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Case Report and Review of the Literature

Multidisciplinary Approach to Acute Cholecystitis in a Severely Cardiopathic Patient: Case Report and Review of Literature on Treatment Strategies

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http://dx.doi.org/10.31487/j.SCR.2020.12.10

ARTICLE INFO

Article history:
Received: 13 November, 2020
Accepted: 26 November, 2020
Published: NA

Keywords:
St Jude ring
acute calculous cholecystitis
myocardial infarction
interventricular septum rupture
Kay procedure
CABG
cholecystectomy
percutanous cholecystostomy
choledochus stones
ERCP

ABSTRACT

Acute cholecystitis in severely cardiopathic patients after major cardiac surgery represents a challenge for surgeons. Treatment with cholecystostomy, may offer a chance to these patients, however there is still a number of controversial issues on the topic: performance surgical techniques (transhepatic or transpapillary), optimal duration and timing of drain removal, the need for further tests before removal as well as the timing for definitive surgery. We therefore deemed it important to share our experience of a multidisciplinary approach for the definitive treatment of this patient with severe heart disease. A percutaneous cholecystostomy was the chosen strategy for a 58-year-old cardiopathic patient who had undergone surgery for hip replacement and had developed acute calculous cholecystitis a few days after surgery. Two weeks after discharge, a cholangiography through the cholecystostomy and an MRI cholangiopancreatography revealed the presence of stones in the cystic duct and in the ductus choledochus. The definitive treatment was decided after consulting with a multidisciplinary team. The choice was to perform an open cholecystectomy with simultaneous removal of the cholecystostomy, endoscopic removal of stones and sphincterotomy of the Oddi papilla. Currently, the patient is healthy and his heart function satisfactory. Although early cholecystectomy is the recommended choice for acute cholecystitis, a patient with severe co-morbidities may benefit from a bridging therapy before definitive surgery and a multidisciplinary approach can provide a safer solution.

Introduction

In case of patients unfit for surgery (due to co-morbidities) the Tokio Guidelines (TG) 2018 recommend the use of percutaneous cholecystostomy (PC) both in grade II and III cholecystitis because this method allows to convert a septic cholecystitis into a non-septic situation with a reduction of inflammation and improvement in clinical condition [1, 2]. However the WSES guidelines reported lack of higher level evidence (LoE 4, GoR C) on this topic [3, 4]. In general, an analysis of the relevant literature confirmed this lack and the need for randomized clinical trials. There are still controversial issues regarding cholecystostomy: the techniques used to perform it (transhepatich or transpapillary), optimal duration and removal time, indications for further examinations prior to removal and finally, the optimal timing of definitive surgery.

In this paper, we report the case of a patient presenting with acute calculous cholecystitis following recent hip replacement, who had undergone several complex cardiac surgical procedures for myocardial infarction with interventricular septal rupture 18 months earlier. We deemed it important to share our experience in this case of acute cholecystitis in a severe cardiopathic patient, providing an overview of the literature on the treatment with PC insertion as a bridge therapy as well as recognizing the value of a multidisciplinary team in finding the definitive therapy

Case Report

A 58-year-old man with cardiopathy, admitted to the Internal and Post-surgical Medicine Unit of our hospital, presented with calcolous cholecystitis during the postoperative course following the prosthetic replacement of the femoral head under spinal anaesthesia performed in June 2019. The calculous cholecystitis was confirmed by ultrasound examination and CT scan, that showed a fluid collection around the gallbladder with delaminated walls and presence of stones. Leukocytosis and abdominal pain were also present. The patient's home therapy included: oral assumption of aspirin, bisoprolol, furosemide, ivabradine, metolazone, potassium canrenoate after the emergency cardiac surgery for acute post-myocardial infarction rupture in the posterior portion of the interventricular septum (IVSR) he had undergone about 18 months earlier. For the surgical repair, a bovine pericardial patch was used ("infarction exclusion technique") through the left ventricular posterior wall and a concomitant coronary artery bypass graft (CABG) with the left internal mammary artery anastomosed sequentially to the left anterior descending artery and the first diagonal branch.

The postoperative cardiac echocolordoppler showed a significant post-operative residual left-to-right shunt and therefore a new elective treatment was planned. A month after surgery, a percutaneous attempt was carried out (with Amplatzer VSD Muscular Occluder n. 18mm) to close the residual IVSR but it was unsuccessful, and a redo surgery was needed. In this instance, after the implantation of an Intra-Aortic Balloon Pump (IABP), the septum was repaired through the tricuspid valve. A mitral valve annuloplasty (with St Jude ring n. 26mm) and tricuspid valve annuloplasty (by the Kay-technique) were also required. The postoperative course was uneventful except for the onset of a marked bradycardia that required pacemaker implantation. At the time of the hospital discharge, the patient was symptomless and in a good and stable hemodynamic status. The cardiac ultrasound examination showed a residual mild left-to-right shunt, a moderate right ventricular dysfunction and a left ventricular ejection fraction of 35%. Follow-up outpatient checkups confirmed the stability of the patient's hemodynamic and clinical status.

At the time of acute cholecystitis, due to the high risk cardiac condition, a bridging procedure with placement of a percutaneous cholecystostomy (PC) was the chosen strategy. PC was performed transhepatically under local anaesthesia by our Interventional Radiologists Team. Two weeks after discharge, a cholangiography through the cholecystostomy revealed the presence of stones in the cystic duct and in the ductus choledochus, confirmed by MRI cholangiopancreatography. The

definitive treatment was decided after consulting with a multidisciplinary team composed of cardiac surgeons, cardiologists, anaesthesiologists and endoscopists.

His cardiac condition was checked once again before surgery, revealing 31% ejection fraction (EF), slight pulmonary hypertension, minimal tricuspid valve insufficiency. The intraoperative phase was managed using advanced hemodynamic and anaesthesia monitoring that included pulse contour analysis to determine the continuous cardiac output (MostCare^{UP}, Vygon, Caen, France), trans-esophageal echocardiography, and depth of anaesthesia monitoring (Sedline®, Masimo, Irvine, CA, USA). An open cholecystectomy was performed with the simultaneous removal of the cholecystostomy tube, endoscopic extraction of stones and sphincterotomy of the Oddi papilla. After surgery, the patient was transferred to the general Intensive Care Unit and then to the Cardiac Surgery Unit from which he was discharged in satisfactory health condition on the tenth postoperative day. He is presently healthy and in good shape.

Discussion and Conclusion

An initial literature search on the subject 'Cholecystostomy' and "Cholecystitis surgical treatment" produced several observational studies, a systematic review, a propensity score analysis in elderly and a Cochrane Systematic review [5-30]. The selection criteria used for the observational studies, but also results and often the conclusions reached by various Authors were found to be largely non-homogeneous. The systematic review stated that PC was performed after failure of medical treatment and was associated to unacceptably high rates of complications and mortality [28]. The propensity score study, that showed a lower rate of definitive cholecystectomy and a higher mortality and readmission rate, concluded that a refinement to the Tokio guidelines was needed on this topic [29]. The Cochrane Systematic Review confirmed a lack of clear indications for the use of PC in the clinical management of high risk surgical patients with cholecystitis and underlined the need of randomized clinical trials [30].

Regarding cholecystostomy placement techniques, although according to TG2018 transhepatic percutaneous cholecystostomy remains the recommendation, it is also worth examining a systematic review and a propensity score paper found in the literature [1, 31-34]. The first compared EUS-guided gallbladder drainage (EUS-GBD) vs endoscopic transpapillary gallbladder drainage (ET-GBD), showing that EUS-GBD was the better choice because of higher rate of technical and clinical success and lower rate of recurrent cholecystitis [33]. The second paper compared percutaneous and endoscopic gallbladder drainage [34]. Results showed that there were no significant differences between the two techniques in clinical efficacy and complication rate.

Also the optimal duration of PC drainage, as reported in a paper by Hasbahceci *et al.* is still a controversial issue [8]. The suggested time is considered to be three to six weeks, with an average of one month, but Morse *et al.* recommended that the PC tube should remain in place in critically ill patients until cholecystectomy (Table 1) [11]. The same was suggested by Wang *et al.* [35]. However, other studies reported adverse events, one of them indicating that a drainage duration longer than two weeks may be associated with increased recurrence rate [6]. Other policies have been catheter removal after confirmation of the patency of the cystic duct [33]. Discharge with the PC tube in place until cholecystectomy has also been reported [6]. So far, no definitive conclusion has been drawn on timing, although catheter removal can generally be performed after temporary clamping [10]. Some Authors left the PC tube in place as a bridge procedure and performed early surgery after a mean of 9.68 ± 6.45 days [11]. However, further studies are needed to clarify the timing of PC tube removal before definitive surgery. Furthermore, recurrence after catheter removal is an important issue in patients not undergoing surgical treatment [6, 8, 11].

Table 1: Articles (2010-2020) reporting a time interval between cholecystostomy and cholecystectomy.

Author	Title	Journal	Timing for cholecystostomy removal an definitive cholecystectomy
De Geus T *et al.* [47] 2020	Outcomes of patients treated with upfront cholecystostomy for severe acute choelcystytis.	Surg Laparosc Endosc percutan Tech 2020;30:79-84	No timing definition reported
Masrani A *et al.* [17] 2020	Management algorithm of acute cholecystitis after percutaneous cholecystostomy catheter placement based on outcomes from 377 patients	Abdominal radiology 20205:1193-1197	Cholangiography after two weeks , no definite timing for catheter removal and delayed cholecystectomy
Alotaibi A *et al.* [48] 2019	Is cholecystostomy e real bridge for cholecystectomy ub acute cholecystitis. A retrospective cohort study	Saudi J Health Sci 2019;8:157-61	No timing definition reported
Aroori S *et al.*[5] 2019	Percutanous cholecystostomy for severe acute cholecystitis: a useful procedure in high-risk patients for surgery.	Scandinavian Journal of Surgery 2019, Vol. 108(2) 124 –129. DOI: 10.1177/1457496918798209	Removal of the cholecystostomy after 6 weeks and concurrent cholecistectomy
Pal I *et al.* [21] 2018	Role of percutaneous cholecystostomy tube placement in the management of acute calculus cholecystitis in high risk patients	JCPSP 2018;28 (5):386-389	6-8 weeks after cholecystostomy placement
Kim D *et al.* [15] 2018	Expanding role of percutaneous cholecystostomy and interventional radiology for the management of acute cholecystitis: An analisys of 144 patients	Diagnost Intervent Imaging 2018;99:15-21	No timing definition reported

Hasbahceci M *et al.* [8] 2018	The impact of a percutaneous cholecystostomy catheter in situ until the time of cholecystectomy on the development of recurrent acute cholecystitis: a historical cohort study	Rev Esp Enferm Dig 2018:110(10):629-633. DOI: 10.17235/reed.2018.5644/2018	6-8 weeks after cholecystostomy placement (3 groups:1)PC no further treatment,2) removal of the PC and subsequent cholecystectomy,3) PC left in situ until removal at the beginning of surgery)
Dai Y *et al.* [49] 2017	Current status of percutaneous cholecystostomy for the management of cholecystitis	Dig Div Interv 2017;1:22-27	No timing definition reported
Zeren S *et al.* [50] 2017	Bridge treatment for early cholecystectomy in geriatric patients with acute cholecystitis:percutaneous cholecystostomy	Ulus Trauma Acil Cerrahi Derg 2017;23 (6):501-505	No timing definition reported
Bala M *et al.* [51] 2016	Percutaneous cholecystostomy is safe and effective option for acute cholecystitis in select group of high-risk patients	Eur J Trauma Emerg Surg 2016;42:761-766	No timing definition reported
Popowicz A *et al.* [12] 2016	Cholecystostomy as Bridge to Surgery and as Definitive Treatment or Acute Cholecystectomy in Patients with Acute Cholecystitis	Gastroenterology Research and Practice 2016, Article ID 3672416, http://dx.doi.org/10.1155/2016/3672416	No timing definition reported
Suzuki K *et al.* [20] 2015	Tube cholecystostomy before cholecystectomy for the treatment of acute cholecystitis	JSLS2015(19)1 DOI:10.4293/JSLS.2014.00200	No timing definition reported
Jung W *et al.* [16] 2015	Timing of cholecystectomy after percutaneous cholecistostomy for acute cholecystitis	Korean J Gastroenterol 2015;66:209-214	No timing definition reported (patients diveded in two group: group1 mild disease had surgery within 10 days. Group 2 moderate disease had surgery after 10 days
Jang WS *et al.* [10] 2015	Outcome of conservative percutaneous cholecystostomy in high-risk patients with acute cholecystitis and risk factors leading to surgery	Surg Endosc 2015;29:2359-64. DOI: 10.1007/ s00464-014-3961-4 11.	Laparoscopic cholecystectomy within 7 days after PC or more than 7 days after PC placement
Mizrahi I *et al.* [52] 2015	Perioperative outcomes of delayed laparoscopic cholecystectomy for acute with and without percutaneous cholecystostomy	Surgery 2015; 158:728-35.	6-8 weeks after PC placement
Sanjay P *et al.* [19] 2013	Clinical outcomes of a percutaneous cholecystectomy for acute cholecystitis:a multicentre analysis	HPB 2013;15:511-516	4-6-weeks after PC placement
Hsieh YC *et al.* [6] 2012	Outcome after percutaneous cholecystostomy for acute cholecystitis: a single-center experience	J Gastrointest Surg 2012;16:1860-8. DOI: 10.1007/s11605-012-1965-8	8-10days from PC insertion after symtomatology resolution
Morse BC *et al.* [11] 2010	Management of acute cholecystitis in critically ill patients: contemporary role for cholecystostomy and subsequent cholecystectomy	Am Surg 2010;76:708-12	small patient population. In critically ill patients, cholecystostomy tubes should remain in place until the patient is suitable to undergo cholecystectomy. Removal of the cholecystostomy tube without subsequent cholecystectomy is associated with a high incidence of recurrent cholecystitis and devastating consequences.
Chok KS *et al.* [18] 2010	Results of percutaneous transhepatic cholecystostomy for high surgical risk patients with acute cholecystitis	ANZ J Surg 2010;80:280-3. doi:10.1111/j.1445-2197.2009.05105.x	No timing definition reported
Koebrugge B *et al.* [9] 2010	Percutaneous cholecystostomy in critically ill patientswith cholecystitis: a sale option	Dig Surg 27:417-421, 2010	No timing definition reported

Both the 2016 WSES guidelines on acute cholecystitis, and in the 2017 WSES and SICG guidelines on acute calculous cholecystitis in the elderly, mentioned the CHOCOLATE study, an ongoing multicentre randomized clinical trials on laparoscopic cholecystectomy versus percutaneous catheter drainage for acute cholecystitis in high risk patients [3, 4, 36, 37]. In 2018 Loozen *et al.* reported that the definitive results of the CHOCOLATE study stated that while the mortality rate, one of the primary endpoints of the study, did not differ significantly between the two groups, (percutaneous cholecystostomy vs early cholecystectomy (P=0.27), differences were significant in the other primary endpoint, i.e. the occurrence of major complications, in favour of early cholecystectomy (risk ratio 0.19, 95% confidence interval 0.10 to 0.37, P=0,001) [37]. The conclusion was that among high risk patients

with acute cholecystitis, cholecystectomy was the preferred treatment over percutaneous cholecystostomy.

However, the rate of recurrent gallstone related symptoms could have been lower if all the patients with drainage had undergone definitive elective cholecystectomy. The CHOCOLATE study did not explore the possibility of cholecystectomy after PC placement, due to the fact that PC by itself is considered the best definitive treatment for avoiding surgical complications [18, 37-40]. To the best of our knowledge, no studies are presently available on clinical, biochemical or radiological predictors for failure of percutaneous catheter drainage in acute cholecystitis.

As to the high risk assessment of individual patients some authors report that in patients with an ASA score grade III and IV, PC is a minimally invasive treatment with a low complication rate for patients with ACC [5, 6, 10]. In particular, in a retrospective study Aroori *et al.* examined 53 patients who had undergone PC [5]. Patients fit enough for surgery had the PC removed at the time of surgery and a definitive cholecystectomy was performed after 6 weeks. Despite the fact that, based on the risk assessment over 50% of the patients were ASA IV and V, the majority survived and underwent the PC procedure. The associated presence of common bile duct stone (Choledocholithiasis) at presentation, has been reported to occur in 10-20% in case series of cholelithiasis, with a lower incidence during ACC ranging from 5-15% of the patients [35, 41, 42].

The American Society of Gastrointestinal Endoscopy and the Society of American Gastrointestinal Endoscopic Surgeons of risk stratification of common bile duct stones (CBDS) defined three different classes: low risk (<10%), moderate (10 to 50%) and high risk (> 50%), (ASGE 2010) [43, 44]. Patients with a low risk of CBDS should be operated upon without further investigation. Patients with moderate risk should undergo a second level examination, i.e., preoperative endoscopic ultrasound (EUS) or preoperative magnetic resonance cholangiopancreatography (MRCP) or intraoperative laparoscopic ultrasound or laparoscopic cholangiography. Depending on the different clinical conditions assessed, patients shall undergo stone removal prior, during or after surgery. Patients at high risk for CBDS should directly proceed to preoperative diagnostic and therapeutic ERCP. With regard to preoperative imaging techniques, Magnetic Resonance Cholangiopancreatography and Endoscopic Ultrasound are the diagnostic procedures of choice.

Intraoperative cholangiography is an invasive procedure with potential severe complications. Positive findings on intraoperative cholangiography lead to intraoperative management of CBDS with prolonged operative time. In this case we utilized ERCP plus sphincterotomy as a combination of intraoperative procedure with the rendezvous technique [1, 11, 25]. Its morbidity includes pancreatitis, cholangitis, hemorrhage, duodenal perforation or allergy to contrast. However, while intraoperative cholangiography significantly increases the length of surgery intraoperative ERCP plus sphincterotomy reduce risks for post-ERCP pancreatitis [1, 3]. Both the procedures require a dedicated staff in the operating room.

This case presented the following critical points:

i. The choice of a multidisciplinary approach to select the best management in difficult clinical cases.
ii. The evaluation of the patient's heart conditions related to a reduced EF, a persistent ventricular septal defect due to previous myocardial infarction with ventricular septal rupture that had required numerous surgical repairs and pacemaker placement.
iii. The choice of PC for first line treatment as a bridge procedure to manage the acute situation before definitive treatment.
iv. The choice of a delayed open cholecystectomy with cholecystostomy tube removal at the time of surgery associated to a rendezvous for the removal of biliary stones from the Common Biliary Duct (CBD) and simultaneous endoscopic sphincterotomy for Oddi dysfunction.

The choice at presentation for acute cholecystitis of a bridging procedure was decided autonomously by the surgeon on call as the best solution to solve the acute condition before definitive surgery. This choice is supported by several studies suggesting that PC followed by laparoscopic cholecystectomy is a suitable management for patients with ACC who are deemed unfit for emergency surgery [8, 12, 45]. In a paper of 2016, Popowicz *et al.*, reviewed the medical reports of seven hospitals with 799 pts. admitted in 2003 and 850 in 2008 [12]. Multivariate regression analysis was performed with adjustments for age, gender, degree of cholecystitis and Charlson comorbidity index [46]. Notably, although patients treated with cholecystectomy as a bridge to elective surgery, were older with a predominance of females, the complications reported in the "bridge to surgery" group were entirely confined to the subsequent final gallbladder operation, confirming the Authors' conclusion that PC is a safe option in high risk patients with ACC. The only negative finding was the longer hospital stay in the PC group.

The multidisciplinary teamwork collaboration enabled the sharing of information about the patient's health, from the initial myocardial infarction to the required cardiac surgical procedures, up to the removal of the gallbladder. This allowed to find a definitive cure and eliminate a potential infection starter in a severe cardiopathic patient. The strategic adoption of a step by step procedure with PC as bridging therapy before definitive cholecystectomy supported by medical and surgical teamwork from different specialties has proven to be a valuable approach in providing the best treatment option for this high risk patient.

Acknowledgment

The Authors thank Patrizia Agresti, registered translator at the Courthouse of Florence, for her help in checking and revising the english version of this manuscript.

Conflicts of Interest

None.

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