The robot for flexible Ureteroscopy

Advantages and limitations

Prof. Dr. med. Jens Rassweiler
Department of Urology Heilbronn
University of Heidelberg, Germany
Flexible Ureteroscopy
Robotic RIRS - The device 2015

- Avicenna Roboflex:
  - Robot = Manipulator of Renoscope
  - Console = Control unit for surgeon
Flexible Ureteroscopy
Robotic RIRS - Avicenna Roboflex

- Preparation of patient
  - adequate placement of access sheath
Flexible Ureteroscopy
Robotic RIRS - Avicenna Roboflex

• Preparation of patient
  - access sheath is fixed stabilizer
Flexible Ureteroscopy
Robotic RIRS - The device 2015

- Avicenna Roboflex: Manipulator
  - applicable for different scopes
  (ie. Flex XC, Cobra-Digital, URF-V2)
Flexible Ureteroscopy - RIRS
Robotic RIRS - Avicenna Roboflex

- Console with adaptable armrest:
  - Individual position stored for five surgeons
Flexible Ureteroscopy
Robotic RIRS - The device 2015

- Avicenna Roboflex: Manipulator
  - 220° rotation to each side (440° range)
Flexible Ureteroscopy
Robotic RIRS - The device 2015

- Avicenna Roboflex: Console
  - display and graduation of rotation
Flexible Ureteroscopy
Robotic URS - The device 2015

- Avicenna Roboflex: Manipulator
  - 220° rotation to each side (440° range)

➢ To be able to rotate, more than manual,
  - manually 120° rotation
  - robotically 440° rotation (almost 1 ¼ turn)
Flexible Ureteroscopy

Robotic RIRS - Avicenna Roboflex

Console with multiple functions
- display of degree of deflection
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Robotic RIRS - Avicenna Roboflex

New ergonomic wheel for flexion
- Fine-tuning of flexion
Flexible Ureteroscopy
Robotic RIRS - Avicenna Roboflex

Ergonomic wheel for deflection
- Fine-tuning of deflection

➢ To be able more precise deflection

☐ manually 10° deflects the tip 60°
☐ robotically 10° deflects the tip 2,5°

ROBOFLEX IS 24 TIMES MORE PRECISE THAN FURS
Flexible Ureteroscopy
Robotic RIRS - Avicenna Roboflex

Ergonomic console
- Scalation and display of horizontal movements
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Robotic RIRS - Avicenna Roboflex

- Concepts of lihotripsy: Fragmentation and extraction with N-gage
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Robotic RIRS - Avicenna Roboflex

• Ergonomic console: Control of irrigation
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Robotic RIRS - Avicenna Roboflex

- Ergonomic console: Control of irrigant
  - no relevant elevation of intrapelvic pressure
    (40 vs 20 cm H₂O)
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Robotic RIRS - Avicenna Roboflex

- Ergonomic console: Activation of laser fibre by foot pedal: optimal lithotriptor (max 80 Hz)
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Robotic RIRS - Avicenna Roboflex

- Manipulator: Advancement of laser fibre
Flexible Ureteroscopy
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- Ergonomic console: Control of laser fibre
Flexible Ureteroscopy
Robotic RIRS - Avicenna Roboflex

• Concepts of lithotripsy: Dusting using console-controlled movement of laser fibre
Flexible Ureteroscopy
Robotic RIRS - Avicenna Roboflex

- Concepts of lithotripsy: Laser-burst (Pop-corn effect)
Flexible Ureteroscopy
Robotic URS - Avicenna Roboflex

- Long Live-time of flexible scope:
  - Remzi > 100 cases
  - Rassweiler > 50 cases

However: Other factors important
- sterilization unit!
<table>
<thead>
<tr>
<th>Criteria</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients</td>
<td>90 male: 31 female: 59</td>
</tr>
<tr>
<td>Age (ys)</td>
<td>56 (25-76)</td>
</tr>
<tr>
<td>BMI</td>
<td>29.1 (20.6-43.3)</td>
</tr>
<tr>
<td>ASA</td>
<td>2.5</td>
</tr>
<tr>
<td>UTI</td>
<td>13 (14 %)</td>
</tr>
<tr>
<td>Renal units</td>
<td>Right: 40 Left: 50</td>
</tr>
<tr>
<td>Number of stones</td>
<td>2.5 (1-6)</td>
</tr>
<tr>
<td>Stone load (mm²)</td>
<td>1621 (98 – 8512)</td>
</tr>
<tr>
<td>Pre-stented</td>
<td>81 (90 %)</td>
</tr>
</tbody>
</table>

No children
No limit
General anaesthesia required
Adequate antibiotics
Bilateral 5%
No exclusion criteria
Maximal 3cm
Concept of pre-stenting
## Flexible Ureteroscopy

**Robot-assisted URS - Heilbronn Experience**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Comment</th>
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<tbody>
<tr>
<td>Surgeons</td>
<td>All experienced with conventional FURS</td>
</tr>
<tr>
<td>Access sheath</td>
<td>According to concept</td>
</tr>
<tr>
<td>Preparation of robot (min.)</td>
<td>Short learning curve for staff</td>
</tr>
<tr>
<td>Docking time (min.)</td>
<td>Temporary malfunction (n=2)</td>
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<tr>
<td>Visual contact to stone (min.)</td>
<td>Including inspection of collecting system</td>
</tr>
<tr>
<td>Stone migration</td>
<td>-</td>
</tr>
<tr>
<td>Laser disintegration</td>
<td>0.5 J / 20 Hz</td>
</tr>
<tr>
<td>Stone clearance (mm²/min)</td>
<td>Depending on stone composition</td>
</tr>
<tr>
<td>Use of Ngage</td>
<td>-</td>
</tr>
<tr>
<td>Radiation exposure (cGy·cm²)</td>
<td>Mean Fluoroscopic time 2 min. 30 sec</td>
</tr>
<tr>
<td>DJ-stent postop</td>
<td>70% string fixed to catheter (1d)</td>
</tr>
<tr>
<td>Major complications Clavien IIIb</td>
<td>Septicaemia</td>
</tr>
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</table>

- FURS: Flexible Ureteroscopy Retrograde Stone
Robotic Ureterorenoscopy

Limitations of Roboflex

- Costs for the device
- Reduction but not obviating learning curve of FURS / RIRS
  - No tactile feedback (no pre-load of laser-fibre)
- You need optimal equipment for best use of the device:
  - Digital flexible scope
  - High-end Holmium-YAG-lithotriptor
Robotic Ureterorenoscopy

Summary

• The Avicenna Roboflex improves ergonomics by providing more dexterity than human hand
  - fine movements steerable at console
  - sitting position for surgeon with armrest and footpedal(s)

• The Avicenna Roboflex may decrease costs
  - by extension of life-time of flexible scopes
  - reducing number of second sessions

The future of flexible ureterorenoscopy