Renal Clamp

Kelsey Duxstad
Naomi Humpal
Andrew Pierce
Michael Stitgen

Dr. E Jason Abel – UW Hospital
Prof. Paul Thompson– BME Department
Point of Interest

- Client Information
- Background
- Problem Statement
- Competition
- Alternative Designs
- Design Criteria
- Design Matrix
- Final Design
- Future Work
- Conclusions
- Questions
Client Information

- Dr. E Jason Abel
- UW- Madison
  - Urologic Surgeon
  - Specializes in urologic malignancies
  - Focus on kidney cancer

http://www.urology.wisc.edu/system/assets/775/Abel_Jason_ForWeb_2012_profile.jpg?1329471542
Background

- Kidney Cancer
- Nephrectomy
  - Full vs. Partial
  - Open vs. Laparoscopic
- Clamping
  - Vessel
  - Parenchymal

http://images.emedicinehealth.com/images/illustrations/urinary_structures.jpg
Problem Statement

- Selective renal occlusive clamp
  - Prevents global ischemia
- Robotic and laparoscopic
- Partial nephrectomy surgery

Competition

- Traditional open surgery clamps\(^4\)
- Simon Renal Pole Clamp\(^6\)
- Laparoscopic vascular clamps\(^5\)
Alternative Design: Modified Bulldog Clamp

- Spring clamping mechanism
- Modifications
  - Length
  - Spring
  - Curvature
Alternative Design: Crisscross Design

- Clamping Mechanism
  - Johns Hopkins
- Removable Sliding Tubing

http://pillinginstruments.com/images/products/hires/SR_353002.jpg
Alternative Design: Zip-Tie Design

- Wire ribbon
- Locking mechanism
- Quick release
Alternative Design: Loop Design

- Wire ribbon
- Adjustable
- Independent actuators
Design Criteria

- Safety
- Ease of placement
- Force distribution
- Maintenance
- Cost
- Manufacturability
- Client Preference
# Design Matrix

<table>
<thead>
<tr>
<th></th>
<th>Weight</th>
<th>Modified Bulldog</th>
<th>Loop</th>
<th>Zip-tie</th>
<th>Crisscross</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety</td>
<td>.20</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Ease of placement</td>
<td>.15</td>
<td>3</td>
<td>4</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Force distribution</td>
<td>.30</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Cost</td>
<td>.05</td>
<td>2</td>
<td>4</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Maintenance</td>
<td>.10</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Manufacturability</td>
<td>.10</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Client Preference</td>
<td>.10</td>
<td>2</td>
<td>5</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Total:</td>
<td>1.00</td>
<td>2.85</td>
<td>3.8</td>
<td>2.8</td>
<td>2.5</td>
</tr>
</tbody>
</table>
Final Design

- Loop Design
Future Work

• Find materials
• Build an accurate prototype
• Test on animal model
• Iterative design
Conclusions

- Benefits of laparoscopic, partial nephrectomy
- Loop design
- Functional end this semester
- Laparoscopic next semester
Acknowledgements

- Dr. Abel- UW Hospital
- Paul Thompson– BME Department
- Prof. Vanderby- BME Department
- Prof. Thelen- BME Department
References

Questions