

Multidisciplinary approach to acute cholecystitis in a severely cardiopathic patient. Case report and review of literature

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Case report

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Abstract

Background. Acute cholecystitis in severely cardiopathic patient after major cardiac surgery represent a challenge for surgeons. Treatment with cholecystostomy could represent a chance for patients even if there are many topics of greatest debate about it: the technique of performing it (if transhepatic or transpapillary), the timing of optimal duration, the timing of drain removal, the need of further examinations before the removal as well as the timing for definitive surgery. We therefore deemed important to share our experience in the treatment of acute cholecystitis in a severe cardiopathic patient, while attempting to clarify all the major topics related to the management of percutaneous cholecystostomy through a literary review.

Case presentation. A 58-year-old severely cardiopathic patient who had undergone surgery for hip replacement, developed an acute calculous cholecystitis a few days after surgery to resolve which a percutaneous cholecystostomy was the chosen strategy. Two weeks after discharge, a cholangiography through the cholecystostomy and a 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. An open cholecystectomy with simultaneous removal of the cholecystostomy, endoscopic removal of stones and sphincterotomy of the Oddi papilla was performed. The patient is currently healthy and his heart function is satisfactory.

Conclusion. Although early cholecystectomy is the recommended choice for acute cholecystitis, a critically ill patients may benefit from a bridging therapy before definitive surgery. The multidisciplinary approach provided a safer solution for this frail patient.

Background

In case of patients not fit for surgery (due to co-morbidities, as elderly patients) the Tokyo Guidelines (TG) 2018 (2) recommend the use of percutaneous cholecystostomy both in grade II and III of cholecystitis because this allow to convert a septic cholecystitis into a non-septic condition obtaining a reduction of the inflammation and improvement of the clinical condition (3). It is important to consider that WSES 2017 guidelines reported lack of high level evidence (LoE 4, GoR C) about this topic (1) and even if several case series, retrospective and observational studies exist (3) as well as a systematic review of the literature, the selection criteria, the results and even the conclusions reached by various authors are largely non-homogeneous (4).

The main controversial issues regarding cholecystostomy are the following: the different techniques used to perform it (whether transhepatic 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 cardiac surgical procedures for a myocardial infarction with interventricular septal rupture 18 months earlier. We deemed important to share our experience in the treatment of acute cholecystitis in a severe cardiopathic patient, while clarifying all the major issues related to the management of percutaneous cholecystostomy through a literary review.

Case Report

A 58 year-old man with cardiopathy presented with calculous cholecystitis during the postoperative course following the prosthetic replacement of the femoral head under spinal anesthesia performed in June 2019. The calculous cholecystitis was confirmed by ultrasound examination and CTscan that showed a fluid collection around the gallbladder with delaminated walls and the presence of stones inside of it. Leucocytosis and abdominal pain were also present. The home

therapy included : oral assumption of aspirin, bisoprolol, furosemide, ivabradine, metolazone, potassium canreonate since, about 18 months earlier, the patient had undergone emergency cardiac surgery for an acute post-myocardial infarction rupture in the posterior portion of the interventricular septum (IVSR). 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 was anastomosed sequentially to the left anterior descending artery and the first diagonal branch.

The postoperative cardiac ecocolor Doppler 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. 18 mm) to close the residual IVSR that was however unsuccessful, and a redo surgery was needed. In this instance, the septum was repaired through the tricuspid valve. A concomitant new onset of significant mitro-tricuspidal regurgitation also required both a mitral valve annuloplasty (with St Jude ring n. 26 mm) and tricuspid valve annuloplasty (by the Kay-technique). Finally, in order to improve postoperative hemodynamic status, the implantation of an Intra Aortic Balloon Pump (IABP) was necessary.

The postoperative course was uneventful except for the onset of a marked bradycardia that required pacemaker implantation.

At 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 patient high risk for cardiac condition, a bridging procedure with placement of a percutaneous cholecystostomy (PC) was the chosen strategy. PC was performed transhepatically under local anesthesia 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, anesthesiologists, and endoscopists. An open cholecystectomy with simultaneous removal of the cholecystostomy, endoscopic removal of stones and sphincterotomy of the Oddi papilla was performed. His cardiac conditions were checked again before surgery, revealing 31% ejection fraction (EF), slight pulmonary hypertension, minimal tricuspid valve insufficiency. Intraoperative phase was managed with advanced hemodynamic and anesthesia monitoring including a pulse contour method for cardiac output measurement (MostCare^{UP}, Vygon, Caen, France), trans-esophageal echocardiography, and depth of anesthesia monitoring (Sedline[®], Masimo, Irvine, CA, USA).

After surgery he was transferred to the general ICU 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

Transhepatic percutaneous cholecystostomy is the recommended technique according to the TG2018(2). However, a recent systematic review about other techniques as EUS-guided gallbladder drainage and endoscopic transpapillary gallbladder drainage in the treatment of high-risk surgical patients with acute cholecystitis shows better results (7).

As reported in a paper by Hasbahceci et al (8), also the optimal duration of PC drainage is still a controversial issue. The suggested time is three to six weeks with an average of one month (8) but Morse et al. recommended that the PC tube should remain in place in critically ill patients until cholecystectomy. (Table1) Also Wang et al, in another paper, suggested

keeping the PC tube in place until cholecystectomy in critically ill patients. However, some other studies report adverse events, one of them (9) indicating that a drainage duration longer than two weeks may be associated with increased recurrence. Other policies have been catheter removal after confirmation of the patency of the cystic duct (8) or until surgery (10,11,12). Discharge with the PC tube in place until cholecystectomy, although a rare condition, is also reported in the literature (10). So far no definitive conclusion has been drawn on the timing, although catheter removal can generally be performed after temporary clamping (13). 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 (12). 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 (10, 12, 9).

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

Author	Year	Title	Journal	Timing for cholecystostomy removal and definitive cholecystectomy
De Geus T et al. ³⁵	2020	Outcomes of patients treated with upfront cholecystostomy for severe acute cholecystitis.	Surg Laparosc Endosc percutan Tech 2020;30:79-84	No timing definition reported
Masrani A et al ³⁶	2020	Management algorithm of acute cholecystitis after percutaneous cholecystostomy catheter placement based on outcomes from 377 patients	Abdominal radiology 2020;5:1193-1197	Cholangiography after two weeks , no definite timing for catheter removal and delayed cholecystectomy
Alotaibi A et al ³¹	2019	Is cholecystostomy a real bridge for cholecystectomy in acute cholecystitis. A retrospective cohort study	Saudi J Health Sci 2019;8:157-61	No timing definition reported
Aroori S et al ⁴	2019	Percutaneous 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 ³⁷	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 ³⁸	2018	Expanding role of percutaneous cholecystostomy and interventional radiology for the management of acute cholecystitis: An analisis of 144 patients	Diagnost Intervent Imaging 2018;99:15-21	No timing definition reported
Hasbahceci M et al ⁹	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 ³⁹	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 ⁴⁰	2017	Bridge treatment for early cholecystectomy in	Ulus Trauma Acil Cerrahi Derg 2017;23 (6):501-505	No timing definition reported

		geriatric patients with acute cholecystitis:percutaneous cholecystostomy		
Bala M et al ⁴¹	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 ³³	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 ⁴²	2015	Tube cholecystostomy before cholecystectomy for the treatment of acute cholecystitis	JLS2015(19)1 DOI:10.4293/JLS.2014.00200	No timing definition reported
Jung W et al ⁴³	2015	Timing of cholecystectomy after percutaneous cholecystostomy for acute cholecystitis	Korean J Gastroenterol 2015;66:209-214	Patients are divided into two groups: group1 mild disease had surgery within 10 days. Group 2 moderate disease had surgery after 10 days
Jang WS et al ⁴⁴	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. ⁴⁵	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 ⁴⁶	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 ¹⁰	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	8–10 days from PC insertion after symptoms resolution
Morse BC et al ¹²	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 ¹⁹	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. ⁴⁷	2010	Percutaneous cholecystostomy in critically ill patients with cholecystitis: a safe option	Dig Surg 27:417-421, 2010	No timing definition reported

In both the 2016 WSES guidelines on acute cholecystitis (1), and in the 2017 WSES and SICG guidelines on acute calculous cholecystitis in the elderly population (2), authors reported on the CHOCOLATE study (15,16), an overview of ongoing multicentre randomised clinical trials on laparoscopic cholecystectomy versus percutaneous catheter drainage for acute cholecystitis in high risk patients. In 2018 Loozen et al.(15) showed that the final results of the CHOCOLATE study stated that although 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) (15), viceversa differences were significant for the other primary endpoint, i. e.the occurrence of major complications, in favor of early cholecystectomy (risk ratio 0.19, 95% confidence interval 0.10 to 0.37, P=0,001) (15). 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 after drainage could have been lower if all the patients had undergone elective cholecystectomy. The CHOCOLATE study didn't explore this possibility because one of the advantages of percutaneous catheter drainage is surgical complication avoidance. For this reason, several Authors suggest that percutaneous cholecystostomy should be the SOLE procedure for high risk patients without any definitive elective cholecystectomy (15, 17-20). However, 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 (4) 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. In particular, in a retrospective study Aroori et al. (4) examined 53 patients who had undergone PC. 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% to 20% in case series of cholelithiasis, with a lower incidence during ACC ranging from 5 to 15% of the patients (16)(22,23).

The American Society of Gastrointestinal Endoscopy and the Society of American of 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). 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, haemorrhage, duodenal perforation or allergy to contrast. However, while intraoperative cholangiography significantly increases the length of surgery [1], intraoperative ERCP plus sphincterotomy reduce risks for post-ERCP pancreatitis, as reported in the WSES guidelines 2016. Both require a dedicated staff in the operating room.

This case presented the following critical points:

- a) the patient's heart conditions with reduced EF and persistent ventricular septal defect due to previous myocardial infarction with ventricular septal rupture that required numerous surgical repairs and pacemaker placement;
- b) the need for an anesthesiological evaluation;
- c) the choice of PC for first line treatment as a bridge procedure to manage the acute situation before definitive treatment;
- d) the choice of a delayed open cholecystectomy with cholecystostomy tube removal, a rendez-vous for the removal of biliary stones from the Common Biliary Duct (CBD) and endoscopic sphincterotomy for Oddi dysfunction at the same time of surgery;
- d) the choice of a multidisciplinary approach as first line treatment for best management in difficult clinical cases .

In this case, the patient had a reduced functional reserve due to previous myocardial infarction with a ventricular septal defect that had required complex procedures. A bridging procedure was the best option for this, at the time, only 58 years old patient, therefore not fitting into the common definition of frailty associated with an age of over 60, but considered frail because of his cardiological conditions. According to the 2016 WSES guidelines, patients with ACC aged 80 years and over have worse clinical outcomes, morbidity and mortality rates (LoE 3 GoR B).

Although in the "2017 WSES and SICG guidelines on acute calculous cholecystitis in elderly population", the latter are also good candidates for early cholecystectomy, in 2016 Jocar et al (26) published a validation study for an emergency-general surgery-specific frailty index, which demonstrated that chronological age was not an independent factor among the 15 variables included in the multivariate analysis for predicting postoperative complications, opening up the way to other possible surgical strategies.

2017 WSES guidelines reported several studies that identified old age as a perioperative risk factor for cholecystectomy, but with regard to early laparoscopic cholecystectomy it was unclear whether this would be the best treatment in the elderly population. The guidelines also reported a few retrospective cohort studies that compared the outcome of early versus delayed cholecystectomy in aged ACC patients but that had however failed to demonstrate a significant difference in mortality and postoperative complications [27-30].

Other studies consider cholecystostomy as a definitive treatment without delayed cholecystectomy in an elderly population. Lack of a definitive surgical treatment upon admission is associated with 38 % gallstone-related readmission rate in two years, compared to 4.4 % with early cholecystectomy [1, 30].

In our case, the surgeon on call decided for a temporizing solution to solve the acute condition before definitive surgery. This choice is supported by several studies suggesting that PC followed by late laparoscopic cholecystectomy is a suitable management for patients with ACC deemed unfit for emergency surgery (9,31,32). In a paper of 2016, Popowicz et al,(32) reviewed the medical reports of seven hospitals with 799 pts. admitted in 2003, and 850 in 2008. Multivariate regression analysis was performed with adjustments for age, gender, degree of cholecystitis and Charlson comorbidity index (33). 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.

In our case, the choice of a step by step procedure with PC as bridging therapy before definitive cholecystectomy, supported by a multidisciplinary cooperation among various medical and surgical specialties has proven to be a valuable strategy in providing the best treatment option for this frail, high risk patient.

Abbreviations

ACC – acute calculous cholecystitis

TG- Tokio guidelines

CT- computed tomography

IVRS-ant interventricular septum rupture

CABG- coronary artery bypass graft

IABP- Intra Aortic Ballon Pump

PC- percutaneous cholecystostomy

MRI-Magnetic Resonance Image

EF-Ejection Fraction

ICU-Intensive Care Unit

EUS-Endoscopic Ultrasound

WSES-World Society of Emergency Surgery

CHOCOLATE- Randomized controlled open parallel multicenter study on laparoscopic cholecystectomy and percutaneous cholecystostomy

ASA-American Society of Anesthersialogists

CBDS-Common bile duct stones

SIGC- Italian Surgical Society for Elderly (Società Italiana di Chirurgia Geriatrica)

CBD-Common biliary duct

ERCP-Endoscopic retrograde cholangiopancreatography

Declaration Section

Ethical Approval : Not applicable

Consent to participate : Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Availability of supporting data: The medical record containing therapies, documentations of the instrumental examinations and the surgical interventions is available on request at the Emergency Surgery Unit - Careggi University Hospital- Azienda Ospedaliero Universitaria Careggi

Research involving animals: This study does not contain any studies animals performed by any of the authors of this study.

Competing interest:: Authors certify that there is no actual or potential conflict of interest in relation to this article and they state that there are no financial interests or connections, direct or indirect, or other situations that might raise the question of bias in the work reported or the conclusions, implications, or opinions stated – including pertinent commercial or other sources of funding for the individual author(s) or for the associated department(s) or organization(s), personal relationships, or direct academic competition.

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References

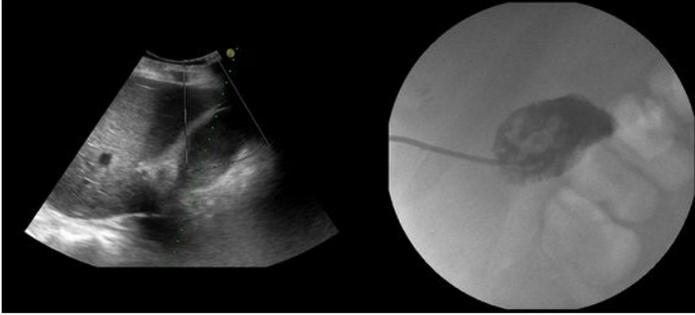
1. Ansaloni L, Pisano M , Coccolini F, Peitzmann AB, Fingerhut A, Catena F, et al. 2016 WSES guidelines on acute calculous cholecystitis. *World Journal of Emergency Surgery* 2016, 11:25 DOI 10.1186/s13017-016-0082-5
2. Pisano M, Ceresoli M, Cimbanassi S, Gurusamy K, Coccolini F, Borzellino G, Costa G et al. 2017 WSES and SICG guidelines on acute calculous cholecystitis in elderly population. *World J Emerg Surg* .
<https://doi.org/10.1186/s13017-019-0224-7>
3. Okamoto K, Suzuki K, Takada T, Strasberg SM, Asbun OJ, Endo I, et al. Tokyo Guidelines 2018: flowchart for the management of acute cholecystitis. *J Hepatobiliary Pancreat Sci* 2018, 25:55–72. DOI: 10.1002/jhbp.516
4. Aroori S, Mangan C, Reza L, Gafoor N. Percutaneous 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
5. Campanile FC, Pisano M, Coccolini F, Catena F, Agresta F, Ansaloni L. Acute cholecystitis: WSES position statement. *World J Emerg Surg*. 2014;9(1):58. doi:10.1186/1749-7922-9-58.
6. Itoi T, Takada T, Hwang TL, Endo I, Akazawa K, Miura F, et al. Percutaneous and endoscopic gallbladder drainage for acute cholecystitis: international multicenter comparative study using propensity score-matched analysis. *J Hepatobiliary Pancreat Sci* 2017; 24:362–368 DOI: 10.1002/jhbp.454
7. Mori Y, Itoi T, Baron TH, Takada T, Strasberg SM, Pitt HA, et al. Tokyo Guidelines 2018: Management strategies for gallbladder drainage in patients with acute cholecystitis (with videos). *J Hepatobiliary Pancreat Sci*. 2018;25:87–95.
8. Krishnamoorthi R, Jayaraj M, Chandrasekar VT, Singh D, Law J, Larsen M, et al. EUS-guided versus endoscopic transpapillary gallbladder drainage in high-risk surgical patients with acute cholecystitis: a systematic review and meta-analysis. *Surgical Endoscopy* (2020) 34:1904–1913 <https://doi.org/10.1007/s00464-020-07409-7>
9. Hasbahceci M, Cengiz MB , Malya FU, Kunduz E and Memmi N. 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
10. Hsieh YC, Chen CK, Su CW, Chan CC, Huo TI, Liu CJ et al. 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
11. Wang B, Guo Z, Liu Z, Wang Y, Si Y, Zhu Y, et al. Preoperative versus intraoperative endoscopic sphincterotomy in patients with gallbladder and suspected common bile duct stones: system review and meta-analysis. *Surg Endosc*. 2013;27(7):2454–65. doi:10.1007/s00464-012-2757-7. Epub 2013 Jan 26.
12. Morse BC, Smith JB, Lawdahl RB, Roettger RH. Management of acute cholecystitis in critically ill patients: contemporary role for cholecystostomy and subsequent cholecystectomy. *Am Surg* 2010;76:708-12.
13. Jang WS, Lim JU, Joo KR, Cha JM, Shin HP, Joo SH. 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.

14. Venara A, Carretier V, Lebigot J, Lermite E. Technique and indications of percutaneous cholecystostomy in the management of cholecystitis in 2014. *J Visc Surg.* 2014;151:435–9 Available from: <https://linkinghub.elsevier.com/retrieve/pii/S1878788614000939>.
15. Loozen CS, van Santvoort HC, van Duijvendijk P, Besselink MGH, Gouma DJ, Nieuwenhuijzen GAP, et al. Laparoscopic cholecystectomy versus percutaneous catheter drainage for acute cholecystitis in high risk patients (CHOCOLATE): multicentre randomised clinical trial. *BMJ* 2018;363:k3965 <http://dx.doi.org/10.1136/bmj.k3965>
16. Kortram K, van Ramshorst B, Bollen TL, Besselink MGH, Gouma DJ, Karsten T, et al. Acute cholecystitis in high risk surgical patients: percutaneous cholecystostomy versus laparoscopic cholecystectomy (CHOCOLATE trial): Study protocol for a randomized controlled trial. *Trials.* 2012;13:7 BioMed Central Ltd. Available from: <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=3285056&tool=pmcentrez&rendertype=abstract>.
17. Griniatsos J, Petrou A, Pappas P, Revenas K, Karavokyros I, Michael OP et al. Percutaneous cholecystostomy without interval cholecystectomy as definitive treatment of acute cholecystitis in elderly and critically ill patients. *South Med J* 2008;101:586-90. doi:10.1097/SMJ.0b013e3181757b77
18. Granlund A, Karlson BM, Elvin A, Rasmussen I. Ultrasound-guided percutaneous cholecystostomy in high-risk surgical patients. *Langenbecks Arch Surg* 2001;386:212-7. doi:10.1007/s004230100211
19. Chok KS, Chu FS, Cheung TT, Lam VWT, Yuen WK, Ng KKC et al. 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
20. Leveau P, Andersson E, Carlgren I, Willner J, Andersson R. Percutaneous cholecystostomy: a bridge to surgery or definite management of acute cholecystitis in highrisk patients? *Scand J Gastroenterol* 2008;43:593-6. doi:10.1080/00365520701851
21. Khalfallah M, Dougaz W, Bedoui R, Bouasker I, Chaker Y, Nounira R, et al. Validation of the Lacaine-Huguier predictive score for choledocholithiasis: prospective study of 380 patients. *J Visc Surg.* 2012;149(1):e66–72. 121.
22. Lee SI, Na BG, Yoo YS, Mun SP, Choi NK. Clinical outcome for laparoscopic cholecystectomy in extremely elderly patients. *Ann Surg Treat Res.* 2015; 88(3):145–51.
23. Williams E, Beckingham I, El Sayed G, Gurusamy K, Sturges R, Webster G, et al. Update guideline on the management of common bile duct stones. *Gut* 66:765-782, 2017
24. Buxbaum JL, Fehmi SMA, Sultan S, Fishman DS, Qumseya BJ, Cortessis VK et al . ASCE guideline on the role of endoscopy in the evaluation and management of choledocolithiasis. *Gastrointestinal endoscopy* 2019; 89 (6): 1075-1105.
25. Sánchez Beorlegui J, Lagunas Lostao E, Lamata Hernández F, Monsalve Laguna EC. Treatment of acute cholecystitis in the elderly: urgent surgery versus medical therapy and surgery delay. *Rev Gastroenterol Peru.* 2009;29: 332–40.
26. Jokar TO, Ibraheem K, Rhee P, Kulavatunyou N, Haider A, Phelan HA. Emergency general surgery specific frailty index: a validation study. *Trauma Acute Care Surg* 2016; 81 (2):254-260.
27. Cheng Y, Leng J, Tan J, Chen K, Dong J. Proper surgical technique approved for early laparoscopic cholecystectomy for non-critically ill elderly patients with acute cholecystitis. *Hepatogastroenterology.* 2013;60:688–91.
28. Cull JD, Velasco JM, Czubak A, Rice D, Brown EC. Management of acute cholecystitis: prevalence of percutaneous cholecystostomy and delayed cholecystectomy in the elderly. *J Gastrointest Surg.* 2014;18:328–33.
29. Haltmeier T, Benjamin E, Inaba K, Lam L, Demetriades D. Early versus delayed same-admission laparoscopic cholecystectomy for acute cholecystitis in elderly patients with comorbidities. *J Trauma Acute Care Surg.* 2015;78:801–7.
30. Riall TS, Zhang D, Townsend CM, Kuo Y-F, Goodwin JS. Failure to Perform Cholecystectomy for Acute Cholecystitis in Elderly Patients Is Associated with Increased Morbidity, Mortality, and Cost. *J Am Coll Surg.* 2010;210:668–77.

31. Alotaibi AM, Nafea O, Deeb AM, Yousef Z. Is cholecystostomy tube insertion a real bridge for cholecystectomy in acute cholecystitis? A retrospective cohort study. *Saudi Journal for Health Sciences* 2019; 8 (3), 157-161.
32. McKay A, Abulfaraj M, Lipschitz J. Short- and long-term outcomes following percutaneous cholecystostomy for acute cholecystitis in high-risk patients. *Surg Endosc* 2012; 26:1343-5
33. Popowicz A, Lundell L, Gerber P, Gustafsson U, Pieniowski E, Sinabulya H, et al. Cholecystostomy as Bridge to Surgery and as Definitive Treatment or Acute Cholecystectomy in Patients with Acute Cholecystitis. *Gastroenterology Research and Practice* Volume 2016, Article ID 3672416, <http://dx.doi.org/10.1155/2016/3672416>
34. E.Charlson,P.Pompei,K.L.Ales,andC.R.MacKenzie. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation,*Journal of Chronic Diseases*,vol.40,no.5,pp.373–383,1987.
35. De Geus T, Moriarty HK, Waters PS, O'Reilly MK, Lowler L, Geoghegan T et al. Outcomes of patients treated with upfront cholecystostomy for severe acute choelcystytis. *Surg Laparosc Endosc percutan Tech* 2020;30:79-84.
36. Masrani A, Young Daniel, Karageorgiou JP, Mani NB, Picus DD, Kim SK. Management algorithm of acute cholecystitis after percutaneous cholecystostomy catheter placement based on outcomes from 377 patients. *Abdominal Radiology* 2020; 45:1193–1197 <https://doi.org/10.1007/s00261-020-02449-y>
37. Pal KMI, Aga SAA, Bari H. Role of percutaneous cholecystostomy tube placement in the management of acute calculus cholecystitis in high risk patients. Role of percutaneous cholecystostomy tube placement in the management of acute calculus cholecystitis in high risk patients. *Journal of the College of Physicians and Surgeons- Pakistan*, 2018; 5(28): 386-389.
38. Kim D, Iqbal SI, Ahari HK, Molgaard CP, Flacke S, Davison BD. Expanding role of percutaneous cholecystostomy and interventional radiology for the management of acute cholecystitis : An analysis of 144 patients. *Diagnostic and interventional imaging* 2018;99:15-21
39. Dai Y, Arellano RS. Current Status of Percutaneous Cholecystostomy for the Management of Cholecystitis. *Dig Dis Interv* 2017;1:22–27.
40. Zeren S Bayhan Z, Koçak G, Kesici U, Korkmaz M., Ekici MF et al. Bridge treatment for early cholecystectomy in geriatric patients with acute cholecystitis: Percutaneous cholecystostomy. *Ulus Travma Acil Cerrahi Derg* 2017;23(6):501–506 doi: 10.5505/tjtes.2017.63668
41. Bala M, Mizrahi I, Mazeh H, Yuval1 J, Eid A, Almogy G. Percutaneous cholecystostomy is safe and effective option for acute calculous cholecystitis in select group of high-risk patients. *Eur J Trauma Emerg Surg* 2016; 42:761–766. DOI 10.1007/s00068-015-0601-1
42. Suzuki K, MD, Bower M, Cassaro S, Patel RI, Karpeh MS, Leitman IM. Tube Cholecystostomy Before Cholecystectomy for the Treatment of Acute Cholecystitis. January–March 2015 Volume 19 Issue 1. DOI: 10.4293/JLS.2014.00200
43. Jung and Park DE. Timing of cholecystectomy after percutaneous cholecystostomy fpr acute Cholecystitis. *Korean J Gastroenterol* 2015; 66 (4): 209-2014.
44. Jang WS, Lim JU, Joo KR, Cha JM, Shin HP, Joo SH. Outcome of conservative percutaneous cholecystostomy in high-risk patients with acute cholecystitis and risk factors leading to surgery. *Surg Endosc* (2015) 29:2359–2364. DOI 10.1007/s00464-014-3961-4.
45. Mizrahi I, Mazeh H, Yuval JB, Almogy G, Bala M, Simanovski N et al. Perioperative outcomes of delayed laparoscopic cholecystectomy for acute calculous cholecystitis with and without percutaneous choelcystostomy. *Surgery* 2015; 158: 728-35.
46. Sanjay P, Mittapalli D, Marioud A, White RD, Ram R Alijani A. Clinical outcomes of a percutaneous cholecystostomy for acute cholecystitis: a multicentre analysis. *HPB* 2013, 15, 511–516, DOI:10.1111/j.1477-2574.2012.00610.x
47. Koebrugge B, van Leuken M, Ernst MF, van Munster I, Bosscha K. Percutaneous Cholecystostomy in Critically Ill Patients with a Cholecystitis: A Safe Option. *ig Surg* 2010;27:417–421 D OI: 10.1159/000308460

Figures

Fig 1



Placement of cholecystostomy



Transcatheter cholangiography showing the presence of gallstones in the cystic and biliary duct

Figure 1