Gallbladder Removal Device for Laparoscopic Surgery

Alex Bryant, Ashley Smith, Stephen Wallace
Department of Bioengineering, Rice University
Team Lith-X: teamlithx@gmail.com

Improving Gallbladder Removal

Team Lith-X’s goal was to advance the quality of care for gallbladder removal patients.

- Standard laparoscopic removal uses at least one 10mm port
- Incisions often must be extended in cases with larger gallstones
- Results in undue pain and longer recovery time
- No specialized tools exist to crush gallstones

Reducing incision size from 10mm to 5mm is proven to reduce pain and recovery time.

The Next Step

How can surgeons remove a stone-filled gallbladder through a 5mm port?

An effective solution would be highly marketable and would significantly improve quality of care:
- Gallstones cause extreme pain and block bile ducts
- 700,000+ gallbladders removed annually
- Total cost over $5 billion per year

Design Objectives

- Effective gallbladder removal with a small incision to decrease postoperative pain
- Increased safety and decreased risk of hernia
- Faster patient recovery due to smaller incision
- Quicker removal procedure than current techniques

Device Operation

- Basket Size: 40 x 120mm
- Shaft Length: 300mm

1. Deployment - Insert device through 5mm port; hold release trigger and push plunger to deploy basket

2. Capture - Position freed gallbladder inside basket; surround basket with a surgical tissue extraction bag

3. Crushing - Repeatedly squeeze grips to fully retract basket and slice through gallbladder and stones

4. Removal - Use standard aspiration techniques to remove fragments; pull out device and tissue bag through port

Validation with a Simulated Gallbladder

Setup
- TUMS substituted for gallstones based on mechanical testing
- Chicken skin substituted for gallbladder based on thickness and elasticity
- TUMS sutured in skin pouch to simulate whole gallbladder with stones
- Basket retracted to crush sample; pieces crushed repeatedly to target size

Key Results
- Manual force sufficient to effectively crush both stones and tissue
- Shaft becomes difficult to redeploy due to tissue debris trapped in shaft
- Wires, joints, mechanism strong enough for single use without failure

Conclusions

- Team Lith-X has developed a unique device for removing gallbladder and stones through a 5mm port while meeting all design objectives.
- Reduced incision size should improve safety over current laparoscopic techniques
- Quicker procedure benefits both patients and surgeons

Acknowledgements and References

Team Lith-X wishes to thank Dr. Brian Dunkin, Dr. Erik Wilson, Dr. Brad Snyder, Dr. Stephanie Kreml, Dr. Maria Oden, Janet Wheeler, Carlos Amaro, Joseph Gesenhues, and the Brown School of Engineering.

NH Afthah, Gallbladder and Biliary Tract Diseases. (Marcel Dekker, New York, 2000)