

Barostat To Measure Esophageal Strictures

Team members: Kevin Wright, Steve Trier, Julie Sauer, Hannah Kirking

Clients: Dr. Mark Reichelderfer, UW Hospital

Date: 4/2/02-4/9/02

Problem Statement:

The reflux of stomach acid into the esophagus is one of the most common GI ailments. One consequence of such reflux is the formation of scar tissue which forms abnormally stiff regions of esophageal tissue, sometimes leading to obstructive swallowing disorders. There are very few methods for either diagnosing or treating this disorder. There are two different measures which would be useful from a clinical point of view:

- a. a device to measure the size of the stricture i.e., the percent reduction in radius of the stricture
- b. a device to measure the compliance of the tissue i.e., the stress-strain behavior

Restatement of Team Goals:

1. Meet with Dr. Reichelderfer-get his reaction to presentation and any other ideas he may have.
2. Look into transducers/sensors to use.
3. Work out more details on design-i.e. interfacing, testing to get curves for comparison, etc.

Summary of Accomplishments:

Main Accomplishments:

1. Communication with Dr. Reichelderfer-planning on meeting either tomorrow or early next week (he is out of town after tomorrow).
2. Trying to set up a meeting with Mark Nicosia-Kevin talked to him about coming in and seeing his lab and also discussing any ways that it would be helpful to us working on this project.
3. Steve has had correspondence with FISCO about their fiber optic pressure sensor. There is a possibility that they would send us one to look at and evaluate for the use in this project.
4. Continuation of research into other transducers.

Statement of Team Goals:

1. Meet with Dr. Reichelderfer-this is of topmost priority because we can't do a whole lot without talking with him first and seeing what his wishes are. Then we will be better able to plan our device and also make some kind of plan for the remainder of the semester.
2. Meet with Mark Nicosia again to see his lab and discuss any possible tests we might be interested in doing.
3. Hopefully, after talking with Dr. R, move forward on our proposed design.

Project Schedule:

Week	Date	Lecture Topic	Activities
1	25 Jan.	Introduction and course expectation	Formed groups, select project, contacted client.
2	1 Feb.	overview of the design process	Literature searched; met with client, watched endoscopic procedure
3	8 Feb.	Outline of PDS	Developed PDS
4	15 Feb.	Discussed brainstorming, did activity	Reviewed lit. and brainstorm direction
5	22 Feb.		Discussed where to go from here
6	1 Mar.		Brainstormed and discussed ideas, Met with Mark Nicosia to gain more knowledge on compliance
7	8 Mar.	Discussed presentation and paper requirements	Continued brainstorming- then concentrated on narrowing down to the best ideas
8	15 Mar.	Gave mid-semester Presentations -handed in notebooks	Listened to presentations
9	22 Mar.	Went over improvements that could be made on paper and presentation	Got evaluation back from paper and presentation-discussed results and where to go from here
10	29 Mar.		Spring Break
11	5 Apr.	Discussed possible transducers - Steve's correspondence with FISCO	Work on design

12	12 Apr.		Work on design
13	19 Apr.		Work on design
14	26 Apr.		Work on design
15	3 May		Prepare poster
16	10 May		Hand in final report and notebook to advisor
17	17 May		final meetings with advisors

Difficulties: trying to set up a meeting-schedules are all too busy and conflicting!

Activities:

1. Steve-BSAC meeting tonight (approx. 1 hour)
2. Class meeting (approx. 1 hour each)
3. Communication time (approx. 2 hours)

Total: Previous: approx. 117 hrs.

New: approx. 124 hrs.

Appendix 1

Product Design Specification

Barostat To Measure Esophageal Strictures

Team: Julie Sauer, Hannah Kirking, Kevin Wright, Steve Trier

Date: 3/5/02

Function: A device to measure the size of the stricture (the percent reduction in radius of the stricture) and the compliance of the tissue (the stress-strain behavior).

Client requirements:

- Allow for easy and quick of interpretation of information of device

Design requirements:

Physical and Operational Characteristics

- Performance requirements:* If cost and time effective, device would be used in every procedure. Must measure size of stricture and compliance of tissue during the procedure.
- Safety:* Can't be toxic in body. Needs to be small enough to fit down esophagus and be of a flexible material as not to puncture esophageal walls. Must not have parts that may fall off into esophagus.
- Accuracy and Reliability:* Must measure within 1mm of actual size. Must be able to measure the size of a structure between 2mm to 25 mm.
- Life in Service:* Dependent upon cost
- Shelf Life:* 2-3 years?
- Operating Environment:* Inside esophagus-approx 37 degrees C, wet, acidic environment.
- Ergonomics:* Easy to learn and use, not complicated.
- Size:* Needs to fit through opening in camera tube and down the esophagus of patient. As small as possible is best in order to allow for maximum comfort of patient.
- Weight:* Dependent upon design-must not be so heavy as to put unneeded pressure on esophageal walls.

- j. *Materials*: Non-toxic materials, safe to use in body. Flexible material, can alter size, volume (like balloon). Blunt as not to puncture balloon or esophagus.
- k. *Aesthetics, Appearance, and Finish*: Smooth edges. It will be similar to other instruments currently used in the esophagus (such as balloons or guidewires).

Production Characteristics

- a. *Quantity*: Depends on disposability, how well it works, expense.
- b. *Target Product Cost*: ?

Miscellaneous

- a. *Standards and Specifications*:
- b. *Customer/Patient-related concerns*: : Reasonable cost, small as possible
- c. *Competition*: none known

Appendix 2

	Description of Device/Idea	Benefits	Questions Involved, Possible Challenges
1	FOR SIZE-Use some kind of foam that would be squirted into the esophagus through a tube inserted in a way similar to the balloon. The foam would “harden” (or at least become more firm) in the form of the stricture.	<ul style="list-style-type: none"> -Creates a representative model of the stricture -Easy to measure size -Inexpensive-dependent upon material type 	<ul style="list-style-type: none"> -Research needs to be done on finding a foam type that may work. -Material must harden but still remain flexible -How will device pass through the “corner” at the meeting of the esophagus and mouth? -Must also involve camera to know when to squirt foam in (When is device actually in stricture?)
2	FOR SIZE-Modified balloon-use the same balloon procedure that is used to stretch stricture but make balloon out of a plastic material that will stretch out but not recoil to original size or shape. Then, when the balloon is deflated and removed, it will hold the form of the stricture to be reinflated for viewing by doctor.	<ul style="list-style-type: none"> -Easy procedure -Little modification needed for entrance of device (same technique as current balloon would be used) -Removal wouldn’t be a problem because “model” would be deflated upon removal from esophagus 	<ul style="list-style-type: none"> -Availability of a plastic material of this description -When reinflated for viewing, balloon must not be overinflated or model will be ruined
3	FOR SIZE-Couple barium swallow and X-ray to manually see size of stricture	<ul style="list-style-type: none"> -Technology already exists -Equipment would already be available to most doctors 	<ul style="list-style-type: none"> -Most patients not wanting to swallow barium -Expensive -Somewhat tedious for doctor
4	FOR SIZE-Use some type of sonar device that when placed in the center of the stricture, it would be able to return the size of the opening	<ul style="list-style-type: none"> -Very accurate -Could be automated to give readout almost immediately 	<ul style="list-style-type: none"> -Very expensive -Would require good understanding of sonar abilities -Challenge of making the device small enough and getting it into the esophagus
5	FOR COMPLIANCE-Modify the current syringe used to inflate balloon to give us a pressure readout that would indirectly represent tissue compliance	<ul style="list-style-type: none"> -Design of actual device would be fairly easy (not counting interfacing) -Would require a modification to the equipment currently used 	<ul style="list-style-type: none"> -Would require some kind of interfacing system-could be very challenging -Requires research on the varying pressures and how they relate to compliance (Which pressure values correspond to which compliance?)
6	FOR COMPLIANCE-Design device using fiberoptic pressure sensor by FISCO (possibly place the sensor inside of current balloon to monitor pressure)	<ul style="list-style-type: none"> -Very small in size -Interfacing system already available (also from FISCO) -Immediate readout of pressure, which could probably be altered to give a compliance readout 	<ul style="list-style-type: none"> -VERY expensive (for interfacing system) -Alteration of readout needed-convert pressure readings to compliance -Requires relationship between pressure and compliance

