Renal Arterial Flow Measurement

Donor: Living Donor Kidney Retrieval
The first measurement is made on the renal artery before the kidney is removed from the donor.

Recipient: Living Donor or Cadaver Kidneys
In primary transplantations, we use the hypogastric artery for the arterial anastomosis. In re-transplantations or in cases where the internal iliac is atherosclerotic the external iliac artery is used. In selected cases, we use a flow measurement to decide which artery to use. For the venous anastomosis, the external iliac is used. No venous flow measurements are made.

After completion of the arterial and venous anastomoses, and immediately after restoration of blood flow to the kidney, but before completion of the ureteronecystostomy, the flow in the renal artery is measured. We use a 4 or 6 mm Flowprobe which is placed, preferably, distal to the anastomosis. The space between the Probe and the vessel is filled with sterile physiological saline. Care is taken to avoid kinking the artery and to place the Probe perpendicular to the longitudinal axis of the vessel. Before the flow is recorded, we allow the flow signal to stabilize for 15-20 seconds. At the end of the operation, after the ureteronecystostomy is completed and before the wound is closed, we make a second measurement.

<table>
<thead>
<tr>
<th></th>
<th>Flow: Cadaver Kidney (mL/mm)</th>
<th>Flow: Living Donor Kidney (mL/mm)</th>
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</thead>
<tbody>
<tr>
<td>Donor</td>
<td>381 ± 150 SD</td>
<td>338 ± 155 SD</td>
</tr>
<tr>
<td>Post flow restoration</td>
<td>283 ± 148 SD</td>
<td>338 ± 155 SD</td>
</tr>
<tr>
<td>At end of operation</td>
<td>422 ± 204 SD</td>
<td>505 ± 177 SD</td>
</tr>
</tbody>
</table>
Intraoperative Blood Flow Measurement

Renal Artery Measurement Protocol

Donor

Cadaver Kidney

No measurements

Living Donor Kidney

Measure renal arterial flow before removing the kidney

Document measurements to serve as guide for expected renal flow in the recipient.

Recipient

Measure renal arterial blood flow following arterial anastomosis

Adequate flow: > 250 mL/min

NO

Check for technical error:
Apply vasodilator & wait several minutes (up to 1 hour)

YES

Remeasure renal flow

NO

Continue attempts to improve flow.

YES

Document flows and save waveforms for the operative record.

NO

Document measurement for operative record:
Assess other clinical parameters (perfusion, urine output)
Consider post-op prophylactic treatment.¹

¹ Lundell A et al, “Impaired Renal Artery Blood Flow at Transplantation Is Correlated to Delayed Onset of Graft Function” Transplant International 1996;9(1)57-61.

Fig. 1: The donor’s renal arterial blood flow prior to excision of the kidney measured 376 mL/min. After anastomosis to the recipient’s renal artery, post-reperfusion renal flow measured 91 mL/min. A second measurement was made after 30 minutes. Renal arterial flow had increased to 290 mL/min.

Fig. 2: The donor’s renal arterial blood flow before traditional removal of the kidney measured 538 mL/min. After anastomosis to the recipient’s renal artery, renal flow post-reperfusion measured 766 mL/min.

Fig. 3: Before a difficult laparoscopic removal of the kidney, the donor’s renal arterial blood flow measured 622 mL/min. After anastomosis to the recipient’s renal artery, renal flow post-reperfusion measured 322 mL/min. One hour later, flow had increased to 442 mL/min.

Fig. 4: Before laparoscopic removal of the kidney, the donor’s renal arterial blood flow measured 91 mL/min. After anastomosis to the recipient’s renal artery, renal flow post-reperfusion measured 290 mL/min.

Waveforms courtesy of Renal Transplantation Unit, Hermann Hospital, Texas Medical Center, Houston, TX.
**Equipment**

HT354 single-channel Optima Flowmeter to acquire precise actual flow measurement quickly and easily.

HT363 dual-channel Optima Flowmeter. permits simultaneous measurements with two Flowprobes. This allows the ability to compare flows simultaneously, or in quick succession, without the need for a second meter.

**References:**


**FLOWPROBE RECOMMENDATIONS**

<table>
<thead>
<tr>
<th>VESSEL</th>
<th>Probe Size (mm)</th>
<th>Handle Probe Series</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renal artery</td>
<td>4, 6</td>
<td>-FMV</td>
</tr>
<tr>
<td>Renal vein</td>
<td>10</td>
<td>-FMV</td>
</tr>
<tr>
<td>External iliac artery</td>
<td>6, 8</td>
<td>-FMV</td>
</tr>
<tr>
<td>Hypogastric a</td>
<td>4, 6</td>
<td>-FMV</td>
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</table>

**References:**


Transonic Systems Inc. is a global manufacturer of innovative biomedical measurement equipment. Founded in 1983, Transonic sells “gold standard” transit-time ultrasound flowmeters and monitors for surgical, hemodialysis, pediatric critical care, perfusion, interventional radiology and research applications. In addition, Transonic provides pressure and pressure volume systems, laser Doppler flowmeters and telemetry systems.

**AMERICAS**
Transonic Systems Inc.
34 Dutch Mill Rd
Ithaca, NY 14850
U.S.A.
Tel: +1 607-257-5300
Fax: +1 607-257-7256
support@transonic.com

**EUROPE**
Transonic Europe B.V.
Business Park Stein 205
6181 MB Elsloo
The Netherlands
Tel: +31 43-407-7200
Fax: +31 43-407-7201
europe@transonic.com

**ASIA/PACIFIC**
Transonic Asia Inc.
6F-3 No 5 Hangsijiang Rd
Dayuan, Taoyuan County
33747 Taiwan, R.O.C.
Tel: +886 3399-5806
Fax: +886 3399-5805
support@transonicasia.com

**JAPAN**
Transonic Japan Inc.
KS Bldg 201, 735-4 Kita-Akitsu
Tokorozawa Saitama
359-0038 Japan
Tel: +81 04-2946-8541
Fax: +81 04-2946-8542
info@transonic.jp