Nutcracker phenomenon: a case with surgical treatment and its diagnostic criteria

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Citation

Issue Date
1994-02

URL
http://hdl.handle.net/2433/115201

Type
Departmental Bulletin Paper

Textversion
publisher

Kyoto University
NUTCRACKER PHENOMENON: A CASE WITH SURGICAL TREATMENT AND ITS DIAGNOSTIC CRITERIA

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A surgically treated case of the nutcracker phenomenon is reported. Severe left flank pain and gross hematuria were relieved by direct renocaval reimplantation. We proposed the diagnostic criteria of the nutcracker phenomenon causing severe flank pain and/or renal hematuria.


Key words: Nutcracker phenomenon, Renocaval reimplantation, Pulsewave Doppler method

INTRODUCTION

The nutcracker phenomenon\(^1\), with the disturbance of the left renal venous circulation and the development of left renal collateral pathways, resulted from compression of the left renal vein (LRV) by the aorta and the superior mesenteric artery (SMA). It sometimes causes left flank pain and gross or occult hematuria. We report a surgically treated case and propose the diagnostic criteria of the nutcracker phenomenon.

CASE REPORT

A 38-year-old thin man was suffering from severe left flank pain and intermittent gross hematuria for more than 3 years without any treatment. Left flank pain and tenderness became rather worse in the standing position, so that he needed to have a continuous indwelling epidural anesthetic tube for 3 months. Left renal venography was performed. We made the diagnosis of the nutcracker phenomenon, because of the increasing pressure gradient between the LRV and the IVC by supine, 24 cm of water by standing. Maximum velocity of the left renal venous flow decreased to 8.7 cm/sec measured by the pulsewave Doppler method (Fig. 2). On October 30, 1990 direct left renocaval reimplantation was performed with excision of gonadal and adrenal veins. The LRV was reanastomosed into the IVC 4 cm caudally to the original site. Ptosis of pancreas body over the LRV was also

Fig. 1. Left renal venography simultaneously with arteriography of the SMA. Compression of the LRV is seen
observed. After the operation his symptoms improved and he was released from continuous epidural anesthesia. He had left renal venography again 30 months after the operation. In spite of the marked improvement of the left renal venous circulation, the pressure gradient between the LRV and the IVC was still 6 cm of water in supine position (that in standing position was not measured). He is now almost free from pain and hematuria (one to four red cells per high-power field were present in the sediment).

**DISCUSSION**

It is well known that compression of the LRV by the aorta and the SMA causes left renal venous hypertension and sometimes leads to left flank pain, gross or microhematuria, and development of collateral renal varices including varicocele. DeSchepper\(^1\) named such a syndrome the "nutcracker phenomenon" in 1972. Recently, with the spread of the concept of this phenomenon, it is considered to be a cause of unknown origin renal hematuria.

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**Table 1. Pressure gradient between the LRV and the IVC**

<table>
<thead>
<tr>
<th>Reference</th>
<th>Age-Sex</th>
<th>Pressure gradient</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dever and associates(^2)</td>
<td>40-F</td>
<td>3 mmHg (=4 cmH(_2)O)</td>
<td>Observation</td>
</tr>
<tr>
<td>Wendel and associates(^3)</td>
<td>45-F</td>
<td>7 cmH(_2)O</td>
<td>Medial fixation of the left kidney</td>
</tr>
<tr>
<td>Stewart and Reiman(^5)</td>
<td>19, 24-F</td>
<td>5.5-6.3 cmH(_2)O</td>
<td>Direct left renocaval reimplantation</td>
</tr>
<tr>
<td>31-M</td>
<td></td>
<td></td>
<td>Excision of extensive renal varicosities</td>
</tr>
<tr>
<td>Choi and Anillo(^6)</td>
<td>19-F</td>
<td>6 cmH(_2)O</td>
<td>Direct left renocaval reimplantation resection of a paraaortic fibrous tissue</td>
</tr>
<tr>
<td>Ariyoshi and Nagase(^7)</td>
<td>20-M</td>
<td>8.2 cmH(_2)O</td>
<td>Direct left renocaval reimplantation</td>
</tr>
<tr>
<td>Sachs and associates(^8)</td>
<td>30-F</td>
<td>8 cmH(_2)O</td>
<td>Direct left renocaval reimplantation</td>
</tr>
<tr>
<td>Present case</td>
<td>38-M</td>
<td>6 cmH(_2)O</td>
<td>Direct left renocaval reimplantation</td>
</tr>
</tbody>
</table>
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Table 2. The Diagnostic Criteria of the Nutcracker Phenomenon

| No specific findings are obtained by ordinarily performed medical and urological examination against hematuria or left flank pain |
| Nutcracker Distance* < 5 mm |
| Maximum velocity of the left renal venous flow** < 15 cm/sec |
| Compression of the LRV by the SMA on selective renal venography The pressure gradient between the LRV and the IVC > 4 cmH2O |

* Nutcracker Distance is the distance between the SMA and the aorta on abdominal CT.
** The velocity is measured by the pulsewave Doppler method and its average of control cases is more than 20 cm/sec.

Dever and associates1 discussed the diagnostic options. They advocated that the diagnosis should be established by demonstrating compression of the LRV on selective renal venography and existence of a significant pressure gradient increase. However, he did not refer to the definitive value of the pressure gradient. Judging from the values of the pressure gradient in 2 patients with the disease and 6 normal controls we previously reported2, and review of the literature (Table 1)3,4,5, we decided the gradient of 4 cm of water to be adequate as the border value. Choi6 mentioned the significance of the decrease in the angle of the SMA from the aorta. We express it by means of the distance between the SMA and the aorta measured in computerized tomography (CT), and call it nutcracker distance (Fig. 3)6. The uniform criteria of the nutcracker phenomenon has not yet been defined in the literature, and we propose our ideal criteria (Table 2). The left renal venous flow velocity measured by the pulsewave Doppler method is useful for estimating the effect of the surgical treatment6.

Stewart5 performed direct renocaval reimplantation for 3 patients with the nutcracker phenomenon and received satisfying results. Wendel7 thought venous compressions was caused by surrounding structures and positional factors, and performed medial fixation of the left kidney and excision of extensive renal varicosities. Dever and associates8 noted the former approach was logical for the patients with the significant pressure gradient increase, and we also recommend it as the best method for the relief from severe pain by recovery of the renal venous circulation. Observation is first and fundamental, but when severe flank pain has continued for a long term we should take a plunge to surgical treatment, and it is of course necessary to rule out any probabilities of other painful diseases before the decision of the surgery.

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(Received on August 31, 1993) (Accepted on November 12, 1993)

Nutcracker 現象：外科的治療例と診断基準

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Nutcracker 現象とは左腎静脉が大動脈と上腸間膜動脈との間に挟まれて逆流障害を生じ，側腹痛，血尿等のものもろの症状を発现する疾患である。われわれは左側腹痛と血尿を長期に渡って患う本疾患の38歳の男性に対して，左腎静脉一下大静脈新吻合術を施行し症状の寛解をえた。また，自験例と文献的考察をもとに本疾患に対する診断基準を提案した。

（泌尿誌 40: 135-138, 1994）