



Automated Collection of Flow and Pressure Data In a Rat Hemorrhagic Shock Preparation

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Our laboratory studies the effect of hemorrhagic shock upon the mesenteric circulation, using the rat as an experimental animal. The Transonics T-206 dual channel flowmeter was used to measure flows in the abdominal aorta and mesenteric artery. The P option of the flowmeter, with an 80386SX-based 20 MHz computer (Gateway 2000), allowed automated collection of flow data. In the past, the arterial pressure was monitored using a carotid artery catheter, a solid-state pressure transducer, and a clinical anesthesia monitor (Hewlett-Packard), with CRT readout. This hybrid system worked poorly, and we resorted to a manual data collection system for pressure and flows. Recently, however, Transonics has installed the R option for automation of pressure measurements.

Our system uses the four-channel version of the P option software. Two channels are used for flows, and one for pressure. The flow channels are calibrated using the pre-set calibration factors from the ultrasonic probes. Calibration of the pressure channel is done using a pressure manometer to provide a reference pressure of 100 torr. The pressure channel calibration remains relatively constant from day to day, providing the same transducer is used; replacement of the transducer requires recalibrating the pressure channel, and re-entering the calibration factor in the P option software.

Since average pressure values are required in this model, we use a 30 second averaging period. Over an experiment lasting 180 minutes, 360 sets of pressure and flow values are logged. This reduces the data stream into a relatively small *.SEQ file on the computer's hard drive. The data file contains voltage levels, and must be converted to an ASCII text file at the end of the experiment. This second conversion is vital; the flow calibrations remain constant, but the pressure calibration, as noted above, changes frequently. The text file contains 360 sets of flow (channels 1 and 2) and pressure (channel 3) values. We maintain a manual data sheet with values every 2 to 5 minutes to allow coordination of the data stream with the events of the experiment, and as a backup to the automated system.

Further manipulation of the data stream is done in the following way. We use a standard spreadsheet (Quattro Pro, Borland). The ASCII text file is read into a standard spreadsheet (Quattro Pro 4.0, Borland), parsed, and converted to numerical cells. Each cell in the spreadsheet contains the a 30-second average of pressure or flow data. Next, the periods of interest (control, early shock, late shock, post-reinfusion, etc.) are identified by correlating the data with the manual data log. The periods of interest range from 5 minutes to 15 minutes. Averages are calculated for the entire periods, using the spreadsheet. Spreadsheet graphics are used to prepare visual representations of the entire data stream, or just the averages. Then the averages are transferred from the spreadsheet into a statistical program (NCSS 5.0, NCSS, Kaysville, Utah). The data from a series of experiments can be combined for formal analysis.

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