Treatment of hemorrhagic complications of percutaneous nephrolithotomy in Galdakao position

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Abstract

Objective: Percutaneous Nephrolithotomy (PCNL) is a technique with good results for the treatment of kidney stones, however, bleeding complications derived can be serious if not diagnosed and treated effectively. The aim of this study is to assess bleeding complications resulting from PCNL in Galdakao position and therapeutic management.

Materials and methods: Retrospective-longitudinal study of 172 PCNL performed in La Ribera Hospital between January 2005 and December 2011, analyzing their bleeding complications and the treatment provided for resolution.

Results: 20 patients (11.6%) had bleeding complications. The need for transfusion in this series was 8.1% and the most common cause of blood transfusion was the presence of postoperative retroperitoneal (7.5%). There were 6 arterial injuries (3.5%), 5 of them successfully treated with angiography and arterial selective embolization.

Conclusions: The arterial injuries following PCNL are rare but can be serious. The possibility of an urgent arteriography and selective embolization to the diagnosis permits an effective and safe treatment of bleeding without risk to the affected renal unit.

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PALABRAS CLAVE
Arteriografía renal; Embolización selectiva; Hemorragia

Tratamiento de las complicaciones hemorrágicas de la nefrolitotomía percutánea en posición de Galdakao

Resumen

Objetivo: La nefrolitotomía percutánea (NLPC) es una técnica con buenos resultados para el tratamiento de la litiasis renal, sin embargo, las complicaciones hemorrágicas derivadas de la misma pueden ser graves si no son diagnosticadas y tratadas eficazmente. El objetivo de este estudio es evaluar las complicaciones hemorrágicas derivadas de la nefrolitotomía percutánea en posición de Galdakao y su manejo terapéutico.
Material y métodos: Estudio longitudinal retrospectivo de 172 NLPC realizadas en el Hospital La Ribera entre enero de 2005 y diciembre de 2011, analizando sus complicaciones hemorrágicas y el tratamiento establecido para su resolución.

Resultados: Presentaron complicaciones hemorrágicas 20 pacientes (11.6%). El requerimiento transfusional de esta serie fue de 8.1% y la causa más frecuente de transfusión el hemATOMa perirrenal post-operatorio (7.5%). Hubo 6 lesiones arteriales (3.5%), 5 de ellas tratadas satisfactoriamente con arteriografía y embolización selectiva de la lesión.

Conclusiones: Las lesiones arteriales por NLPC son poco frecuentes pero pueden ser graves. La posibilidad de realizar de manera urgente arteriografía y embolización selectiva, ante el diagnóstico de una lesión vascular tras NLPC, permite el tratamiento de la hemorragia de una manera eficaz y segura sin riesgo para la unidad renal afectada.

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Introduction

In the treatment of large intrarenal calculi, the success of stone elimination is as important as the care of kidney. Thus, minimally invasive surgery has replaced open surgery, which is relegated to exceptional cases. Among them, percutaneous nephrolithotomy (PCNL) is the technique of choice because of its good results in the management of complex lithiasis both in supine and prone position. However, percutaneous access has a risk of vascular lesion in regard to renal vasculature with fatal consequences, being essential the prevention of these lesions and its early detection and treatment. The aim of this study is to assess bleeding complications resulting from percutaneous nephrolithotomy in Galdakao position (PCNLs) and their therapeutic management.

Materials and methods

Retrospective-longitudinal study of 172 PCNL performed for the treatment of staghorn renal or pseudo-staghorn stones, in La Ribera Hospital between January 2005 and December 2011.

In order to obtain a good definition of segmental renal circulation, computerized tomography with volumetric reconstruction of lithiasis and angiographic study were carried out in preoperative evaluation. There were not specific exclusion criteria.

Urgent renal arteriography was carried out when active postoperative bleeding was diagnosed by computerized tomography (CT) with angiographic study. The remaining cases were managed conservatively.

Through the femoral artery, abdominal aortography with vascular pigtail catheter and subsequent selective catheterization of the renal vessel bleeding were performed (renal artery branches, renal polar arteries or lumbar arteries, according to the case). These selective catheterizations are performed with micrormitters (Tracker® 0.018, Terumo), followed by sealing the bleeding point with controlled-release microcoils (IDC®, Boston Scientific®), whose size varies depending on bleeding vessel size. The release of the coils is conducted under fluoroscopic control until total vessel occlusion is achieved.

Results

In Table 1 general characteristics of the patients with hemorrhagic complications after surgery and the type of lithiasis are shown.

A total of 20 patients (11.6%) suffered hemorrhagic complications, and 8.1% of the total required blood transfusions.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>General characteristics of patients with bleeding complications after percutaneous nephrolithotomy in Galdakao position.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>53.35 ± 13</td>
</tr>
<tr>
<td>Male/female</td>
<td>8 (40) 12 (60)</td>
</tr>
<tr>
<td>BMI</td>
<td></td>
</tr>
<tr>
<td>Normoweight</td>
<td>5 (25)</td>
</tr>
<tr>
<td>Overweight</td>
<td>5 (25)</td>
</tr>
<tr>
<td>Obesity</td>
<td>10 (50)</td>
</tr>
<tr>
<td>ASA</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>3 (15)</td>
</tr>
<tr>
<td>2</td>
<td>10 (50)</td>
</tr>
<tr>
<td>3</td>
<td>7 (35)</td>
</tr>
<tr>
<td>Size</td>
<td></td>
</tr>
<tr>
<td>Length (mm)</td>
<td>39.7 ± 11.3</td>
</tr>
<tr>
<td>Area (mm²)</td>
<td>860.4 ± 527.7</td>
</tr>
<tr>
<td>Shape</td>
<td></td>
</tr>
<tr>
<td>Staghorn</td>
<td>2 (10)</td>
</tr>
<tr>
<td>Complete staghorn</td>
<td>12 (60)</td>
</tr>
<tr>
<td>Pseudo-staghorn</td>
<td>4 (20)</td>
</tr>
<tr>
<td>Mold</td>
<td>2 (10)</td>
</tr>
<tr>
<td>Lithiasis composition/Hounsfield units</td>
<td></td>
</tr>
<tr>
<td>Uric acid</td>
<td>3 (15) 526 ± 156.82</td>
</tr>
<tr>
<td>Calcium phosphate</td>
<td>5 (25) 1016 ± 294.6</td>
</tr>
<tr>
<td>Struvite</td>
<td>6 (30) 881 ± 246.4</td>
</tr>
<tr>
<td>Oxalate monohydrate</td>
<td>6 (30) 1074 ± 273.2</td>
</tr>
</tbody>
</table>

Data presented as number of patients and percentage mean ± standard deviation or median and range.
In 13 patients (7.5%), perirenal hematoma was detected, being the most frequent complication. The choice of treatment was performed according to the hemodynamic stability of the patient and the hemoglobin and hematocrit levels. The treatment was conservative in 12 patients (7%), of which 6 patients needed blood transfusions as the sole measure of treatment. Only one hematoma was resolved with percutaneous drainage and supportive measures of fluid and blood transfusion.

One patient (0.6%) who showed anemic hematuria without associated vascular injury underwent blood transfusion. Intervventional treatment was required in the 6 patients (3.5%) who showed arterial bleeding in CT and angiographic study. The characteristics of these cases are detailed in Table 2. In 5 of these 6 patients, superselective catheterization with embolization of the damaged vessel was carried out with satisfactory results. In the remaining patient, due to the complexity of the lesion we performed lumbotomy with sealing of the access with hemostatic agents (Flossyl©) and hemostatic suture on the renal parenchyma. All these cases required blood transfusion before or after surgical intervention and their evolution were satisfactory without any delaying bleeding. No impairment of renal function after treatment was observed; 2 cases of vascular lesion and its supralselective embolization are shown in Figs. 1 and 2.

Discussion

Vascular injuries are a relatively common complication of PCNL, although different published studies show disparate data. The rates of flood transfusion range from 0% to 23%. Fortunately, arterial lesion requiring interventional treatment is less frequent (0.4–3.8%). In our study, with a mean stone size (in terms of length and surface area) larger than such groups, both transfusion and arterial lesion rates are within this range. The stone size is a predictive factor of vascular damages.

The treatment success is based on 3 mainstays: prevention, detection and treatment of complications. Regarding prevention, we consider necessary an angiographic study of the kidney to be operated. As the segmental arteries are terminal arteries and they do not form collaterals, they provide possible access path, free of vascularization and relatively exsanguine, to achieve the urinary collecting system. However, up to 43% of the kidneys...
show normal anatomical variants of the renal arteries.\textsuperscript{12} Moreover, a proper preoperative radiological study is one of the most important factors in preventing complications.\textsuperscript{10} In consequence, an accurate preoperative vascular study of the patient is mandatory. In our case, a CT with volumetric reconstruction and angiographic study were carried out in all patients, allowing us not only a better characterization of the vascular tree, but also of the stone to be treated.\textsuperscript{13}

\begin{table}[h]
\centering
\begin{tabular}{|c|c|c|c|c|c|c|c|}
\hline
Arterial injury & Anomaly & Age & Sex & ASA & BMI & Type of lithiasis & Lithiasis composition & Creatinine pre-post & Treatment of complication \\
\hline
Arcuate artery & Malrotation & 43 & F & 1 & 24 & Mold & Calcium phosphate & 0.59/0.69 & Open surgery \\
Arcuate artery & None & 68 & F & 3 & 32 & Staghorn & Struvite & 0.9/0.75 & Embolization \\
Arcuate artery & None & 67 & M & 2 & 33 & Complete staghorn & Calcium oxalate monohydrate & 0.69/0.66 & Embolization \\
Isthmus accessory artery & Horseshoe kidney & 39 & M & 2 & 33 & Mold & Calcium oxalate monohydrate & 0.9/0.9 & Embolization \\
Polar artery & None & 49 & F & 2 & 36 & Complete staghorn & Calcium phosphate & 0.7/1.1 & Embolization \\
Pseudoaneurysm & None & 63 & M & 2 & 37 & Staghorn & Uric acid & 0.8/0.8 & Embolization \\
\hline
\end{tabular}
\end{table}

\textbf{Table 2} General characteristics and treatment of patients with arterial lesions after percutaneous nephrolithotomy in Galdakao position.

\textbf{Figure 2} (A) Coronal reconstruction in angiographic phase showing large left perirenal hematoma and extravasation of contrast adjacent to nephrostomy tube. (B) Renal arteriography hemorrhage located in the lower pole of the left kidney. (C) Supraselective arteriography with microcatheter evidencing accessories bleeding vessels. (D) Image of metal coils arranged on a lower polar vessel for the cessation of bleeding.
Thanks to close monitoring of the patient immediately after the procedure the early detection of these lesions is possible. Moreover, its earlier treatment requires stopping the bleeding with less damage of the renal parenchyma. Superselective embolization is an efficient technique for controlling renal bleeding in stable patients with minimal loss of renal function. These are reasons for making this technique the first-choice treatment option in cases of renal hemorrhage. The availability of on-call interventional radiologists has allowed us to implement this treatment in most patients with excellent results.

Conclusion
Arterial lesions following percutaneous nephrolithotomy are rare but endanger the patient’s life. The treatment success is based on 3 mainstays: prevention, detection and treatment of complications. In our series, a close monitoring immediately after the procedure and the availability of vascular interventionism has allowed us to achieve an early diagnosis of vascular complications and to implement a conservative treatment for renal unit with excellent results.

Conflict of interests
The authors declare that they have no conflict of interest.

References