Factors associated with complications in patients that underwent percutaneous nephrolithotomy


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Abstract

Background: Percutaneous nephrolithotomy (PNL) is the standard procedure for kidney stones larger than 2 cm, thus displacing open surgery. The incidence of complications varies from 12.5 to 52.5%, the main ones being fever and bleeding.

Aim: To identify the factors associated with complications in patients that underwent PNL, in accordance with the Clavien-Dindo classification.

Materials and methods: A retrospective, correlational, descriptive, cross-sectional study was conducted. We reviewed 104 patients that underwent PNL within the time frame of 2008 and 2014.

Results: One hundred and four patients were included in the study and there were 38 complications. In accordance with the Clavien-Dindo classification there were grade I (19), grade II (10), grade IIIa (8), and grade IVA (1) complications. The most frequent complication was postoperative bleeding in 11 patients. The complications were related to residual stones (p = 0.032). A grade 2 or higher complication was more likely when the lower calyx was affected (p = 0.027). We found a relation between bleeding and surgery duration > 100 min (p = 0.019).

Conclusions: The Clavien-Dindo classification is a useful tool for standardizing and reporting complications in PNL. Surgery duration > 100 min increased the risk for postoperative bleeding and complications were associated with residual stones.

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Factors associated with complications in patients that underwent percutaneous nephrolithotomy

Introduction

Few epidemiologic studies on kidney stones have been conducted in Mexico. Otero et al. reported that this pathology represented 13% of all national hospitalizations due to kidney disease in the Instituto Mexicano del Seguro Social. Another national survey carried out at that institution reported a prevalence of 2.4 cases of kidney stones in 10,000 inhabitants. In the United States incidence was reported at 5.2% from 1988-1994.3

Percutaneous nephrolithotomy (PNL) has become the standard procedure for kidney stones larger than 2 cm, displacing open surgery. A variable complication incidence is reported. De la Rosette described an incidence of 12.5% in a case series of 4,230 patients, whereas Labate et al. reported 20.5%, and the most frequent complications were postoperative fever and bleeding. However, some authors have reported incidence of up to 52.5%.4 Thanks to its practicality, the Clavien-Dindo classification (Clavien classification) was validated in 2012 and has been adopted by the different surgical areas, including urology, to classify postoperative complications.5

It is well known that preoperative factors, such as stone size, stone location, stone composition, and positive urine culture can increase the incidence of complications. Moreno et al. described the relation of complex stones (that encompass more than one calyx or the pelvis) and prolonged surgery duration (> 120 min) to the increase in complications, odds ratio (OR) 4, confidence interval (CI) 1.6-9.6 and OR 2.9, CI 1.2-6.9, respectively. Bayar et al. obtained a higher complication rate in patients with complex stones (that encompass more than one calyx) than in patients with simple stones (a single calyx or the pelvis) (p = 0.006). Factors associated with bleeding during PNL are: multiple access sites, supracostal access, diameter of the percutaneous tract, dilation method, prolonged surgery duration, and perforation of the renal pelvis.6-8

Materials and methods

A retrospective, descriptive, correlated, cross-sectional study was carried out within the time frame of 2008 and 2014. A total of 206 PNLs were performed at the regional hospital of the ISSSTE, “Valentin Gomez Farias”. We reviewed and analyzed the case records of 104 patients that met the inclusion criteria: having undergone PNL, being older than 18 years of age, and having the necessary data in the case record.

The following factors were analyzed: postoperative bleeding, stone location, history of extracorporeal shock wave lithotripsy (ESWL), urinary tract abnormality, previous kidney surgery, surgery duration, and complex stone. Postoperative bleeding was evaluated through urethral catheter and nephrostomy and control blood counts were done when necessary. Stone location was specified in the collecting system together with the number of calyces occupied as revealed through computerized axial tomography (CAT). The past history of ESWL was recorded (present or absent), regardless of the number of sessions. Urinary tract abnormality was defined as the presence of an anatomic variant, including stricture at any level. Prior kidney surgery was defined as a past history of open surgery that included the approach to the kidney unit. Surgery duration: surgery commencement was viewed as the moment the Chiba needle was introduced into the skin and surgery completion, the removal of the Amplatz sheath after nephrostomy placement. A complex stone was defined as the presence of 2 or more branches occupying 2 or more
segments in the collecting system. A stone-free patient was considered one whose postoperative x-ray, or CAT scan in the case of a radiolucent stone, confirmed the complete absence of stones. Complications were reported according to the Clavien classification modified for PNL and validated in 2012. PNL indications were those listed in the guidelines for lithiasis management: a stone larger than 2 cm, a density greater than 1,000 HU, and ESWL-resistant stones. Cystoscopy with a 21 Fr cystoscope (Storz®, Karl Storz Endoskope, Tuttlingen, Germany) and ureteral stent (6F Boston Scientific, Marlborough, MA, USA) placement ipsilateral to the stone were carried out in all the procedures. Pyelogram was taken before the Chiba needle puncture, the tract was dilated with Amplatz, Alken, or balloon, according to the surgeon’s choice, and we used a 24 Fr nephroscope (Storz®, Karl Storz Endoskope, Tuttlingen, Germany) and pneumatic lithotripter.

The SPSS 20.0 (IBM statistics) program was used for the statistical analysis. Contingency tables were elaborated for the nominal variable analysis, applying the Pearson chi-square or Fisher’s exact tests, as needed, and the OR was calculated. A multinomial logistic regression multivariate analysis with a 95% CI was carried out in all the tests.

Results

A total of 104 patients were included in the study, with a mean age in years of 50.21 ± 12.16 standard deviation. Table 1 shows the general characteristics. There were 38 complications in 29 patients (some patients presented with more than one complication), resulting in a complication incidence rate of 27%. According to the Clavien classification, there were 19 grade 1 complications (50% of the total), 10 grade 2 (26.31%), 8 grade 3a (21.05%), and one grade 4a (2.63%). The most frequent complication was postoperative bleeding in 11 patients, 2 of whom required transfusion, followed by fever (8) and urine leakage (8) (table 2). A past history of ESWL (p = 0.114) (OR 1.57, 95% CI 0.864-2.853), urinary tract abnormalities (p = 0.146) (OR 2.018, 95% CI 0.738-5.52), previous kidney surgery (p = 0.711) (OR .99, 95% CI 0.566-1.75), age (p = 0.88), and sex (p = 0.121) were not related to a greater risk for complications. Other complications were reported in a lower number of cases (table 3). We obtained a p = 0.002 (OR 1.42, CI 1.17-1.72) that related the complications to simple stones. Surgery duration < 120 min presented as a protective factor (OR 0.731, CI 0.19-1.362). Complications were significantly related to residual stones (p = 0.032) (OR, 1.6, CI 0.914-2.84) upon applying the multivariate analysis.

We did a subgroup analysis, separating the patients that presented with grade 1 complications (19) from those that presented with complications of grade 2 or higher (18). When the lower calyx was affected, there were more grade 2 complications or higher (p = 0.027) (OR 2.34, CI 0.989-5.57). We found a relation between bleeding and surgery duration > 100 min when we analyzed just the patients that presented with postoperative bleeding (p = 0.019) (OR 1.583; CI 1.123-2.232) (table 4).

Discussion

PNL has been established as the treatment of choice for large, complex stones at the kidney level. However, it is important to report the complications of the surgery, and

Table 1 Patient characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>No. of patients, 104</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean ± TD</td>
<td>50.21 ± 12.16 years</td>
</tr>
<tr>
<td>Sex</td>
<td>Men (49), Women (55)</td>
</tr>
<tr>
<td>Comorbidities</td>
<td></td>
</tr>
<tr>
<td>High blood pressure</td>
<td>17 (16.3%)</td>
</tr>
<tr>
<td>Type 2 diabetes mellitus</td>
<td>11 (10.6%)</td>
</tr>
<tr>
<td>Heart disease</td>
<td>2 (1.9%)</td>
</tr>
<tr>
<td>ESWL</td>
<td>30 (28.8%)</td>
</tr>
<tr>
<td>Previous kidney surgery</td>
<td>37 (35.6%)</td>
</tr>
<tr>
<td>Urinary tract abnormalities</td>
<td>13 (12.5%)</td>
</tr>
<tr>
<td>Surgery duration, mean ± TD</td>
<td>124.37 min (± 44.74)</td>
</tr>
<tr>
<td>Residual stone</td>
<td>32 (30.8%)</td>
</tr>
<tr>
<td>Stone location</td>
<td></td>
</tr>
<tr>
<td>Lower calyx</td>
<td>41 (39.4%)</td>
</tr>
<tr>
<td>Middle calyx</td>
<td>5 (4.8%)</td>
</tr>
<tr>
<td>Upper calyx</td>
<td>4 (3.8%)</td>
</tr>
<tr>
<td>Kidney pelvis</td>
<td>27 (26%)</td>
</tr>
<tr>
<td>Complete staghorn</td>
<td>11 (10.6%)</td>
</tr>
</tbody>
</table>

TD: typical deviation.
not only the success rates. The Clavien classification is a practical and easy-to-use tool that helps us standardize this process. Over the years its applicability has extended to the different areas of surgery. In 2012, Rosette et al. conducted a study on patients of the Clinical Research Office of the Endourological Society (CROES) group, validating the Clavien classification for its use in PNL and explaining in detail the type of complication for each grade.5 Knowing our complication rate provides us with important surgical feedback, enabling us to make the necessary modifications and perform our techniques more accurately for the benefit of the patient. The incidence of complications in our study is within the range observed in the literature.4-5 Postoperative bleeding was the most frequent complication in our series, whereas other authors have reported fever or urine leakage as the most frequent.5,9 We feel that each hospital should monitor their complications, given the variability in their frequency, so that the relevant actions can be taken to reduce their incidence.

We found no relation in the increase of complication incidence to variables, such as a past history of ESWL, urinary tract abnormalities, previous kidney surgery, complex stone, age, or sex. However, Moreno et al. reported that female sex influenced complications. They also stated that complex stones and surgery duration > 120 min were factors associated with complications.8 Khorrami et al. concluded that previous open kidney surgery did not influence PNL efficacy or its complications, concurring with our results.10 A sub-analysis of the CROES study determined that kidney malformations or anatomic variants did not modify PNL results or complications, but that they made surgery time longer and hindering access.11 Despite the fact that a past history of ESWL was described as a factor that can predispose to complications due to the changes produced in the renal and perirenal tissue, making access more difficult, we did not observe that it had an impact on our dependent variable, the same as reported by the other 2 authors.9,12 A technically difficult surgical procedure in patients with complications could explain the higher incidence of residual stones in this group. As in our study, Shin et al. described a relation between surgery duration and postoperative bleeding, the same as Lee et al.12-13 Finally, the greater number of complications grade 2 or higher in the stones that affected the lower calyx could be due to the fact that the lower calyx was the most frequently affected.

Conclusions

The Clavien classification is a useful tool for standardizing and reporting PNL complications. A past history of ESWL, urinary tract abnormalities, previous kidney surgery, age, or sex did not influence the complication incidence in this study. Surgery duration > 100 min increased the risk for postoperative bleeding and the complications in this case series were associated with residual stones.

Ethical responsibilities

Protection of persons and animals. The authors declare that no experiments were performed on humans or animals for this study.

Data confidentiality. The authors declare that they have followed the protocols of their work center in relation to the publication of patient data.

Right to privacy and informed consent. The authors declare that no patient data appear in this article.

Financial disclosure

No financial support was received in relation to this study.

Conflict of interest

The authors declare that there is no conflict of interest.

References


