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论著

# 彩色超声多普勒在输尿管结石伴肾盂积水治疗中的临床应用

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提 要:目的 探讨彩色多普勒在输尿管结石伴肾盂积水治疗中的临床应用价值。方法 检测42只输尿管结石伴肾盂积水采用输尿管切开取石术前的肾内血流动力学指标,并与术后15 d、1月、3月检测的肾内血流动力学指标相比较,观察其变化情况并与术后肾功能恢复情况相联系,了解其相关性。结果 36只输尿管结石伴肾盂轻中度积水肾内血管彩色血流信号欠丰富,主肾动脉峰值流速(*V*max)和肾脏血流量(CO)明显低于对侧正常组($P<0.05$),RI值两者无显著性差异($P>0.05$)。6只输尿管结石伴肾盂重度积水肾内血管彩色血流信号显示稀疏或缺乏,*V*max和CO也明显低于对侧正常,但RI值升高,与对侧正常比较差异显著($P<0.05$)。手术后肾内彩色血流信号、*V*max和CO与术前比较有明显改善($P<0.05$),重度积水者其RI值恢复至正常范畴。结论 彩色多普勒在手术前即能判断患侧肾功能,能够较为准确地预测手术后肾功能恢复的状况。

关键词:彩色多普勒;输管尿切开取石术
中图法分类号:R445.1;R692.7;R693.4 文献标识码:A

# Clinical application of color Doppler of ultrasonography in the treatment of ureteral calculus with hydronephrosis

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**Abstract:** **Objective** To investigate the clinical value of color Doppler of Ultrasound (CDU) in the treatment of ureteral calculus with hydronephrosis. **Methods** The hemodynamic parameters of the kidney for 42 cases of ureteral calculus with hydronephrosis were determined with CDU before operation, and at the 15th day, 1 and 3 month after operation. The relationship of the alteration of hemodynamic parameters with the recovery of renal function after operation was analyzed. **Results** The signal of 36 cases of ureteral calculus with mild or moderate hydronephrosis showed not rich in intra-kidney blood flow. The maximal flow velocity of main renal artery and renal blood flow were significantly lower than the normal kidney ($P<0.05$). There was no significant difference in resistance index between 2 sides. Six cases of ureteral calculus with severe hydronephrosis showed little blood flow signal or no signal. The maximal flow velocity of main renal artery and renal blood flow were also significantly lower than the normal side, but the resistance index was significantly higher than the opposite ($P<0.05$). After operation, the blood flow signal, the maximal flow velocity, and the renal blood flow were obviously improved ($P<0.05$), the resistance index of the patients with severe hydrops was restored to the normal level. **Conclusion** CDU can be used to judge the renal function of illed kidney before operation, and can predict the post-operative prognosis rather precisely.

**Key words:** color Doppler; ureter calculus; renal pelvis hydrops; hemodynamics; prognosis

本研究应用彩色多普勒血流显像(Color Doppler flow image, CDFI)检测输尿管切开取石手术前、后肾脏血流动力学变化,探讨其在手术前后应用的临床价值。

## 1 资料和方法

### 1.1 一般资料

本组38例患者共42只输尿管结石,男24例,女12例,年龄16~76岁,平均年龄42.3岁。术前常规作彩色多普勒超声、拍腹部平片、静脉肾盂造影,必要时作逆行尿路造影检查,均诊断为输尿管结石伴肾盂积水。术后15 d、1月、3月复查CDFI,对重度肾盂积水患者于1月的复查静脉肾盂造影。

### 1.2 检测方法

仪器采用美国Acuson-128型彩色多普勒超声仪,探头频率3.5 MHz。受检查者禁食、禁水8 h以上,常规观察比较双肾大小结构、肾实质回声、皮质厚度、肾内血管床彩色血流信号。测主肾动脉(MRA)、段动脉(SRA)的收缩期峰值流速(*V*max)、舒张末期峰值流速(*V*min),阻力指数(RI)。比较手术前、后肾内血流动力学变化。我们将肾内血管床彩色血流信号分为Ⅳ级:Ⅰ级:肾内彩色血流丰富,即主肾动脉、段动脉、叶间动脉彩色血流信号显示清晰,呈树枝状分布,弓状动脉显示较连续;Ⅱ级:肾内彩色血流欠丰富,主肾动脉、段动脉、叶间动脉彩色血流信号显示清晰,弓状动脉显示不清;Ⅲ级:肾内彩色血流稀疏,主肾动脉、段动脉血流信号显示清晰,叶间动脉显示稀疏;Ⅳ级肾内彩色血流信号缺乏,主肾动脉显示,段动脉显示稀疏。

### 1.3 手术方法

采用开放性输尿管切开取石术。

### 1.4 统计学处理

数据以$\bar{x}\pm s$表示,采用$\chi^2$检验。

## 2 结果

本组38例42只输尿管结石伴肾盂积水,24只伴轻度积

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水,12 只伴中度积水,6 只伴重度积水。36 只轻中度积水肾皮质厚度平均为 1.5 cm,与对侧正常比较无显著性差别($P>0.05$)。重度积水 6 只肾皮质厚度平均为 0.9 cm,与对侧正常比较有显著性差别($P<0.05$)。36 只输尿管结石伴肾盂轻、中度积水中肾内血流信号为Ⅰ级 18 只,Ⅱ级 11 只,Ⅲ级 7 只;6 只输尿管结石伴肾盂重度积水中肾内血流信号Ⅲ级 4 只,Ⅳ级 2 只。而对侧正常组均为Ⅰ级或Ⅱ级。术前输尿管结石伴肾盂积水时 *V*max、*V*min 和 CO 均低于对侧正常组($P<0.05$)。术后其血流动学改变明显($P<0.05$),*V*max、*V*min 和 CO 与对侧正常比较无显著差异,特别是重度积水者 RI 值在术后即有明显下降,1 个月后降至正常范围,见表 3。

表 1 输尿管结石伴肾积水组肾内彩色血流显示结果

**Tab 1 Results of color Doppler of ultrasonogram of the intra-kidney blood flow of ureteral calculus with hydronephrosis**

| | | Grade Ⅰ | | Grade Ⅱ | | Grade Ⅲ | | Grade Ⅳ | |
|---|---|---|---|---|---|---|---|---|---|
| | | *n* | % | *n* | % | *n* | % | *n* | % |
| Severe hydronephosis | *n*=6 | 0 | | 0 | | 4 | 66.7 | 2 | 33.3 |
| Moderate hydronephosis | *n*=12 | 6 | 50.0 | 2 | 16.7 | 4 | 33.3% | 0 | |
| Mild hydronephosis | *n*=24 | 12 | 50.0 | 9 | 37.5 | 3 | 12.5 | 0 | |
| Contralateral kidney | *n*=36 | 30 | 83.3 | 6 | 16.7 | 0 | 0 | 0 | 0 |

表 2 输尿管结石术前、后与对侧正常肾动脉血流参数比较

**Tab 2 Hemodynamic parameters of renal arterial blood flow in the side with ureteral calculus and the normal side before and after operation**

| | *n* | MRA | | | | SRA | | |
|---|---|---|---|---|---|---|---|---|
| | | *V*max(cm/s) | *V*min(cm/s) | Co(ml/min) | RI | *V*max(cm/s) | *V*min(cm/s) | RI |
| Before operation | 42 | 56.4±12.6 * | 19.6±6.2 | 364±85 * | 0.71±0.10 | 38.3±7.2 * | 14.5±6.3 | 0.73±0.08 |
| After operation | 42 | 76.5±19.6 | 34.6±3.6 | 489±80 | 0.64±0.05 | 43.2±9.0 | 19.4±5.0 | 0.62±0.04 |
| Contralateral kinley | 36 | 78.5±12.6 | 38.4±6.8 | 509±118 | 0.64±0.07 | 45.0±10.3 | 20.1±6.5 | 0.60±0.07 |

*: $P<0.05$ *vs* after operation and contralateral

表 3 输尿管结石伴肾重度积水术前、后 **15 d**、**1** 月、**3** 月肾脏血流动力学改变

**Tab 3 Hemodynamic parameters of ureteral calculus with severe renal pelvis hydrops before and 15 d, 1 and 3 months after operation**

| | MRA | | | | SRA | | |
|---|---|---|---|---|---|---|---|
| | *V*max(cm/s) | *V*min(cm/s) | Co(ml/min) | RI | *V*max(cm/s) | *V*min(cm/s) | RI |
| Before operation | 50.1±9.2 | 13.6±4.0 | 260±61 | 0.78±0.08 | 29.5±5.8 | 12.8±3.9 | 0.75±0.04 |
| 15 d after operation | 60.2±10.9 | 28.8±4.3 | 390±68 | 0.65±0.05 | 36.1±7.2 | 16.4±4.1 | 0.68±0.05 |
| 1 month after operation | 68.5±10.4 | 34.0±5.2 | 450±85 | 0.68±0.04 | 38.0±6.1 | 18.9±5.2 | 0.64±0.07 |
| 3 month after operation | 72.4±15.6 | 37.8±5.5 | 498±75 | 0.65±0.03 | 43.5±5.8 | 20.1±4.8 | 0.62±0.03 |

## 3 讨论

Ryan 等[1]实验发现梗阻导致灌注下降贯穿于整个积水形成的全过程,肾灌注下降导致肾内动脉阻力指数升高,且与积水程度成正比。肾积水时肾实质被挤压于高压的肾盂与坚强的肾包膜之间,使肾实质受压而萎缩。肾动脉分枝变直,管腔变细或移位,导致肾血管床阻力增高,而 RI 值主要反应外周血管阻力,此值增大说明外周血管阻力增加,减低为外周血管阻力降低。姚启盛等[2]认为 RI 值对预测肾功能可恢复有较好的指导作用,即当 RI 值<0.7 时,肾功能属于正常范畴;0.7<RI<0.8 时,肾功能部分受损,在解除梗阻后,可能完全或部分恢复;RI>0.8 时,肾功能受损较为严重,肾功能不能恢复或恢复概率很少。本组 6 例输尿管结石伴肾盂重度积水 0.7<RI<0.8,手术中见肾脏色泽正常,无坏疽征象,术后 RI 降至正常范围,肾功能恢复正常,故 RI 不仅于术前即可判断患侧肾功能,而且能预测患肾功能恢复的状况。本组 6 只重度肾盂积水在手术后,肾脏功能恢复尚可,表明肾积水时肾脏段间动脉没有完全闭塞、坏死,在解除梗阻后,肾功能有可能恢复。

输尿管结石伴肾盂重度积水时肾内彩色血流显示稀疏或缺乏,主肾动脉血流速度及血流量明显低于对侧正常肾($P<0.05$),是因为积水时肾窦内压力过高,扩张的肾窦使肾皮质受压变薄以至肾内小动脉被牵引受压,影响肾组织血供导致部分或全部肾功能受损。而术后肾动脉峰值流速、血流量及肾内血管床彩色血流信号有明显改善($P<0.05$)。特别是 RI 下降值至正常范围,是因为术后结石摘除,解除梗阻,积水减少,肾窦内压力逐渐减低,肾血管再通血供恢复,肾功能恢复正常。

IVP 与 CDFI 对输尿管结石伴肾积水输尿管切开取石手术前后的评价:IVP 可确定梗阻部位、原因和双肾功能情况。对输尿管结石伴肾积水诊断、治疗及术后随访有重要意义[3]。彩色多普勒超声是将二维彩色血流信号重叠显示于二维切面声像图区域中,因此 CDFI 不仅能观察双肾大小结构、形态、肾积水程度、肾皮质厚度及梗阻部位以上的输尿管扩张程度,还可以观察肾内血流动力学变化情况。以此综合判断输尿管结石伴肾盂积水时患肾病变及肾功能。为临床术前选择治疗方案,预测手术后肾功能恢复情况提供预测信息。

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