

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.

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Key words: Nutcracker phenomenon, Renocaval reimplantation, Pulsed-wave Doppler method

INTRODUCTION

The nutcracker phenomenon¹⁾, 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 left renal vein (LRV) and the inferior vena cava (IVC) by an other establishment, and the absence of any other reasons explaining his violent pain in the detailed examinations on the other abdominal organs. Left renal venography simultaneously with arteriography of the superior mesenteric artery (SMA) (Fig. 1) demonstrated compression at the cross

point of the SMA and pooling of contrast medium. The pressure gradient between the LRV and the IVC was 6 cm of water 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 pulsed-wave 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

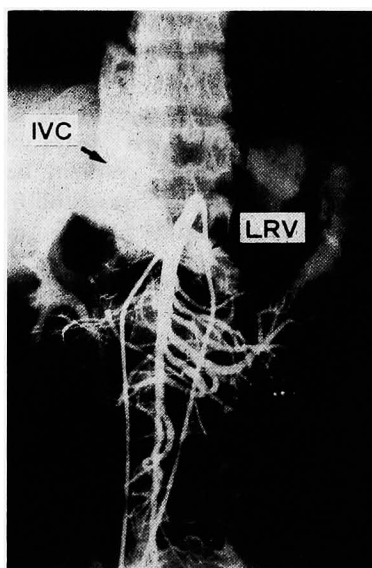


Fig. 1. Left renal venography simultaneously with arteriography of the SMA. Compression of the LRV is seen

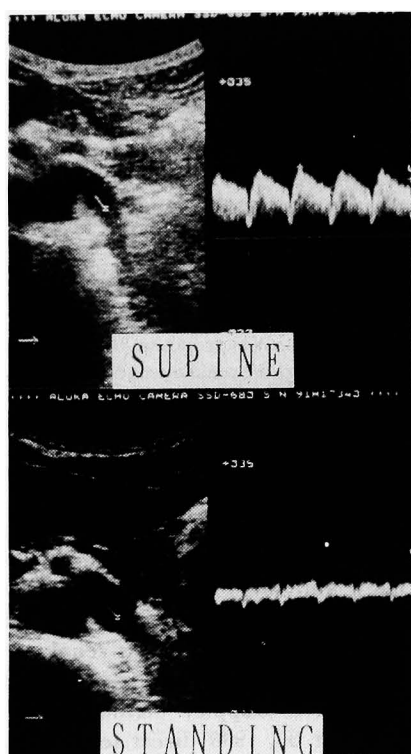


Fig. 2. Pulsewave Doppler method shows the decreased maximum velocity of the left renal venous flow, especially in standing position (below).

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

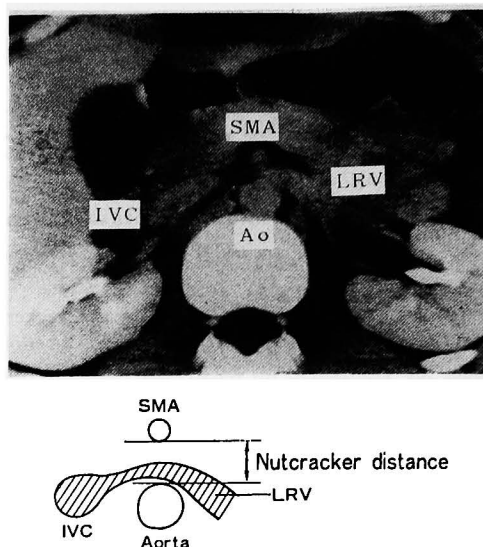


Fig. 3. Nutcracker distance is easily measured by abdominal CT.

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. DeSchepper¹⁾ 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.

Table 1. Pressure gradient between the LRV and the IVC

Reference	Age-Sex	Pressure gradient	Treatment
Dever and associates ²⁾	40-F	3 mmHg (=4 cmH ₂ O)	Observation
Wendel and associates ⁴⁾	45-F	7 cmH ₂ O	Medial fixation of the left kidney excision of extensive renal varicosities
Stewart and Reiman ⁵⁾	19, 24-F 31-M	5.5~6.3 cmH ₂ O	Direct left renocaval reimplantation
Choi and Anllo ⁶⁾	19-F	6 cmH ₂ O	Direct left renocaval reimplantation resection of a paraaortic fibrous tissue
Ariyoshi and Nagase ⁷⁾	20-M	8.2 cmH ₂ O	Direct left renocaval reimplantation
Sachs and associates ⁸⁾	30-F	8 cmH ₂ O	
Present case	38-M	6 cmH ₂ O	Direct left renocaval reimplantation

Table 2. The Diagnostic Criteria of the Nutcracker Phenomenon

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- 1 No specific findings are obtained by ordinarily performed medical and urological examination against hematuria or left flank pain
 - 2 Nutcracker Distance* <5 mm
 - 3 Maximum velocity of the left renal venous flow** <15 cm/sec
 - 4 Compression of the LRV by the SMA on selective renal venography
The pressure gradient between the LRV and the IVC >4 cmH₂O
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- * 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.
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Dever and associates²⁾ 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 reported³⁾, and review of the literature (Table 1)^{2,4-8)}, 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)⁹⁾. 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 treatment³⁾.

Stewart⁵⁾ performed direct renocaval reimplantation for 3 patients with the nutcracker phenomenon and received satisfying results. Wendel⁴⁾ 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 associates²⁾ 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.

REFERENCES

- 1) De Schepper A: "Nutcracker" phenomenon of the renal vein causing left renal vein pathology. *J Belge Radiol* 55: 507-511, 1972
- 2) Dever DP, Ginsburg ME, Millet DJ, et al.. Nutcracker phenomenon. *Urology* 27: 540-542, 1986
- 3) Chiba Y, Tanahashi Y, Toyota S, et al.. Ultrasonographic diagnosis of renal vein abnormality causing renal bleeding (2nd report) -Study of left renal venous flow pattern using color Doppler technique-. *JSUM Proceedings Vol. 17, Supplement I*: 415-416, 1990
- 4) Wendel RG, Crawford ED and Hehman KN: The "nutcracker" phenomenon: an usual cause for renal varicosities with hematuria. *J Urol* 123: 761-763, 1980
- 5) Stewart BH and Reiman G: Left renal venous hypertension "Nutcracker" syndrome managed by direct renocaval reimplantation. *Urology* 20: 365-369, 1982
- 6) Choi SH and Anllo V: Left renal vein "nutcracker" phenomenon. *Urology* 20: 549-551, 1982
- 7) Ariyoshi A and Nagase K: Renal hematuria caused by "nutcracker" phenomenon: a more logical surgical treatment. *Urology* 35: 168-170, 1990
- 8) Sacks BA, Gomori J, Lerner M, et al.: Left renal hypertension in association with the

nutcracker phenomenon. Cardiovasc Intervent Radiol 4: 253-255, 1981

- 9) Chiba Y, Tanahashi Y, Toyota S, et al.: Ultrasonographic diagnosis of renal vein abnormality causing renal bleeding (1st report)-Study of cases with nutcracker phe-

nomenon-. JSUM Proceedings Vol. 16, Supplement II: 759-760, 1989

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(迅速掲載)

和文抄録

Nutcracker 現象：外科的 1 治療例と診断基準

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Nutcracker 現象とは左腎静脈が大動脈と上腸間膜動脈との間に挟まれて還流障害を生じ，側腹部痛，血尿等のもろもろの症状を発現する疾患である。われわれは左側腹部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，左腎静脈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。

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