calot was cleared of fat and fibrous tissue elements elevating and dividing tissue with hook cautery commonly from the front to the back. The gallbladder was completely dissected off the cystic plate. Once this was done, there were 2 and only 2 structures attached to the gallbladder; the CVS was achieved allowing cystic artery and duct to be identified, clipped, and dissected.

An endobag was used for the extraction of the gallbladder. Accurate abdominal washing was performed and complete hemostasis was secured.

The 8-mm port site on the right hip was used to position a 19-Fr drain under the liver. The other port site accesses were closed.

The orogastric tube was removed at the end of the procedure.

Table 1

Patients' characteristics.

	Age, y	Sex	BMI, kg/m^2	ASA Score	Comorbidity
Patient 1	58	F	26.3	II	Hiatal hernia, GERD
Patient 2	75	M	26.7	III	Hypertension, Benign prostatic hyperplasia, Type 2 diabetes mellitus
Patient 3	53	F	34.2	III	Rheumatoid arthritis, Cervical disc herniation

ASA = American Society of Anasthesiologists, BMI = body mass index, GERD = gastroesophageal reflux disease.

3. Case reports

3.1. Case 1

A 58-year-old woman (body mass index [BMI] 26.2 kg/m^2) with hiatal hernia and gastroesophageal reflux disease presented pain in right upper quadrant and epigastric region, nausea, and vomiting 2 months before surgery. She was treated in emergency with fluid therapy and pain medicines, an abdominal ultrasound was also performed which found out a 4-mm gallbladder stone.

At the admission to the hospital, the patient had moderate right upper quadrant pain (visul analog scale [VAS] = 6; Murphy +),

Table 2

Clinical characteristics of the patients at the time of the intervention.

	Tokio Guidelines classification	Intraoperative diagnosis	Time to surgery	WBC count at time 0, cells/mL	WBC count after surgery, cells/mL	Fever at time 0, °C	Murphy at time 0	Pain (VAS scale)
Patient 1	Moderate	Gangrenous and empyematous cholecystitis	5 days	16,300	9150	39.2	+	6
Patient 2	Moderate	Perforated cholecystitis	7 days	13,460	10,040	39.5C	+	9
Patient 3	Moderate	Empyematous cholecystitis	5 days	15,180	8810	39.4	+	8

VAS = visual analog scale, WBC = white blood celss.

Table 3

Intraoperative and postoperative outcomes.

	Operative timing, min	Hospital stay after surgery, h	Intraoperative blood loss, mL	Complications	Pain	Rescue analgesia
Patient 1	135	20	75	No	Mild	No
Patient 2	120	16	55	No	Mild	No
Patient 3	130	18	50	No	Mild	No

leukocytosis (16,300 WBC/mL), and fever (39.2°C). After 5 days, she underwent robotic cholecystectomy with the da Vinci Robotic Surgical System for gangrenous and empyematous acute cholecystitis and adherence between gallbladder, duodenum, jejunum, and omentum. The entire procedure required 135 minutes with an average blood loss of 75 mL, without any intraoperative or postoperative complications. WBC count after surgery was 9150 cells/mL and there was no need of rescue analgesia.

According to enhanced recovery after surgery (ERAS) guidelines, she was mobilized since 2 hours after surgery and liquid and solid diet were resumed since 6 hours after surgery.

The patient was discharged after 20 hours and the 30-day follow-up period was uneventfull (Table 3).

Final diagnosis was confirmed by histopathological examination which found out an 8-cm empyematous gallbladder.

3.2. Case 2

A 75-year-old man (BMI 26.7 kg/m^2) with hypertension, benign prostatic hyperplasia, and type 2 diabetes mellitus had multiple episodes of postprandial pain in right upper quadrant 3 years before surgery. After an abdominal ultrasound examination, cholelitiasis was found.

The patient was admitted to the hospital because of an extremely severe right upper quadrant pain (VAS = 9; Murphy +), leukocytosis (13460 WBC/mL), and fever (39.5°C). After 7 days, he underwent robotic cholecystectomy with the da Vinci Robotic Surgical System for perforated cholecystitis and adherence between gallbladder, duodenum, and omentum. The entire procedure required 120 minutes with an average blood loss of 55 mL, without any intraoperative or postoperative complications. WBC count after surgery was 10,040 cells/mL and there was no need of rescue analgesia.

According to ERAS guidelines, he was mobilized since 2 hours after surgery and liquid and solid diet were resumed since 6 hours after surgery.

The patient was discharged after 16 hours and the 30 days' follow-up period excluded any problems after surgery (Table 3).

Final diagnosis was confirmed by histopathological examination which found out a 7-cm gallbladder.

3.3. Case 3

A 53-year-old woman (BMI 34.2 kg/m^2) with rheumatoid arthritis and cervical disc herniation presented pain in right upper quadrant and epigastric region, nausea, and vomiting 8 months before surgery. She was treated in emergency with fluid therapy and pain medicines; an abdominal ultrasound which found out a 4-mm gallbladder stone was also performed.

Three months later, symptoms occurred again and the patient was admitted to the hospital with a severe right upper quadrant pain (VAS = 8; Murphy +), leukocytosis [15,180 WBC/mL] and fever (39.4°C). After 5 days, she underwent robotic cholecystectomy with the da Vinci Robotic Surgical System for cholecystic empyema and adherence between gallbladder, duodenum, and omentum. The entire procedure required 130 minutes with an average blood loss of 50 mL, without any intraoperative or postoperative complications. WBC count after surgery was 8810 cells/mL and there was no need of rescue analgesia.

According to ERAS guidelines, she was mobilized since 2 hours after surgery and liquid and solid diet were resumed since 6 hours after surgery.

The patient was discharged after 18 hours and the 30 days' follow-up period excluded any problems after surgery (Table 3).

Final diagnosis was confirmed by histopathological examination which found out a 6 cm empyematous gallbladder.

4. Discussion

According to the third National Health and Nutrition Examination Survey, 6.3 million men and 14.2 million women aged 20 to 74 in the United States had gallbladder disease.[5] In Europe the Multicenter Italian Study on Cholelithiasis (MICOL) examined nearly 33,000 subjects aged 30 to 69 years in 18 cohorts of 10 Italian regions with a clear-cut definition of the gallbladder status assessing that among those, 6.5% of the males and 10.5% of the females had gallstones. Among subjects with gallstones, 87% of men and 84.9% of women were asymptomatic.[6]

It can be asserted that gallstone disease is a highly prevalent condition that rarely causes symptoms.

It is worth mentioning that 10% to 20% of untreated patients developed acute cholecystitis,[1] that is, according to the World Society of Emergency Surgery, the second source of complicated intra-abdominal infection (18.5%).[5]

Acute cholecystitis can lead to potentially life-threatening complications such as empyema, gallbladder gangrene, and gallbladder perforation with higher morbidity and mortality rates, particularly in the elderly.

A new edition of the Tokyo Guidelines 2018 (TG 2018) has defined the best surgical treatment for acute cholecystitis (AC) according to grade of severity, timing, and procedure.

The severity of acute cholecystitis is classified into 3 categories: "mild (grade I)," an acute cholecystitis in a healthy patient with no organ dysfunction and only mild inflammatory changes in the gallbladder; "moderate (grade II)," an acute cholecystitis associated with local inflammation; "severe (grade III)," an acute cholecystitis associated with organ dysfunction.

Mild (Grade I) AC can be safely treated by early laparoscopic cholecystectomy.

For moderate (Grade II) AC, an initial antibiotic therapy should be administered to control inflammation. Later, early laparoscopic cholecystectomy could be performed if advanced laparoscopic techniques are available, otherwise gallbladder drainage is required.

In case of severe (Grade III) AC, conservative treatment with antibiotics and general organ support should be performed first. If patient's performance status is good it can be followed by early laparoscopic cholecystectomy, otherwise a gallbladder drainage should be placed.[7]

Despite the benefits of minimally invasive approach, for 48.7% of acute cholecystitis open technique is currently still preferred because it may be a safer choice based on perceived limitations and supposed morbidity increasing of the laparoscopic technique.[8]

Laparoscopic cholecystectomy (LC) could be considered the gold standard treatment, even in case of ACC. The advantages of minimally invasive surgery could be considered open-and-shut nowadays.

The presence of inflammation, oedema, and necrosis is considered as unfavorable condition to perform a safe dissection.[2] Some authors assume that laparoscopic surgical removal

of an acutely inflamed gallbladder might have higher risk of conversion to open cholecystectomy and higher number of complications, including bile duct injury.[9]

Thus, some studies have shown a 3-fold higher conversion rate to open cholecystectomy when laparoscopic surgery is performed for complicated acute cholecystitis than for uncomplicated cholelithiasis.[10]

However, conversion to open cholecystectomy is associated with elevated postoperative pain, potentially higher blood loss, suboptimal cosmetic outcomes, longer recovery time, and time-off work.[11,12]

Recently some possible scenarios have been identified where the robotic approach may be better suited in case of ACC to reduce the risk of open conversion.[8]

Robotic surgery is more complex than laparoscopic surgery because of the absence of tactile feedback to the surgeon, the necessity of bimanual control of the instruments, and a 3-dimensional user interface. However, several published reports assert that robotic cholecystectomy can be quickly learned and safely performed by surgeons with experienced laparoscopic skills, with a reasonable learning curve and acceptable perioperative outcomes.

Many successful experiences with the da Vinci Instrumentation and Accessories when it is used for cholecystectomy procedures were described.

Giulianotti[3] asserted that "the robot will be the future for laparoscopic cholecystectomy," and one motivation is that superior microsurgical capabilities may decrease the rate of biliary injuries and conversions rates.

In Strosberg et al's study, a total of 237 patients underwent cholecystectomy performed with minimally invasive approach. Of these, 140 robotic cholecystectomies when compared to 97 laparoscopic cholecystectomies had a lower percentage of conversion to an open procedure (0.7% vs 7.2%; $P < .01$).[13]

In details about ACC, Gangemi et al analyzed a total of 960 minimally invasive cholecystectomies, 284 treated by laparoscopic approach and 676 treated by robotic approach. For the first time, they found out that patients with intraoperative diagnosis of acute or gangrenous cholecystitis had an open conversion rate of 8.33% and 0.76% respectively, confirming the superiority of robotic approach.[8]

Nevertheless, literature has to be considered far to give definitive conclusions and the findings of this study are limited by retrospective study design and lack of number of patients.

5. Conclusions

Waiting for further data on robotic cholecystectomy for acute cholecystitis, our series give additional evidence of its safety and effectiveness.

An important consideration is that although gallbladder empyema was significantly associated with a higher rate of local complications when compared with nonempyematous acute cholecystitis,[14] we have successfully treated without complications 2 patients with empyematous acute cholecystitis and 1 with gangrenous cholecystitis.

It is the time to include robotic surgery in the emergency setting to obtain definitive conclusions about its advantages in the treatment of acute cholecystitis on large series of patients.

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