INGUINAL HERNIA MODEL

Carmen Coddington, Bryan Jepson, Laura Platner, Taylor Powers
Advisor: Thomas Yen, PhD
Client: Jon Gould, MD

Abstract

An inguinal hernia is a protrusion of bowel in the abdominal cavity through the inguinal canal. This condition is very common and its repair is frequent. However, the procedure remains difficult to learn. We will create an inguinal hernia model that allows for the practice of open and laparoscopic surgery as well as teaching medical students and residents the anatomy. Our team considered different materials and ways to assemble the model, as well as client input, while developing a way to accomplish this goal. We evaluated the options giving us the most feasible and realistic design. Successful fabrication of the design will increase the accuracy and improve the learning process of medical students when performing open or laparoscopic surgery on patients.

Motivation

- 600,000 hernia repairs occur each year [4]
  - About one third of those are inguinal hernias
- One of he most frequently performed surgical operations
- Chance of having a hernia in lifetime [4]
  - Males 27%
  - Females 3%
- Learning curve to master surgery is 250
- Three types
  - Indirect: lifting, straining, coughing, obesity, pregnancy, or constipation
  - Direct: may occur at birth or later in life
  - Femoral: rarer than the other types and mainly affects women [5]

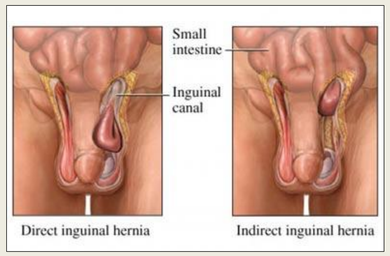


Figure 1: Example of direct and indirect inguinal hernias. [6]

Goal: To create an inguinal hernia model that allows for the practice of open and laparoscopic surgery as well as teaching medical students and residents the anatomy

References

[1] ¨Simulab Corporation. (2010). *Hernia Model*. Retrieved February 28, 2010, from Simulab Corporation: Products: http://www.simulab.com/product/surgery/open/hernia-model
[2] ¨Goldfarb. (1999). *Patent No. 5,908,302.* United States of America.
[3] ¨3B Scientific. (2002). Inguinal Hernia Model. *User Manual*.
[4] ¨Rhodes, Monica. (2009, April 29). *Inguinal hernia.* Retrieved January 24,2010, from http://www.webmd.com/hw-popup/inguinal-hernia
[5] http://www.netdoctor.co.uk/diseases/facts/groinhernia.htm
[6] http://drzeze.files.wordpress.com/2008/05/hernia2.jpg
[7] http://www.enasco.com/prod/images/products/36/AC064423l.jpg

Final Design

Silicone
- Silicone coloring
- Plaster molds for shaping
- Added incrementally

Component Attachment
- Vessel ends wrapped in fabric
- Screws secure fabric to base
- Fabric strengthens screw attachment
- Neodymium magnets or Velcro for convenient reattachment

Figure 2: Side view of muscle layers

Cost Analysis

Item	Price
Model of Pelvis	$56.38
Silicone	$55.00
Screws/ Bolt	$1.59
Coloring Dye	$2.00
Nylon	$1.76
Aluminum Support Bar	$0.90
Magnets	$14.00
Fabric	$2.00
Velcro	$0.72
Polyurethane Foam	$10.00
Total Cost	$144.35

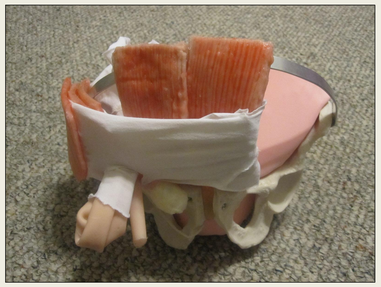


Figure 3: Front view of inguinal hernia model.

Figure 4: Pelvic skeleton base [7]

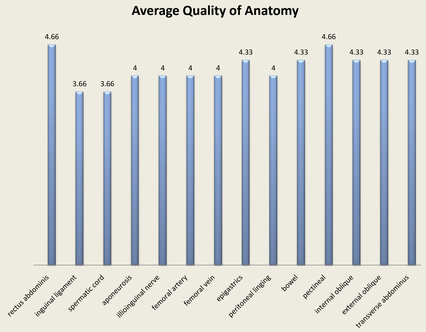
Anatomical Features
- Illioinguinal ligament
- Illioinguinal nerve
- Epigastrics
- Hernia sac
- Pectineal ligament

Other Components
- Aluminum support bar
- Nylon transversalis fascia
- Space-filling polyurethane foam
- Peritoneum fabric covering

Testing

Evaluation
- Three doctors filled out an evaluation to rate the models effectiveness
- Scale from 1(bad) to 5(good)

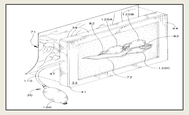
	Will this model improve the learning curve?	Will this model help in learning the anatomy?	How accurate is the model?
Dr. Gould	4	4	4
Dr. Barker	4	4	4
Prof. Bersu	5	5	4
Average	4.33	4.33	5



Competition

Simulab Inguinal Hernia Model [1]
- Stiff with unrealistic texture
- Does not simulate important aspects of procedure

Inguinal hernia model [2]
- Patent number 5908302
- Informs patients about hernias and surgical operation
- Lacks structural landmarks and anatomical features



American 3B Scientific Inguinal Hernia Model [3]
- One solid piece of plastic
- Unrealistic texture and appearance

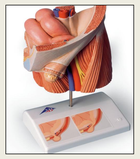


Figure 6: From top to bottom: Simulab, [1] Patent Model,[2] American 3B. [3]

Design Criteria

- Realistic appearance and texture
- Correct anatomy with important anatomical landmarks
- Maintained easily
- Laparoscopic surgery simulation
- No detrimental health effects
- Flexible budget of $500

Future Work

More Realistic Appearance
- Moist texture
- Duller colors for vessels and muscles
- Removable skin

Mechanism for Protrusion and Retraction of Bowel
- Reduce resistance of relocating bowel
- Manual bowel retraction

Material Changes
- Stronger attachment points
- Less tacky material
- Stainless steel support bar for strength

Further Testing
- Implement in educational setting
- Analyze test scores and learning curve

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