

# **AUTOMATED URETERO-INTESTINAL ANASTAMOSIS WITH ABSORBABLE STAPLES**

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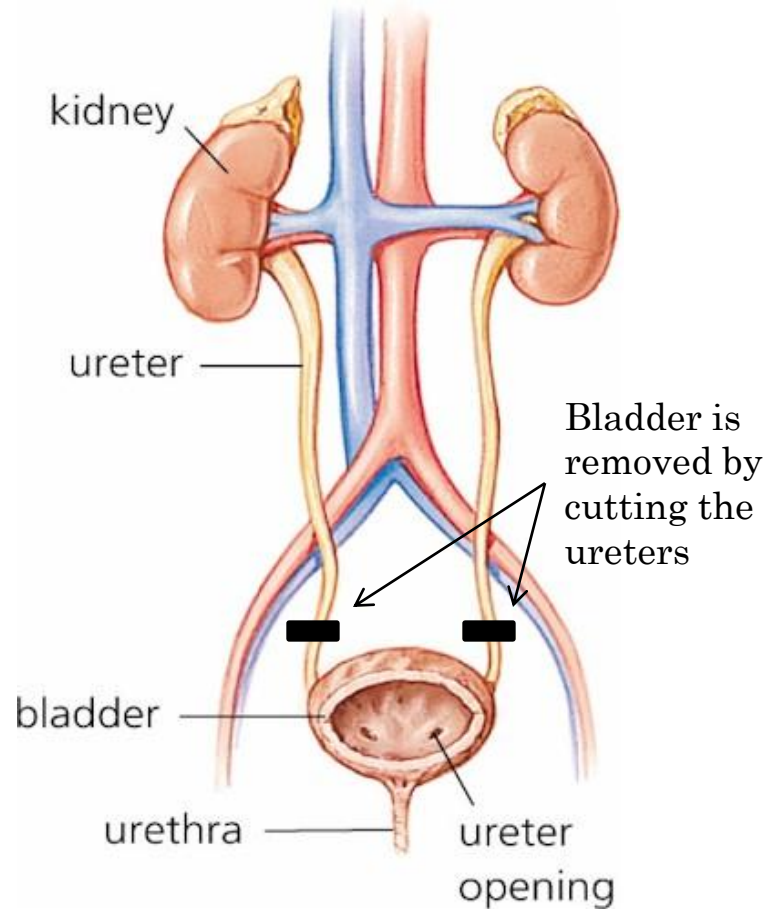
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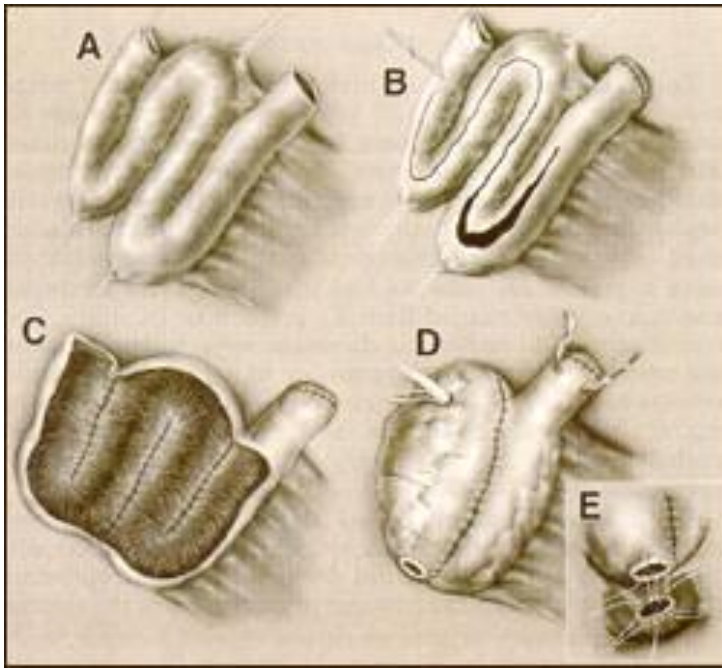


# BLADDER CANCER

- 5th most common cancer in US
- 70,530 new cases and 14,680 deaths in 2010
- Radical cystectomy
  - Required when muscle layer is invaded
- Urine storage
  - Urostomy bag or neobladder



# CURRENT TREATMENT: BLADDER CANCER



<http://www.ucurology.urologydomain.com/images/uploaded/whu/ileal1.gif>

- Bladder removed
- Neobladder formed from small bowel
- Two ureters attached via suture



# PROBLEM STATEMENT

- Ureters connected to new bladder tissue via suture
- Lengthy procedure time
- Metal staples = stones
- Goals
  - Semester 1: Small Stapler
  - Semester 2: Absorbable Staples

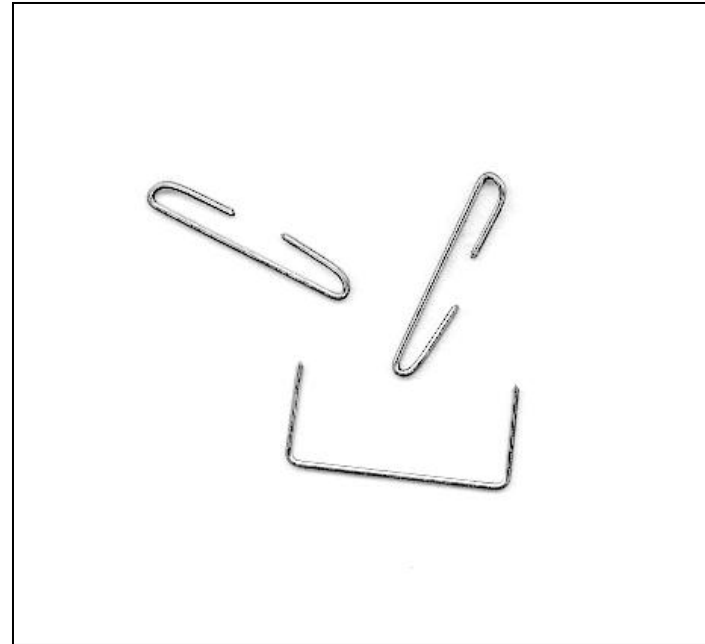


[http://www.swicofil.com/images/suture\\_needle.jpg](http://www.swicofil.com/images/suture_needle.jpg)



# DESIGN REQUIREMENTS

- Open surgery
- Sterile
- 1.5 cm diameter
- Operate with single motion
- Must create a water tight seal
- Mitigate tissue damage



<http://bostinnovation.com/wp-content/uploads/2010/06/staple-icon.jpg>



# DESIGN 1: MINIATURIZE ETHICON

- Current tool used for bowel surgery
- Connects two tubes of similar diameter
- Compresses tissues and ejects metal staples
- Easy to operate
- Adjustable head, current diameter of 3.3 cm
- Not well matched to ureter procedure

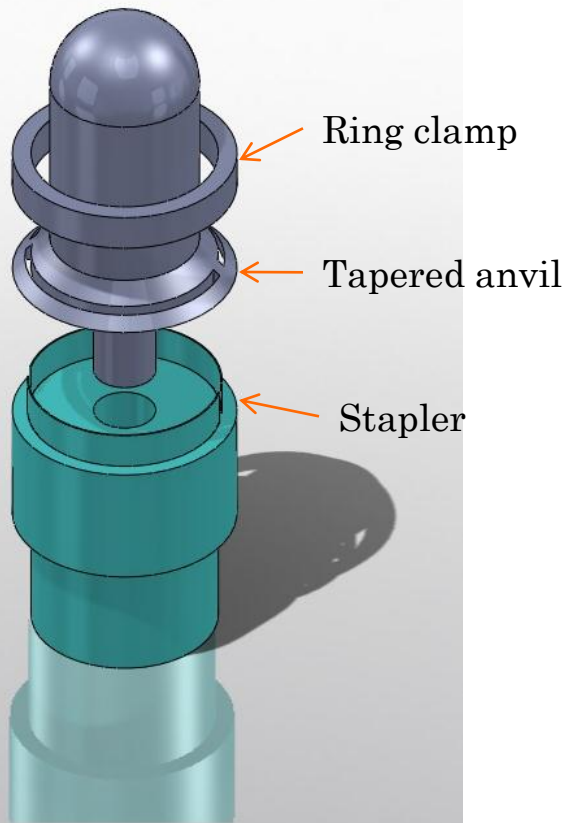


<http://qjmed.win.mofcom.gov.cn/www/18%5Cqjmed%5Cimg%5C20081223151619.jpg>

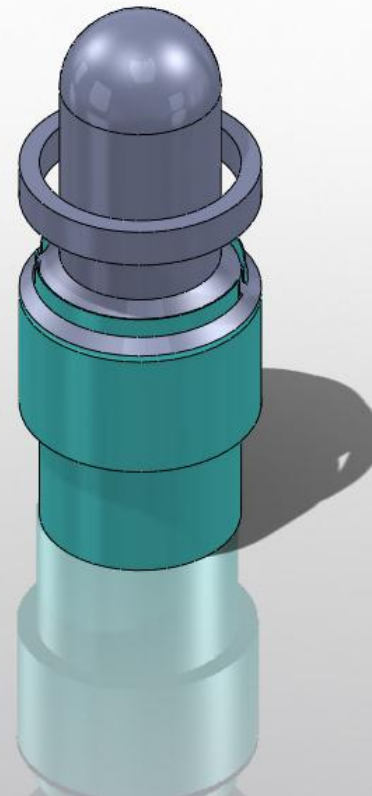


# DESIGNS 2 AND 3

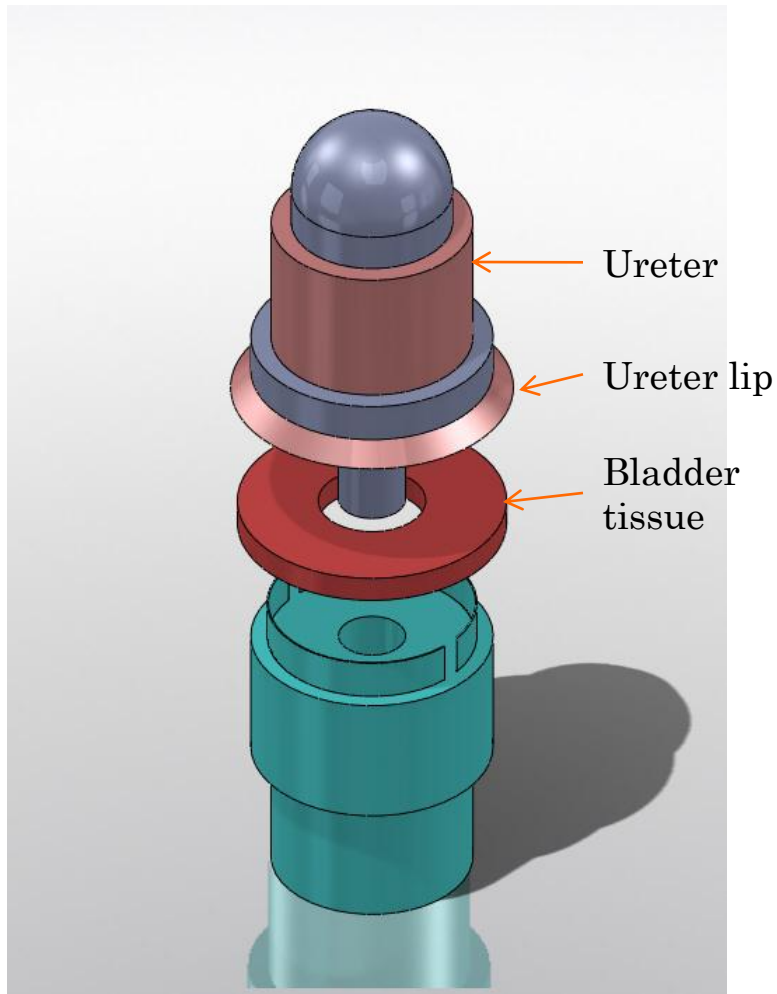
Apart



Together



## DESIGN 2: URETER LIP ABOVE BLADDER



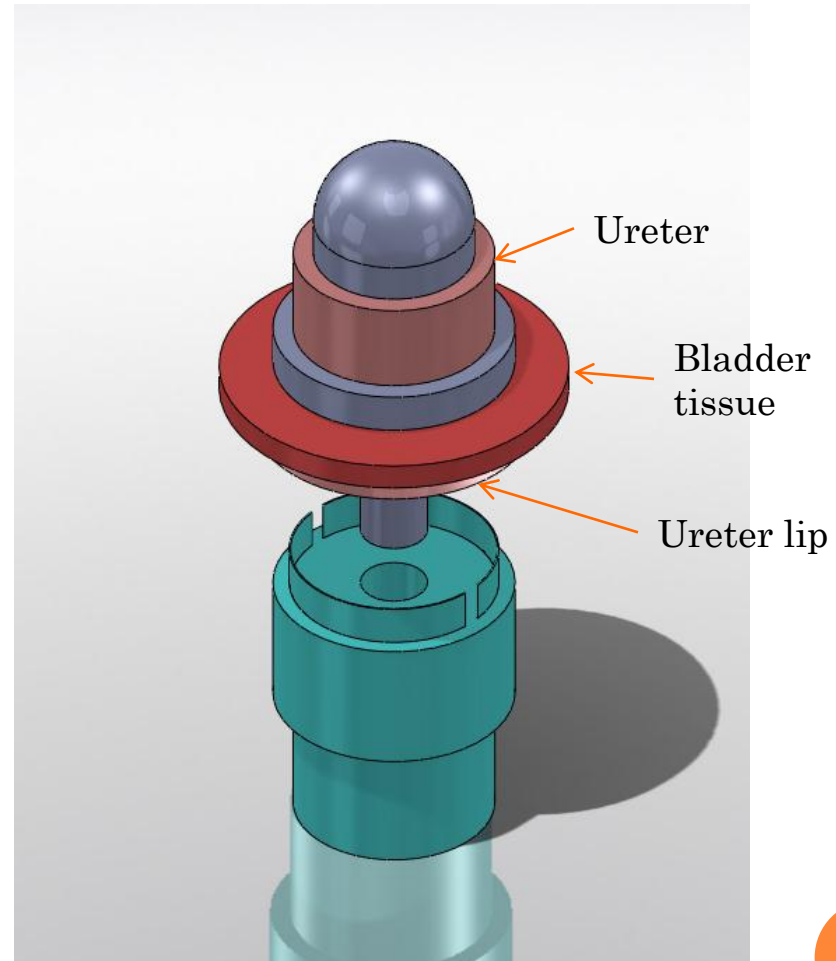
- Ring clamped to secure ureter
- Outside lumen of bladder
- Pressure from inside bladder
- Difficult to clamp
- Tissue compression difficult to monitor





## DESIGN 3: URETER LIP BELOW BLADDER

- Ureter inverted through bladder
- Easy to clamp/secure
- Slightly more tissue damage



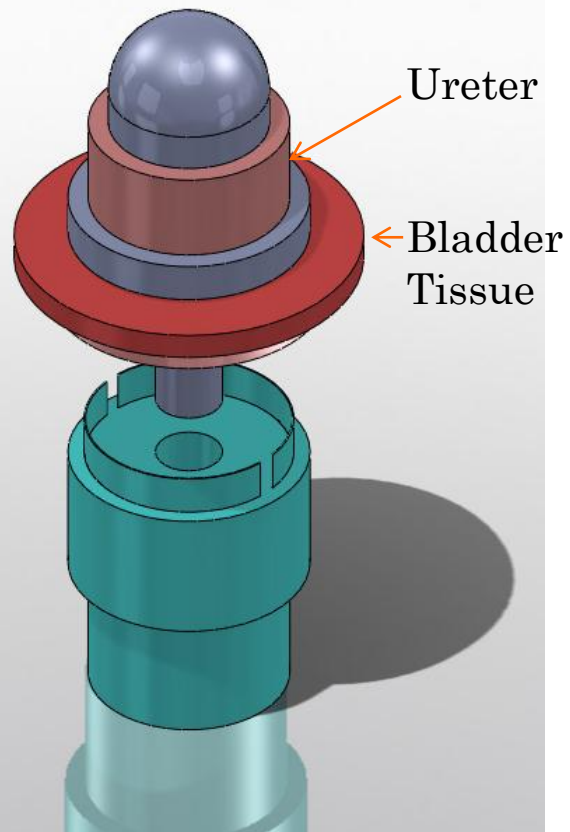
# DESIGN MATRIX

| Design   | Security/<br>Clampability<br><b>(20)</b> | Ease of<br>Construction<br><b>(20)</b> | Aesthetics<br><b>(10)</b> | Ease of Use<br><b>(30)</b> | Limited tissue<br>damage<br><b>(20)</b> | Total |
|--|--|--|---------------------------|----------------------------|---|-------|
| Ring clamp –<br>ureter <u>above</u><br>bladder | 15                                       | 18                                     | 7                         | 22                         | 18                                      | 80    |
| Ring clamp –<br>ureter <u>below</u><br>bladder | 18                                       | 18                                     | 7                         | 25                         | 16                                      | 84    |

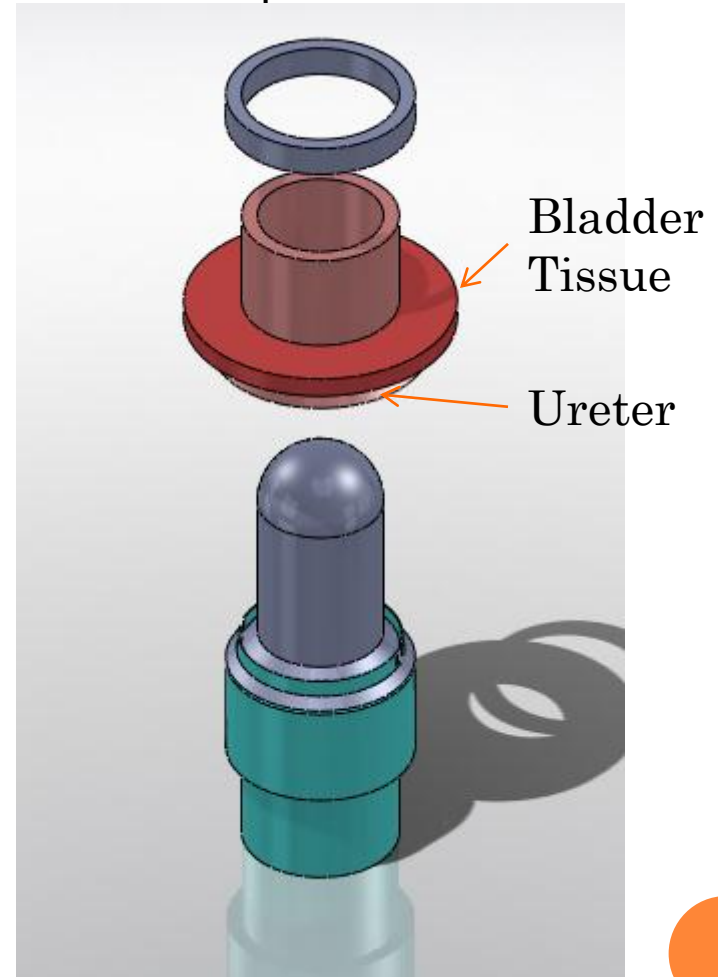


# FINAL DESIGN

Before staples are fired



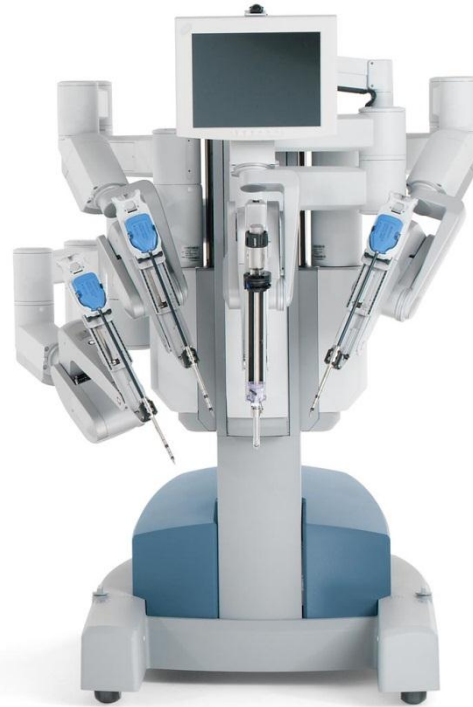
After staples are fired



# FUTURE WORK

- Semester 1: Stapler
  - 3 differently sized ring clamps for ureter variation
- Long Term:  
Integration into radial cystectomy procedure, minimally invasive surgery

- Semester 2:  
Absorbable Staples
  - IRB testing



# REFERENCES AND ACKNOWLEDGEMENTS

- Dr. Tracy Downs, Department of Urology
- Dr. Wan-Ju Li, Department of Orthopedics



QUESTIONS?

