

Abstract



Blood pressures within the heart and surrounding vessels are typically measured with pressure transducer equipped catheters. The accuracy of blood pressure measurements has been called into question, as calibration data is not provided to the client. A product is needed to calibrate and verify the catheter pressure transducer measurements while simulating in vivo conditions.



Abstract

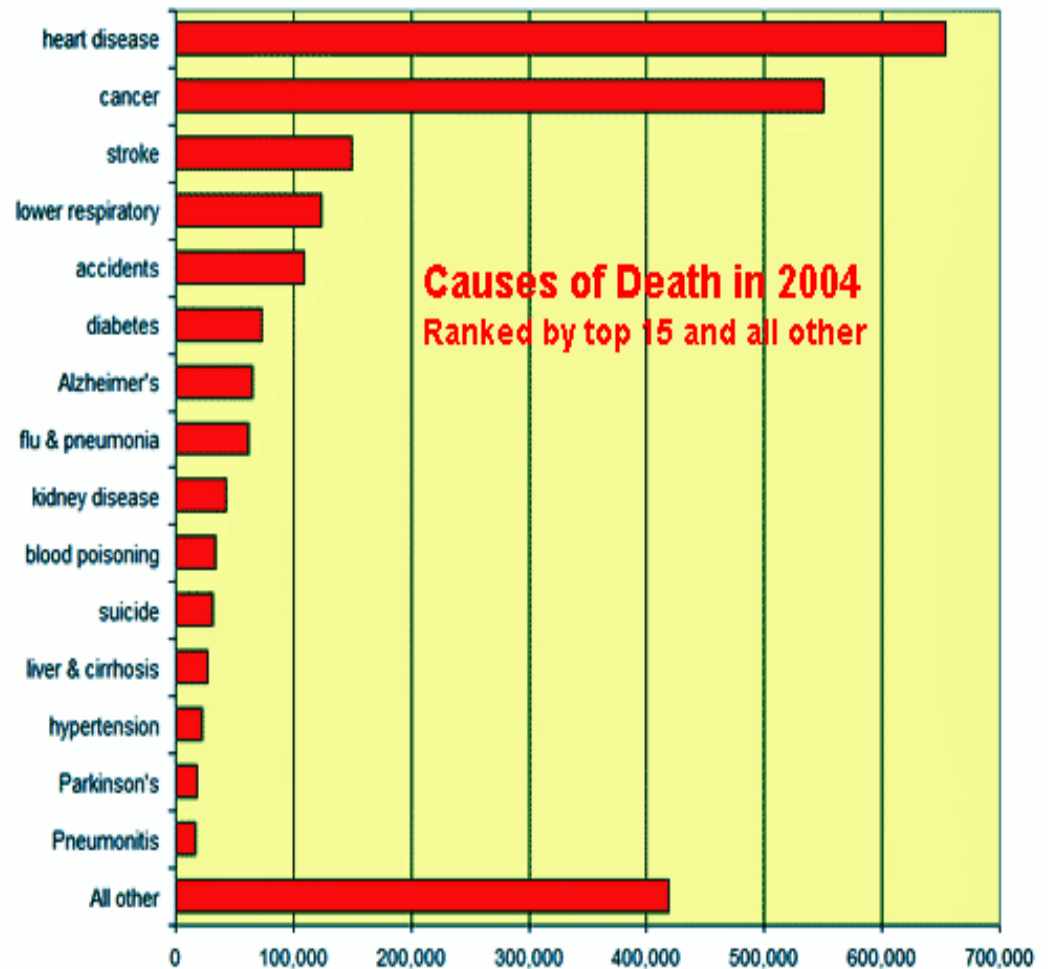
This product was developed to encase the catheter in saline solution while achieving pressures up to 200mmHg. An air pump increases pressure in the chamber through manual or computer control. Pressure in the chamber is monitored with an additional pressure transducer imbedded in the tank.

In a second generation prototype, a feedback loop will pressurize the chamber to a user specified value via pressure sensor, micro-controller, and air pump.



Background

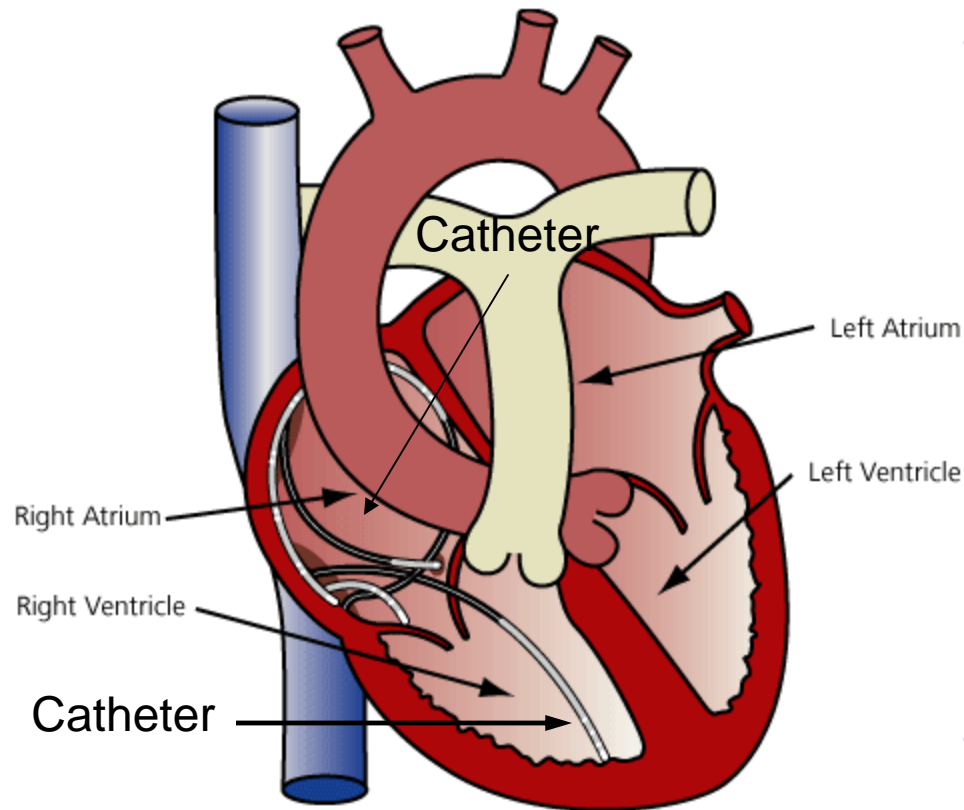
- Heart Disease #1 Killer of Americans
 - Potential for new blood pressure monitoring technology to have high impact
- Proper catheter calibration key to validate new technology



Source: National Center for Health Statistics of the Centers for Disease Control and Prevention



Problem Motivation



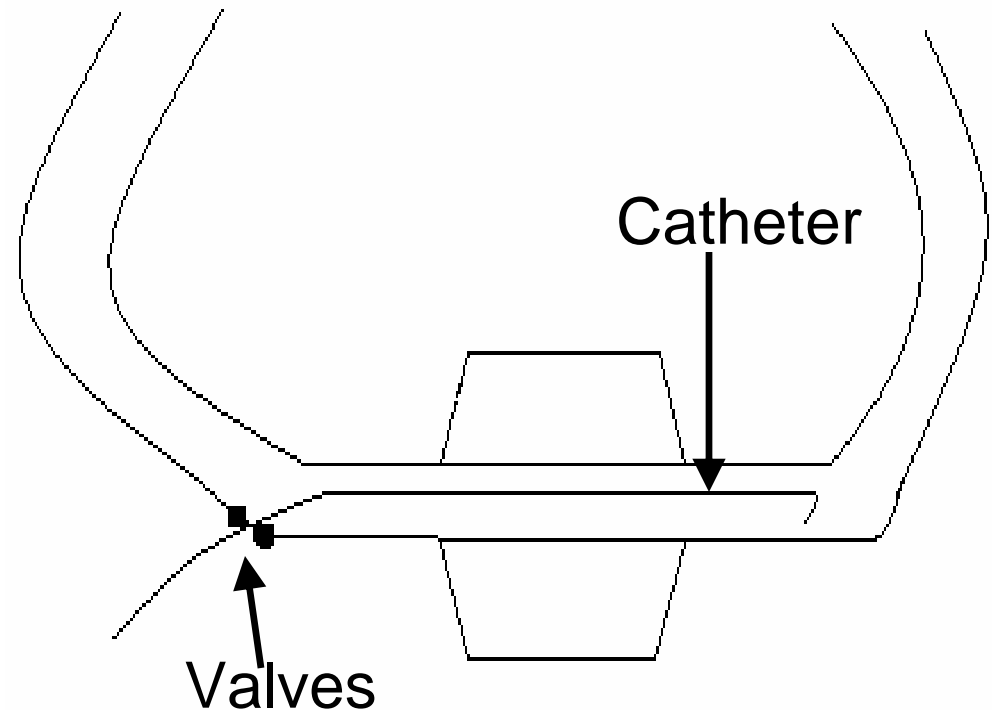
www.sjm.com/globals/popups/ablate.htm

- Developing Technology
 - New method for BP measurements in clinical trials
 - Catheter BP measurements must be valid and accurate
 - Catheter validates new technology
- Catheter's accuracy is questionable
 - Calibration procedure is lacking and/or unknown



Existing Calibration Design

- Description
 - Tubular enclosure holds saline solution and catheter
 - Monometer pressurizes enclosure
- Shortcomings
 - Leaks
 - Unstable pressure
 - Not repeatable





Design Criteria

- Test at range of pressures in saline
 - 50 mmHg increments
- Stable/constant calibration values
 - 2% allowable error
- Inexpensive
- Minimal setup
- Sterile
- Complimentary calibration protocol



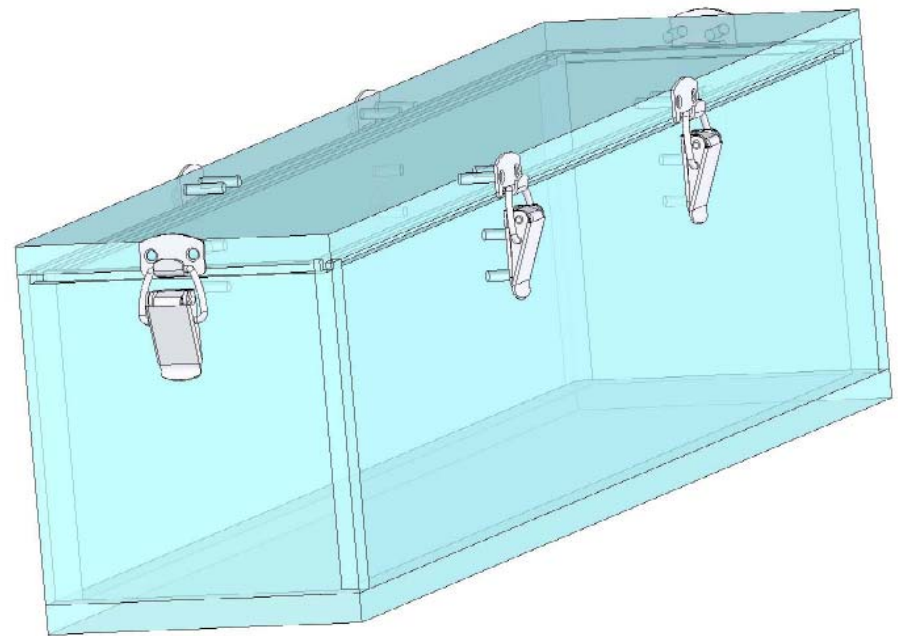
Final Design

- Air/water tight container
- Partially filled with saline
- Pressure sensor mounted in wall
- Air pump compresses air in the top of the container
 - Pressure is transferred to saline
- Operator enters desired pressure
 - Pressure maintained by feedback from sensor to pump
- Compare catheter pressure readings to container pressure



Design Specifics

- Rectangular
 - Easy & accurate machining
 - Easy adjustments via removable top
- Acrylic
 - Chemically bond acrylic with ethylene dichloride
- All edges were sealed with
 - Silicon caulk
 - Silicone o-ring



Testing



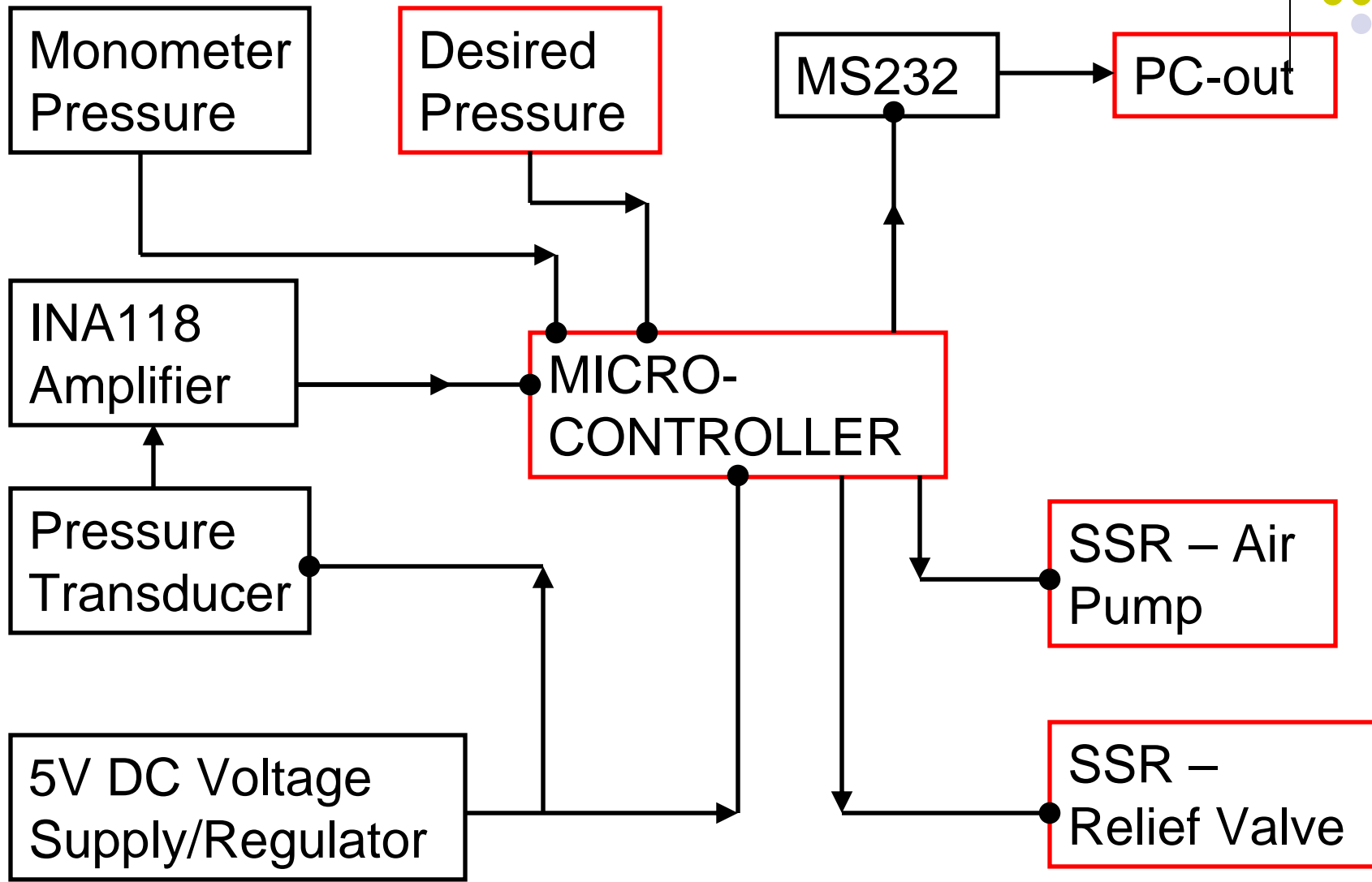
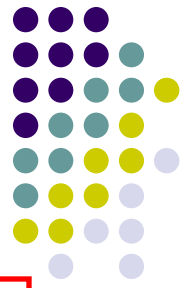
- Air Tight Seal
 - Manually tested container for air tight seal using manometer
 - Corners of container, catheter insertion, and pressure sensor entry point are leak-free
 - O-ring failed to seal in some areas
- Air Pump
 - Donated pump was intended for liquid applications
 - Insufficient for generating adequate air flow rate

Future Work



- Evaluate methods in creating entirely sealed container
- Custom air pumps
- Design and implement temperature control
- Evaluate and improve calibration methods
- Integrate feedback control
 - Programming

Future Work



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