An intraoperative photograph showing a hand-assisted laparoscopic radical nephrectomy specimen retrieval bag. The bag is a large, clear, plastic structure with a dark, rounded opening at the bottom, used for containing the removed kidney specimen. It is positioned within the abdominal cavity, surrounded by various anatomical structures, including the liver and surrounding vessels. The background shows the reddish, moist tissue of the abdominal cavity.

Hand-assisted Laparoscopic Radical Nephrectomy Specimen Retrieval Bag

Josh Kolz, Sarah Sandock, Claire Wardrop,
Kevin Beene, Vivian Chen

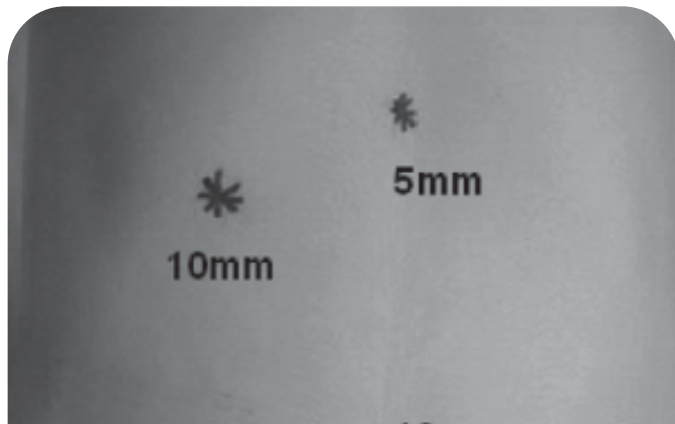
Image taken from client's procedure

Outline

- Background
 - Procedure
 - Competition
 - Motivation
- Designs
 - Design criteria
 - Materials & sterilization
 - Bag form
 - Bag closure
- Matrix
- Final designs
 - Finger port
 - Accordion
- Future work

Procedure

- Incisions
- Abdominal cavity
- Tools

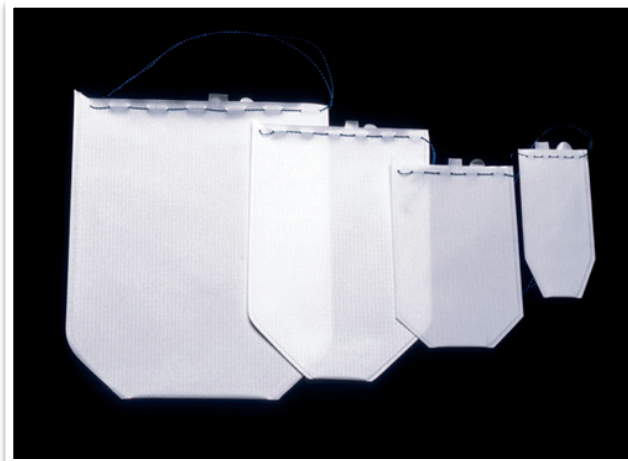


Putting kidney in current bag (image from client's procedure)
Incisions made for procedure (image from client's procedure)
Graspers (image from Sarah Sandcock)

Closing the bag using drawstring (image from client's procedure)
Removing bag and kidney from abdomen (image from client's procedure)

Competition

- Specimen retrieval bags exist
- No standard form or criteria
- No consensus among physicians
- Home-made bags



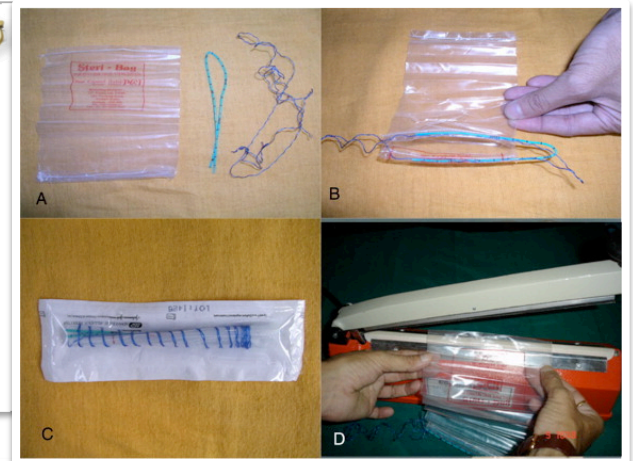
LapSac

(www.cookmedical.com/uro/content/lg_thumbnail/uro_lapsac.jpg)



Endocatch

(www.hc21.ie/images/clip_image001_049.jpg)



Homemade Nadiad Bag

(Ganpule et. al., 2010)

Motivation

- Easy to use
- Decrease total operative time



Above: Normal kidney size

Right: Typical kidney removed

These images have been scaled to show actual size comparison



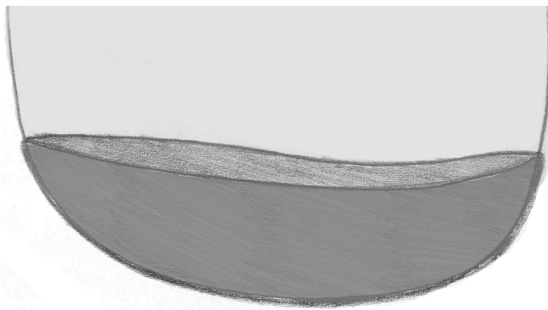
Image taken from client's procedure

Design Criteria

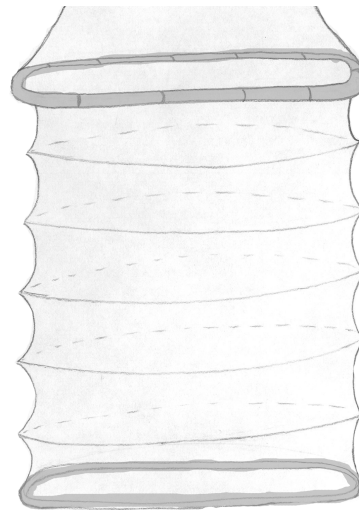
- Biologically inert
- Easy grip & insertion/extraction
- One time use/disposable
- Minimize damage to abdominal cavity
- Minimize risk of metastasis
- One hand and graspers

Bag Form

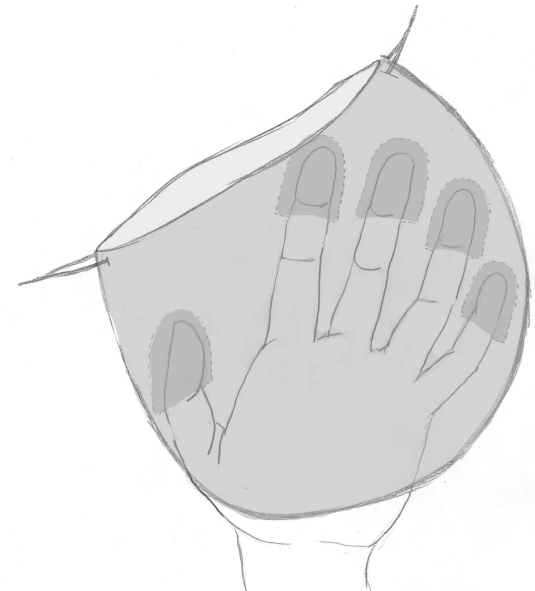
Firm Bottom



Accordion

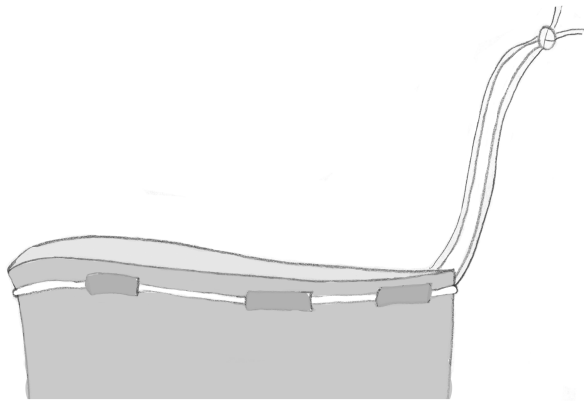


Finger Ports

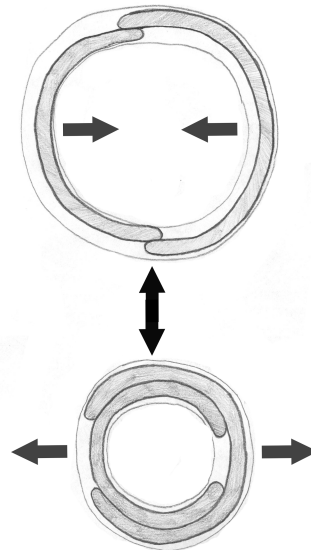


Bag Closure

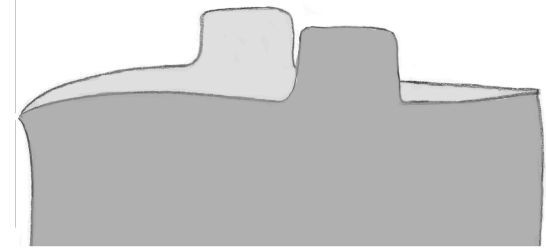
Drawstring



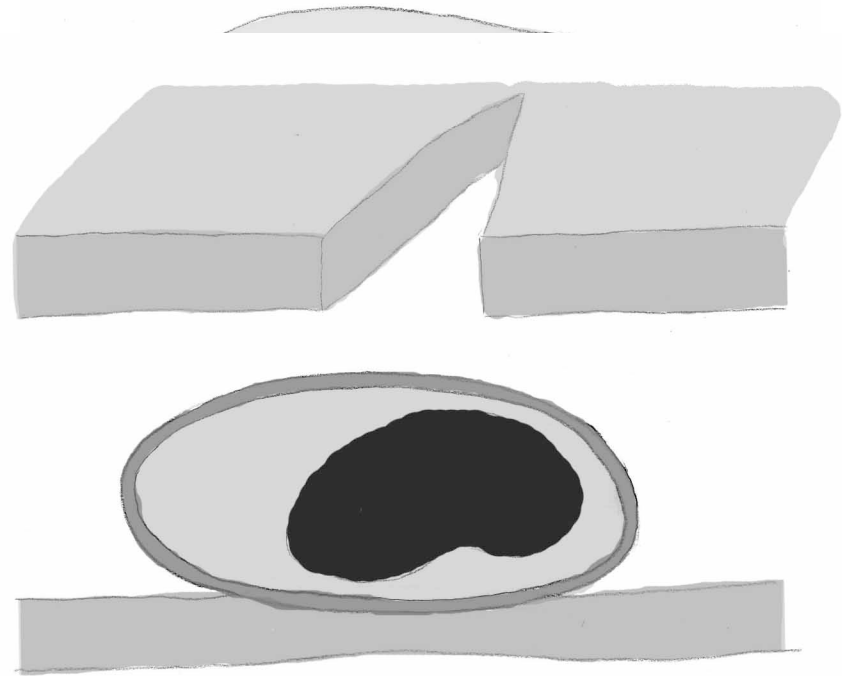
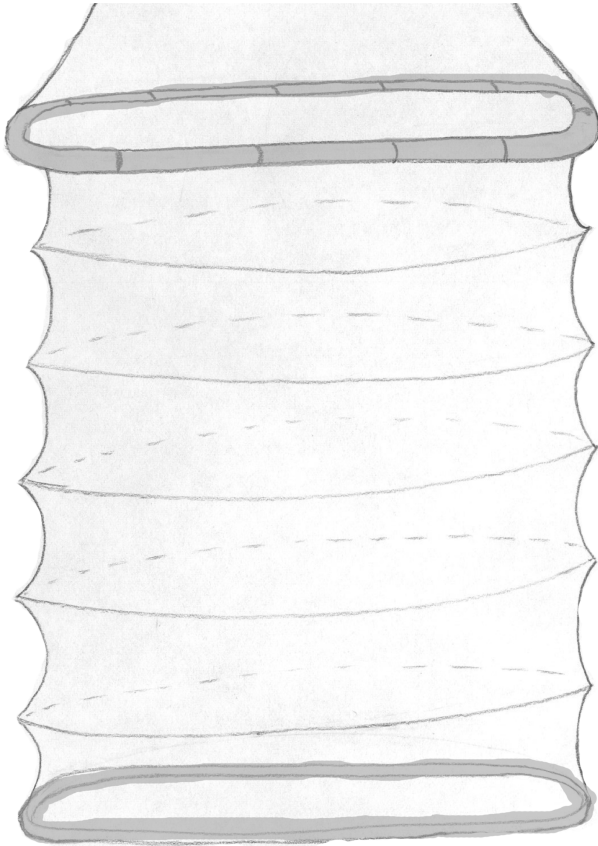
Telescope



Tabs



Protecting the Abdomen



Within abdominal cavity

Materials & Sterilization

Materials

- Wide range
- Low density polyethylene
- Nylon string
- Silicone gel rings
- Metal/plastic telescope

Sterilization

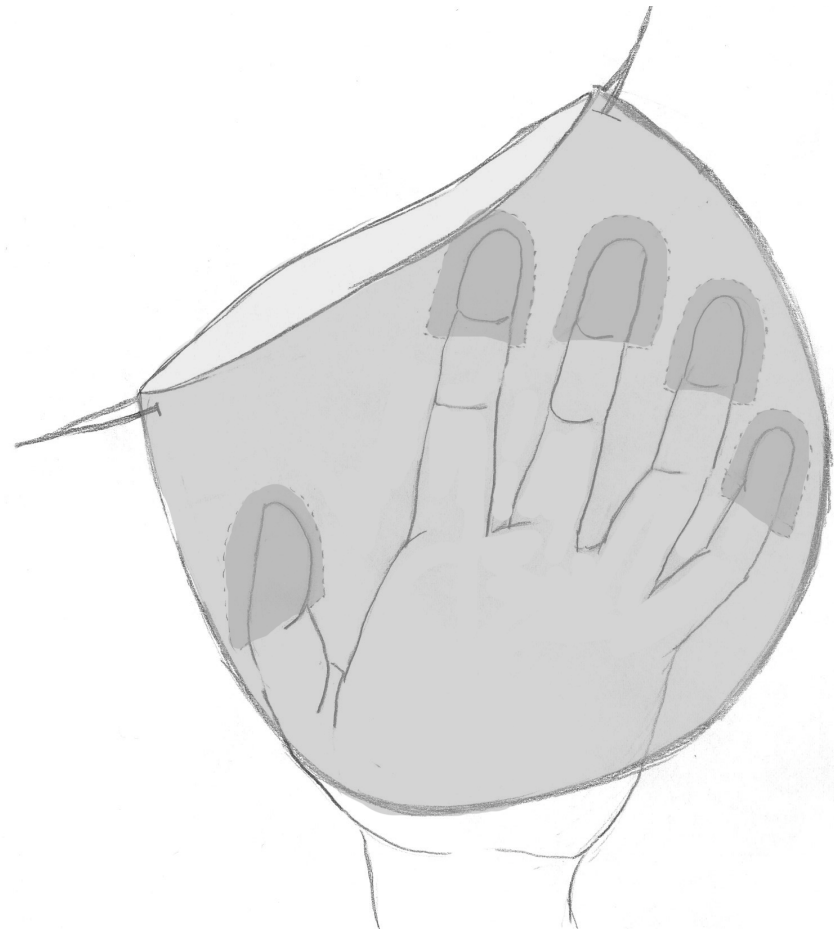
- Sterile manufacturing environment
- Removed from packaging in operating room
- Gamma radiation

Design Matrix

Protection	Sub	Options	Client Preference (40)	Practicality (40)	Ease of Construction (20)	Total (100)
Kidney	Form	Accordion	23	37	10	70
		Finger Ports	35	20	15	70
		Rigid Bottom	25	25	10	60
	Lid	Drawstring	30	20	15	65
		Telescoping	35	20	10	65
		Tabs	20	35	10	65
Abdomen	Cylinder		20	10	10	50

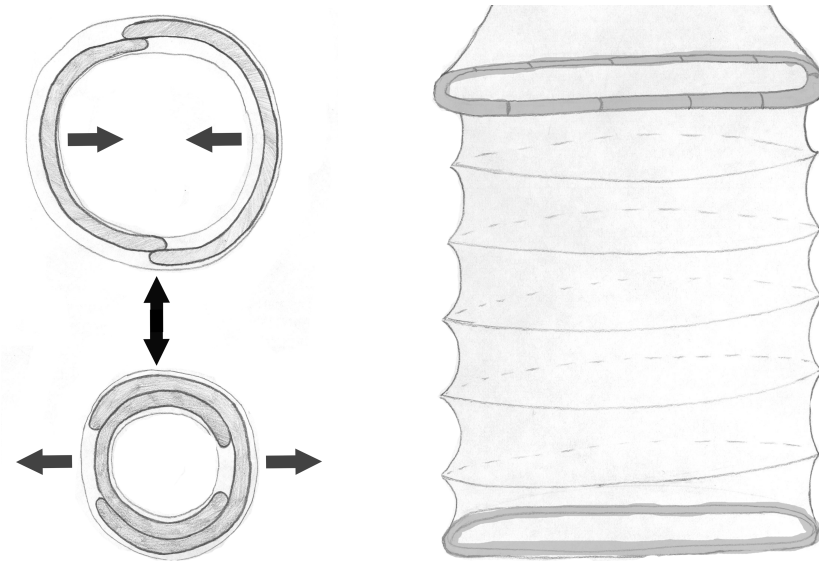
Final #1: Finger Port

- Six finger ports
 - 2 thumb, 4 finger
- Polyethylene
- Drawstring
- Use of graspers to help enclose kidney
- Will it work?



Final #2: Accordion with Telescoping lid

- Accordion-style
- Flexible ring at bottom
- Telescoping ring around rim
- Drawstring?



Future Work

- Finger port design
 - Tabletop poly bag sealer
 - Construct inside out
- Accordion with telescoping ring
 - Moldable polyethylene sewn/sealed into rings
- Testing
 - Create environment
 - Simulate procedure

References

- Plastic properties of low density polyethylene (ldpe). (n.d.). Retrieved from http://www.dynalabcorp.com/technical_info_ld_polyethylene.asp
- Crowninshield, Roy D., and Orhun K. Muratoglu. "How have new sterilization techniques and new forms of polyethylene influenced wear in total joint replacement?." *Journal of the American Academy of Orthopaedic Surgeons*. 16. (2008): S80-85. Web. 10 Oct 2010. <http://www.jaaos.org/cgi/content/abstract/16/suppl_1/S80>.
- Sharma, Abhaya. "Radiation Sterilization of Healthcare Products at ISOMED." *National Association for Applications of Radioisotopes & Radiation in Industry*. N.p., 01 Jan 2007. Web. 10 Oct 2010. www.naarri.com/presentations/abhaya_final.pdf.
- <http://www.mdconsult.com/das/article/body/221884599-2/jorg=journal&source=&sp=23290993&sid=0/N/746654/lf08016907001.fig?issn=0090-4295>
- http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1807-59322007000300026#fig01
- Pictures from the procedure were provided by our client, Sutchin
- Designs drawn by Sarah and Kevin, edited in photoshop