ORIGINAL REPORT

Percutaneous cholecystostomy to treat acute cholecystitis in patients with high risk for surgery

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KEYWORDS
Acute cholecystitis; Percutaneous cholecystostomy

Abstract
Objective: To evaluate the results of percutaneous cholecystostomy for urgent treatment of acute cholecystitis, with the aim of identifying factors that predict survival. To analyze the recurrence of cholecystitis after catheter withdrawal in patients considered unsuitable candidates for delayed surgery, with the aim of identifying factors that predict recurrence.

Material and methods: We reviewed 40 patients who underwent percutaneous cholecystostomy in a two-year period. We analyzed survival during hospitalization in relation with fever, abdominal pain, leukocytosis, and C-reactive protein before and after the procedure. We analyzed the recurrence of cholecystitis after catheter withdrawal in patients considered unsuitable candidates for delayed surgery, as well as the influence of obstruction seen on cholangiography, age, sex, and comorbidities on the recurrence rate.

Results: During the hospital stay, 4 (10%) patients died of septic shock. Cholecystostomy improved fever, leukocytosis, and abdominal pain within five days of the procedure, but these improvements did not have a statistically significant effect on survival and were not therefore considered useful prognostic factors. Among the 15 patients considered unsuitable candidates for delayed surgery, 6 (40%) had recurrences of cholecystitis during a mean follow-up period of 6.7 months after catheter withdrawal. We found no association between recurrence and any of the parameters analyzed.

Conclusions: Outcomes in our series of patients with high risk for surgery who underwent cholecystostomy for urgent treatment of acute cholecystitis were similar to those reported in other series. Withdrawing the catheter in patients considered unsuitable candidates for delayed surgery is not recommended due to the high risk of recurrence of cholecystitis in comparison with other series.

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PALABRAS CLAVE
Colecistitis aguda; Colecistostomía percutánea

Colecistostomía percutánea como tratamiento de la colecistitis aguda en pacientes con alto riesgo quirúrgico

Resumen

Objetivo: Evaluar los resultados de las colecistostomías percutáneas realizadas como tratamiento urgente de colecistitis aguda, en busca de predictores de supervivencia. Valorar la recurrencia de colecistitis tras la retirada del catéter en pacientes descartados para cirugía diferida, y buscar factores predictores de recurrencia.

Material y métodos: Se revisan retrospectivamente 40 pacientes sometidos a colecistostomía durante dos años. Se analiza la relación de la supervivencia durante el periodo de hospitalización con la evolución de fiebre, dolor abdominal, leucocitosis y proteína C reactiva después del procedimiento. Se analiza la recurrencia de colecistitis tras la retirada del catéter en pacientes descartados para colecistectomía diferida por alto riesgo quirúrgico, así como la influencia de la colangiografía no permeable, la edad, el sexo y las comorbilidades en el porcentaje de recurrencias.

Resultados: Durante la hospitalización fallecieron cuatro pacientes por shock séptico (10%). La colecistostomía mejoró significativamente la fiebre, la leucocitosis y el dolor abdominal en un máximo de 5 días tras el procedimiento, pero estas mejoras no tuvieron un efecto estadísticamente relevante sobre la supervivencia, por lo que no se consideran útiles como factores pronósticos. Entre los 15 pacientes descartados para cirugía hubo seis recurrencias de colecistitis (40%) con un seguimiento medio de 6,7 meses tras la retirada del catéter. Un paciente falleció por recurrencia. No se encontró asociación de recurrencia con los parámetros analizados.

Conclusiones: La colecistostomía ofrece resultados similares a los obtenidos en otras series como tratamiento urgente de la colecistitis aguda en pacientes con alto riesgo quirúrgico. La retirada del catéter en pacientes descartados para cirugía con colecistitis litiásica es una opción desaconsejable debido al elevado riesgo de recurrencia de colecistitis en comparación con otras series.

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Introduction

Acute cholecystitis (CA) is a common cause of acute abdominal pain in elderly people, its origin is usually lithiasic, and its most accepted treatment today is laparoscopic cholecystectomy (LC). This procedure and even more open cholecystectomy presents great variations in its morbimortality depending on whether it is performed on patients with a high or low surgical risk, either in an urgent or deferred manner. There is no unanimous definition of high-surgical-risk patient. The most frequently used assessment modality is the one proposed by the American Society of Anesthesiologists (the ASA Physical Status Classification System) that grades from ASA 1 (healthy patient) to ASA 6 (cerebral death), being ASA > 2 (for example, ASA 3, serious systemic disease) indicative of greater risk. On the other hand the trend to solve the acute episode with analgesia, hydration and antibiotic therapy, performing the surgery in a deferred manner, is being questioned due to the continued improvement of the results obtained by LC in the first 72 h of evolution in non-high risk patients. There are few prospective trials about the most adequate treatment for AC in high-surgical-risk patients or those with a poor response to conservative treatment, especially when it comes to the role of percutaneous cholecystotomy (PC). The CHOCOLATE trial, a randomized, controlled study comparing the results of PC and LC in high-surgical-risk patients is still in the pipeline. There are systematic reviews claiming that it is not possible to make a clear recommendation on the most adequate treatment in the trials available. There are guidelines based on expert consensus (Tokyo Guidelines) on diagnostic criteria, assessment of seriousness and therapeutic recommendations in AC. PC is recommended as first line therapy in Grade III or serious AC (AC associated with organic dysfunction), in patients with ASA 3–4 or situations such as pregnancy or acute non-lithiasic cholecystitis (ANLC). In patients non-responsive to medical therapy after the first 72 h, it is also the option recommended. PC attains vesicular drainage with a <1% mortality and a >80% positive response in almost all the series which allows us to delay the cholecystotomy, which when performed urgently in high-risk patients shows a mortality of up to 30%. In patients with ANLC or in a permanent high-risk situation, PC can be the only definitive therapeutic option, with a variable percentage of relapses after the removal of the catheter based on the series, which generates disparate recommendations between withdrawing or keeping the catheter indefinitely and changing it every 3 months, which seems to be the most widely accepted option.

The primary goal of this study is to evaluate the results obtained in our cholecystotomies in search for survival predictors during hospitalization. As a secondary goal we intend to find out the percentage of cholecystitis relapse after
catheter removal in patients ruled out for deferred surgery, compare them to other series and find the existence of factors predicting relapse whose presence would recommend keeping the catheter indefinitely.

Materials and methods

Patient selection

A retrospective study of the 40 patients that underwent PC in our hospital between December, 2011 and December, 2013 was carried out. In one case it was repeated due to the spontaneous removal of the catheter and subsequent recurrence of AC; therefore, 41 PCs were performed. All the cholecystostomies were requested by the surgery team. Before they were performed patients were informed (or their representatives if they were disabled) on the advantages and risks of the procedure, and written consent was obtained. This study had the favorable evaluation of our center ethical committee.

The search was carried out by crossing the information obtained from the minimum data set (MDS) of the hospital when using the code 51.01 assigned to PC by CIE9MC, and the information obtained from the local radiological information system, which allowed us to review the reports and know the technical results of each procedure. Demographic information and information about the delay between admission and the PC, average hospital stay, mortality, complications and delay until the deferred cholecystotomy was obtained from the MDS. The most comprehensive information about the indication for the procedure added to morbidities and follow-up, including AC relapses was obtained from reviewing each medical history. Three hundred and twenty-three (323) patients were identified with AC diagnosis in the study period.

Proceeding

The platelet and coagulation levels were determined (international normalized ratio, INR), and their correction was requested if the values observed (platelets < 50,000/μL, INR > 1.5) increased the risk of hemorrhagic complications; 400 mg of subcutaneous meperidine were administered at the puncture point. In patients with impaired levels of consciousness, anesthetic support was requested for sedation (usually 2 mg of IV midazolam and 0.05–0.10 mg of IV fentanyl), and pulse, blood pressure and oxygen saturation were monitored. In all cases, the standards for asepsis were observed.

The gallbladder puncture was performed using ultrasound guidance, using the transhepatic pathway (even if it presupposed intercostal approach) but not in one patient with serious chronic liver disease. After puncturing the gallbladder, the catheter was introduced using the Seldinger technique with fluoroscopic guidance—the most recommended one. When the procedure was performed at bedside in the intensive care unit the direct puncture technique (trocars) was used with exclusively ultrasound guidance. The catheters used were 8 Fr caliber pig-tail catheters.

Bile and antibiogram samples were sent for culture in six cases (15%), and in five of them the sample was positive for gram-negatives.

Post-procedure management was handled by the surgery team. Once the symptoms had disappeared for 48 h drainage was blocked with a three-step valve to assess the tolerance to withdrawal in such a way it could be un-blocked in the presence of symptom relapse.

Thirty-one (31) transcatheter cholangiographies were performed in 29 patients, with an average of 13.5 days after the PC (range from 2 to 44 days, variable based on the clinical state). It was not performed in six patients due to early death (four during hospitalization), in two with spontaneous expulsion of the catheter and in three lost to follow-up. The cholangiography is recommended to assess patency and catheter position, the presence of stones and the patency of the cystic duct and the biliary tract—all of this key information to be able to decide along with the patient’s basal situation what deferred therapy should be used.

In the 28 patients in whose medical history the date of catheter removal was located, the hospital stay ranged from 13 to 240 days, with an average of 63 days (excluding two extreme cases with 240- and 136-hospital stays).

Definitions

The guidelines for improving the quality of PC designed by the SIR (Society of Interventional Radiology) defines technical success by the presence of the catheter inside the gallbladder (Fig. 1) which provides continuous drainage of its content and which should be attained at least in 90% of the cases. The clinical success or the positive response to drainage is defined by a decrease in fever, pain, leukocytosis and C-reactive protein (CRP) being a minimum threshold of 75% recommended which in turn can be lowered to 65% in ANLC. The recommended mean time to assess response in most documents is 3 days.

We define mortality or in-hospital mortality (IHM) as that occurring during the period of hospitalization in which the PC was performed regardless of its duration and cause. We

![Figure 1](http://www.elsevier.es) Well-delivered catheter inside the gallbladder with its distal edge in pig-tail shape. The multiple repletion defects in the vesicular fundus are due to lithiasis.
define delayed mortality (DM) as the one recorded in subsequent hospitalizations, regardless of its cause. We define AC relapse as the appearance of a new AC episode after the withdrawal of the PC catheter, or when after a spontaneous expulsion or accidental withdrawal an expectant attitude was decided without repeating the cholecystotomy.

Data analysis

A descriptive analysis was carried out with central trend measurements (means, medians) and dispersion (ranges, typical deviation, interquartile ranges) for quantitative variables, and frequency distribution for the qualitative ones. To evaluate the statistic significance of changes occurred before and 2–5 days after performing PC in quantitative variables the McNemar test was used, while to evaluate the change mean in quantitative variables the Student’s t test was used for samples > 30, or the Wilcoxon signed rank test for samples < 30 (Table 1). To assess the association between disappearance of fever, leukocytosis or pain after PC and survival the Fisher’s test was used (Table 2). To assess the association between the decision to perform or rule out the surgery (Table 3) or the appearance of age-associated cholecystitis relapses (Table 4) the Mann–Whitney U test was used, while the Fisher’s test was used with morbidities (Tables 3 and 4). In all tests the level of statistic significance was set at p < 0.05 (confidence interval > 95%).

The statistic software used was SPSS v15.

Table 1  Evaluation of response to percutaneous cholecystotomy (PC).

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Pre-PC</th>
<th>2–5 days post-PC</th>
<th>p</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fever (F &gt; 37°C)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td>18/40</td>
<td>2/40</td>
<td>&lt;0.001</td>
<td>McNemar</td>
</tr>
<tr>
<td>Median</td>
<td>37.54</td>
<td>37.02</td>
<td>&lt;0.001</td>
<td>Student’s t test</td>
</tr>
<tr>
<td>Typical deviation</td>
<td>0.7977</td>
<td>0.0911</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Leukocytosis (&gt;11.5 × 10⁹/μl)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td>27/40</td>
<td>11/34 (1)</td>
<td>&lt;0.001</td>
<td>Paired Student’s t test</td>
</tr>
<tr>
<td>Median</td>
<td>15.08 (16.01) (2)</td>
<td>10.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Typical deviation</td>
<td>7.014</td>
<td>6.2653</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CRP elevation (&gt;0.5)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td>35/36 (3)</td>
<td>10/10 (4)</td>
<td>0.059</td>
<td>Wilcoxon</td>
</tr>
<tr>
<td>Median</td>
<td>17.8 (21.62) (5)</td>
<td>14.92</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Typical deviation</td>
<td>12.529</td>
<td>17.062</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>EVA” (pain if &gt;0)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td>36/40</td>
<td>14/40</td>
<td>&lt;0.001</td>
<td>McNemar</td>
</tr>
<tr>
<td>Median</td>
<td>2.98</td>
<td>0.58</td>
<td>&lt;0.001</td>
<td>Student’s t test</td>
</tr>
<tr>
<td>Typical deviation</td>
<td>1.593</td>
<td>0.931</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) White blood cells count occurred 2–5 days post-PC only in 34 patients and there was leukocytosis in 11 patients and absence of leukocytosis in 23. The statistical significance was estimated on the 34 patients through pre- and post-proceeding assessments (paired samples).

(2) 15.08: median of 40 patients. 16.01: median of 34 patients with white blood cell count post-PC.

(3) Measurement of the CRP levels occurred pre-PC in 36 patients and CRP elevation could be confirmed in 35.

(4) Measurement of the CRP levels occurred 2–5 days post-PC in 10 patients and there was CRP elevation in all of them. Statistical significance was estimated on these 10 patients through pre- and post-proceeding assessments (paired samples).

(5) 17.8: median of 36 patients with CRL level measurements pre-PC. 21.62: median of 10 patients with CRL level measurements post-PC.

CRP, C-reactive protein.

” AVS, analog visual scale for pain assessment from no pain (AVS = 0) to unbearable pain (AVS = 10).
Table 2  Correlation between the normalization of infection parameters and survival post-percutaneous cholecystotomy (PC).

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>A + B</th>
<th>A + C</th>
<th>B + C</th>
<th>A + B + C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(n = 38/40)</td>
<td>(n = 23/34)</td>
<td>(n = 26/40)</td>
<td>(n = 21/34)</td>
<td>(n = 25/40)</td>
<td>(n = 14/34)</td>
<td>(n = 13/34)</td>
</tr>
<tr>
<td>Death</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>No death</td>
<td>34</td>
<td>21</td>
<td>25</td>
<td>19</td>
<td>24</td>
<td>13</td>
<td>12</td>
</tr>
<tr>
<td>p</td>
<td>1</td>
<td>0.57</td>
<td>0.11</td>
<td>0.62</td>
<td>0.14</td>
<td>0.62</td>
<td>1</td>
</tr>
</tbody>
</table>

A: absence of fever (T < 37.5°C).
B: absence of leukocytosis (white blood cell count < 11.5 × 10³/µL).
C: absence of pain assessed through analog visual scale (AVS = 0).
A + B: F < 37.5°C + white blood cell count < 11.5 × 10³/µL.
A + C: F < 37.5°C + absence of pain (AVS = 0).
B + C: white blood cell count < 11.5 × 10³/µL + absence of pain (AVS = 0).

* Measurements of fever and abdominal pain 2–5 days post-PC in 40 patients. Statistical significance was estimated in 40 patients.

Table 3  Morbidity differences between eligible and non-eligible patients for delayed surgery.

<table>
<thead>
<tr>
<th>Morbidity</th>
<th>Eligible for surgery (n = 14)</th>
<th>Non-eligible for surgery (n = 18)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agea</td>
<td>71.8 (58.07–78.15)</td>
<td>80.4 (71.62–84.37)</td>
<td>0.024</td>
</tr>
<tr>
<td>Cardiologic</td>
<td>12 (66.6%)</td>
<td>8 (44.4%)</td>
<td>0.07</td>
</tr>
<tr>
<td>Respiratory</td>
<td>10 (55.5%)</td>
<td>4 (22.2%)</td>
<td>0.02</td>
</tr>
<tr>
<td>Neurological</td>
<td>4 (22.2%)</td>
<td>1 (5.5%)</td>
<td>0.56</td>
</tr>
<tr>
<td>Hepatic</td>
<td>4 (22.2%)</td>
<td>1 (5.5%)</td>
<td>0.67</td>
</tr>
<tr>
<td>Pancreatic</td>
<td>4 (22.2%)</td>
<td>1 (5.5%)</td>
<td>0.67</td>
</tr>
<tr>
<td>Renal</td>
<td>9 (50%)</td>
<td>7 (38.8%)</td>
<td>0.14</td>
</tr>
<tr>
<td>Diabetes</td>
<td>3 (21.4%)</td>
<td>7 (38.8%)</td>
<td>0.44</td>
</tr>
<tr>
<td>Cancer</td>
<td>3 (21.4%)</td>
<td>7 (38.8%)</td>
<td>0.44</td>
</tr>
<tr>
<td>Four or more morbidities</td>
<td>8 (44.4%)</td>
<td>12 (66.6%)</td>
<td>0.12</td>
</tr>
<tr>
<td>Three or more morbidities</td>
<td>12 (66.6%)</td>
<td>4 (22.2%)</td>
<td>0.07</td>
</tr>
<tr>
<td>Two or more morbidities</td>
<td>14 (77.7%)</td>
<td>6 (42.8%)</td>
<td>0.068</td>
</tr>
<tr>
<td>One or more morbidities</td>
<td>16 (88.8%)</td>
<td>6 (42.8%)</td>
<td>0.09</td>
</tr>
<tr>
<td>No morbidities</td>
<td>2 (11.1%)</td>
<td>2 (11.1%)</td>
<td>0.09</td>
</tr>
</tbody>
</table>

*a The data: median (value of central age; half of the patients will be older and the other half will be younger) and interquartile range (age values where we can find 50% of the patients).

Table 4  Risk factors for cholecystitis relapse post-catheter removal.

<table>
<thead>
<tr>
<th>Factors</th>
<th>Relapse (n = 5)</th>
<th>No relapse (n = 10)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agea</td>
<td>816 (75–81.90)</td>
<td>81.45 (70.4–87.68)</td>
<td>0.806</td>
</tr>
<tr>
<td>Gender (male/female)</td>
<td>2/3</td>
<td>7/3</td>
<td>0.32</td>
</tr>
<tr>
<td>Cardiologic</td>
<td>7 (70%)</td>
<td>3 (30%)</td>
<td>0.50</td>
</tr>
<tr>
<td>Respiratory</td>
<td>5 (50%)</td>
<td>0 (0%)</td>
<td>1</td>
</tr>
<tr>
<td>Neurological</td>
<td>4 (40%)</td>
<td>4 (40%)</td>
<td>0.28</td>
</tr>
<tr>
<td>Hepatic</td>
<td>3 (30%)</td>
<td>0 (0%)</td>
<td>1</td>
</tr>
<tr>
<td>Pancreatic</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>1</td>
</tr>
<tr>
<td>Renal</td>
<td>2 (20%)</td>
<td>2 (20%)</td>
<td>0.52</td>
</tr>
<tr>
<td>Diabetes</td>
<td>6 (60%)</td>
<td>6 (60%)</td>
<td>0.60</td>
</tr>
<tr>
<td>Cancer</td>
<td>5 (50%)</td>
<td>5 (50%)</td>
<td>0.58</td>
</tr>
<tr>
<td>Four or more morbidities</td>
<td>8 (80%)</td>
<td>5 (50%)</td>
<td>0.58</td>
</tr>
<tr>
<td>Three or more morbidities</td>
<td>8 (80%)</td>
<td>5 (50%)</td>
<td>0.58</td>
</tr>
<tr>
<td>Two or more morbidities</td>
<td>9 (90%)</td>
<td>5 (50%)</td>
<td>0.58</td>
</tr>
<tr>
<td>One or more morbidities</td>
<td>10 (100%)</td>
<td>5 (50%)</td>
<td>1</td>
</tr>
</tbody>
</table>

*a The data: median (value of central age; half of the patients will be older and the other half will be younger) and interquartile range (age values where we can find 50% of the patients).
statistically significant relation between positive response to PC and survival \( p = 0.0016 \). We believe that this modality had limited validity to know the specific effect of PC because the reports were completed at the end of the usually prolonged hospitalization in those patients who did not die (range 7–37 days, mean 16.8 days). The second modality consisted in using the SIR criteria, taking measurements of fever and abdominal pain in the nurses’ records and in the white blood cell counts and CRP levels in blood, before and 2–5 days post-PC. The abdominal pain values were measured according to the analog visual scale (AVS), which scores pain from 0 (absence of pain) to 10 (unbearable pain). The deployment of PC reduced fever, leukocytosis and pain in a statistically significant manner (Table 1). However, we did not observe any statistically significant correlations between the normalization of one or several parameters and survival (Table 2).

Comorbidities were analyzed in the 40 patients to detect biases that would influence mortality, and only one statistically significant relation was observed with more advanced age \( p = 0.024 \). The most common cardiology morbidities were ischemic or arrhythmias, especially atrial fibrillation. Among the respiratory ones, chronic obstructive pulmonary disease (COPD) or sleep apnea. Among the neurologic ones, senile dementias or Alzheimer’s disease. Among the hepatic and renal ones, failure. Among the pancreatic ones, neoplasms. Among the most frequent oncologic histories, breast cancer in women and prostate cancer in men. In nine patients there were no previous morbidities. Of these, in seven (17.5%) the delay between admission and PC was equal to or greater than 4 days.

Fig. 2 shows the evolution of the patients that underwent PC. Excluding the four IHM cases and the four cases lost to follow-up, cholecystostomy was performed in 14 of the 32 remaining patients (43.7%), while 18 were ruled out after assessment by the surgery service (56.3%). In the patients who underwent surgery ASA was 1 in two cases (14.2%) and 2 or 3 in six cases each (42.8%). We observed a statistically significant relation between older age \( p = 0.024 \) or suffering neurologic morbidity \( p = 0.02 \) and not undergoing surgery (Table 3). No other morbidity analyzed showed a similar relation.

![Figure 2](image_url)

**Figure 2** Evolution in the patients from the series. AC, acute cholecystitis; PC, percutaneous cholecystostomy; DM, delayed mortality; IHM, in-hospital mortality. * Dead due to end-stage pancreatic neoplasm. ** Dead due to multi organ failure. *** After spontaneous expulsion AC relapse occurred managed with a new PC at 36 days after the expulsion of the first catheter.
Among the 18 patients ruled out to undergo cholecystotomy there were three without the date in which the catheter was withdrawn, two of them because they died early (Fig. 2), who did not prove useful for the assessment of AC relapse. Among the 15 remaining ones there were six relapses (40%) in five patients since one patient them suffered two relapses. One case happened after the spontaneous removal of the catheter, and it required a new PC after initially attempting conservative treatment. There was one death when relapse and pneumonitis were associated. The three remaining patients had a good response to conservative treatment. The mean follow-up time after the withdrawal of catheter was 6.7 months (203 days), with a range from 7 to 730 days. The mean delay between withdrawal and relapse was 194 days (range 3–730 days). The cholangiography was performed in 12 of the 15 patients, and no significant relation was observed between non-patent cholangiography and AC relapse (p = 1). Table 4 analyzes the relation of relapse with other variables, and no statistically significant association was found.

Discussion

A mean mortality of 15.4% at 30 days, with a range of 8–36% has been reported in patients with AC and high surgical risk submitted to PC. Our series shows an in-hospital mortality (IHM) of 10%. Taking these data into consideration, describing survival predictors in the early response to cholecystotomy would be relevant from the prognostic point of view, but we have not found any with enough statistic value. In any case this work has allowed us to know our results when it comes to PC, to compare them to other series and to detect points that need improvement.

We believe that IHM reflects the evolution of the AC episode more reliably than mortality at 30 days. In any case, the IHM that occurred the latest was 30 days post-PC, and the earliest DM at 65 days; this is why changing the measurement method would not have altered our results.

PC was performed in 12.38% of the ACs diagnosed during the study period, ranging between 8.4 and 15% in the literature. 17.5% of them were performed in patients without morbidities associated with being nonresponsive to conservative treatment after 72 h. According to the consensus Tokyo Guidelines on acute cholecystitis care, it would be the most recommendable treatment.

We performed a transhepatic approach to attain a faster maturation of catheter trajectory and reduce the risk of biliary fistula to the peritoneum. Even though it is the most recommended approach, no significant differences have been seen in the percentage of complications with respect to the transperitoneal approach—better in patients with serious hepaticopaties or coagulopathies to reduce the risk of infra-abdominal hemorrhages.

The withdrawal of the catheter is not recommended before the third week, to allow fibrosis of the trajectory and avoid biliary fistula, although the three cases with early withdrawal in our series (13, 18 and 20 days) did not show this complication. Our percentage of complications was consistent with the SIR recommendations and the results of other series. No deaths due to cholecystotomy occurred described between 0.3 and 2.5% and usually due to intestinal perforation, biliary fistula or intra-abdominal hemorrhages.

When performing the cholecystotomy, we did not systematically send bile samples to the lab to perform cultures and antibigrams because the patients were already receiving broad-spectrum antibiotics. Some articles claim that one positive culture does not affect survival. In any case sending samples to the lab systematically is considered a good practice. we all should follow since there can be cases where the results from the culture alter the antibiotic therapy.

When it comes to the use of PC as a single treatment, without deferred cholecystotomy, Jang et al. described significant associations between being non-eligible for surgery and being older, ASA > 2 or having suffered a stroke, whereas we only found an association with older age. The catheter management that should be given to these patients (indefinitely keeping or withdrawing the catheter) is an issue that has disparate results and recommendations. Withdrawing the catheter after a minimum period of 3–4 weeks seems to be the most general agreement in ANLC, where low percentages of cholecystitis relapse are described, between 0 and 7% depending on the series. When AC and ANLC are studied together relapse percentages range from 9.5% to 42%, and 11.7% stands out in the series with the greatest number of cases and average follow-up time, 60 patients in 38 months. Our relapse percentage was relatively high (40% in 15 cases, with a mean follow-up of 6.7 months) in comparison with other studies, which made us consider as a secondary goal the search for risk factors for PC relapse whose presence would recommend keeping the catheter indefinitely, and none of these risk factors was found. Chang et al. did not find either any risk factors either after analyzing multiple parameters. Jang et al. described an association between lithiasis and relapse. Bergman et al. observed a significantly lower percentage of relapses in women. Most studies reviewed recommend performing deferred cholecystotomies whenever possible and leaving the PC catheter permanently changing it every three months in such a way that its trajectory can be used to extract calculi through the papillary pathway. This makes us think of whether the option of keeping the catheter indefinitely in non-eligible patients for deferred surgery would be more convenient as the general rule, as opposed to the usual practice in our hospital. In any case, prospective studies would be necessary to help in the decision-making process.

There are two main limitations in our study: the first is the relatively small size of the sample, which makes it difficult to obtain significant conclusions in issues such as the improvement of acute parameters after PC and survival, the relation between associated morbidities and mortality in acute episodes, or the relapse percentage in non-eligible patients to deferred cholecystotomy, and therefore, in the identification of risk factors for relapse. The second limitation is its retrospective descriptive nature, with much variability of the data available, especially in the follow-up of patients excluded from surgery (range 7–730 days), which can have an influence on the detection of relapses.

In sum PC in our hospital is a safe therapy whose effectiveness is comparable to that of other series in an attempt to resolve AC acute episodes when emergency
cholecystotomy is considered to be a risk due to its associated morbidities or to the time of evolution of cholecystitis. In patients with lithiasis who are non-eligible for deferred surgery, after resolving the acute outbreak it would be good to keep the catheter indefinitely due to our relatively high relapse percentage and wait for recommendations with a greater level of evidence.

Ethical responsibilities

Protection of people and animals. The authors declare that no experiments with human beings or animals have been performed while conducting this investigation.

Data confidentiality. The authors declare that in this article there are no data from patients.

Right to privacy and informed consent. The authors declare that they have obtained the prior written informed consent from the patients referred to in this article. This document belongs to the corresponding author.

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Conflict of interests

The authors declare no conflict of interests associated with this article whatsoever.

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