

Invasive Blood Pressure – Rat Model

Introduction

Blood pressure (BP) measurement is one of the basic procedures in biomedical research. Three methods are most widely used for recording the BP in a rat: tail cuff plethysmography (noninvasive), intra-arterial catheters (invasive), and radio telemetry.

Intra-arterial catheters yield the most precise values, and surgery is required to use them. Most of our physiological and pharmacological knowledge related to BP, and its regulation has been derived from acutely prepared, anesthetized, or immobilized laboratory animals.

Invasive blood pressure (IBP) is the gold standard against which the accuracy of noninvasive blood pressure method (NIBP) is compared. IBP is the arterial pressure directly measured in any artery such as the radial, femoral, or brachial artery using a saline-filled catheter/cannula.

NIBP is more suitable as a basal BP value when a compound is to be screened for anti-hypertensive activity, whereas the invasive technique is usually suitable for measuring the vascular reactivity to various agonists and antagonists.

Invasive measurements yield the correct basal BP, but sometimes there are fluctuations in the basal BP due to the anesthesia which interferes with the normal BP. The best anesthesia for conducting invasive Rat blood pressure measurements is urethane or pentobarbitone.

Materials

IX-RA-834 or any one of the IX-4xx Recorders with the IA-400D Amplifier

A-BP-CATH-16 solid state Intravascular Blood Pressure sensor

LabScribe software

Blood Pressure Analysis Module

Calibration kit for the A-BP-CATH-16

Optional

ECG measurement with the iWire-BIO4

SA-TCS-6 : Complete Small Animal Heater Controller with a 6" x 8" heated bed.

A-BP-CATH-16 Pressure Transducer Calibration



A-BP-CATH-16 Solid State Intravascular Blood Pressure Transducer

The A-BP-CATH-16 Blood Pressure catheter can be used to measure direct arterial or venous pressure in animals. A precision laser-trimmed chip provides accurate and linear measurements over a broad range.

Note: Care needs to be taken around the tip and the tip should not be grabbed with forceps or tweezers. It should only be handled behind the tip about 1cm back from the tip. If the tip is damaged it would only be from mishandling and can not be repaired.

A-BP-CATH-16 Specifications	
Operating Pressure	0 to +300 mmHg
Over Pressure	-500 to +500 mmHg
Sensitivity	5 $\mu\text{V}/\text{V}/\text{mmHg}$
Excitation Voltage	+/- 5 VDC
Catheter Diameter	1.6 French
Catheter Length	6 inch (exposed length)
	6 inch (sleeve) (6 ft DIN8 extension cable available)
Operating Temp.	15° C to 40° C

IBP with A-BP-CATH-16



Calibration accessories required:

1) BP-Cal-Kit, with the male luer plugged into the black tube.

2) Calibration Chamber



Connect the BP Cal Kit to the calibration chamber as shown.



Tech Note

IBP with A-BP-CATH-16



Insert the needle into the side of the calibration chamber. Make sure that the needle is pointed so that it will be easy to insert the catheter into the needle.

Connect the catheter to the extension cable and plug it into the iWorx Recorder.

Start Labscribe and set it up to record from the catheter.

Insert the catheter into the needle.

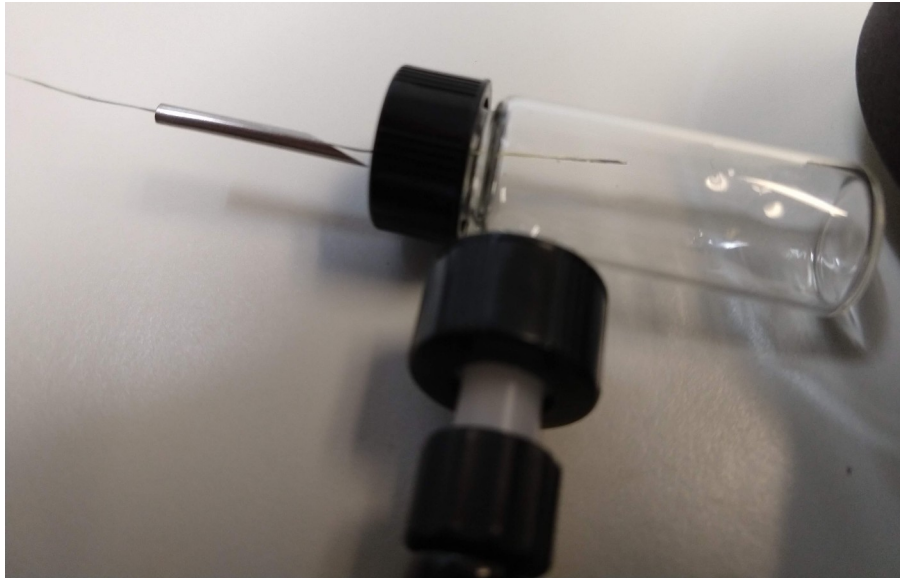


Tech Note

IBP with A-BP-CATH-16



Then slowly remove the needle while keeping the catheter inside the chamber.



Increase the pressure, using the bulb to 50 mmHg. Hold the pressure steady for a few seconds.

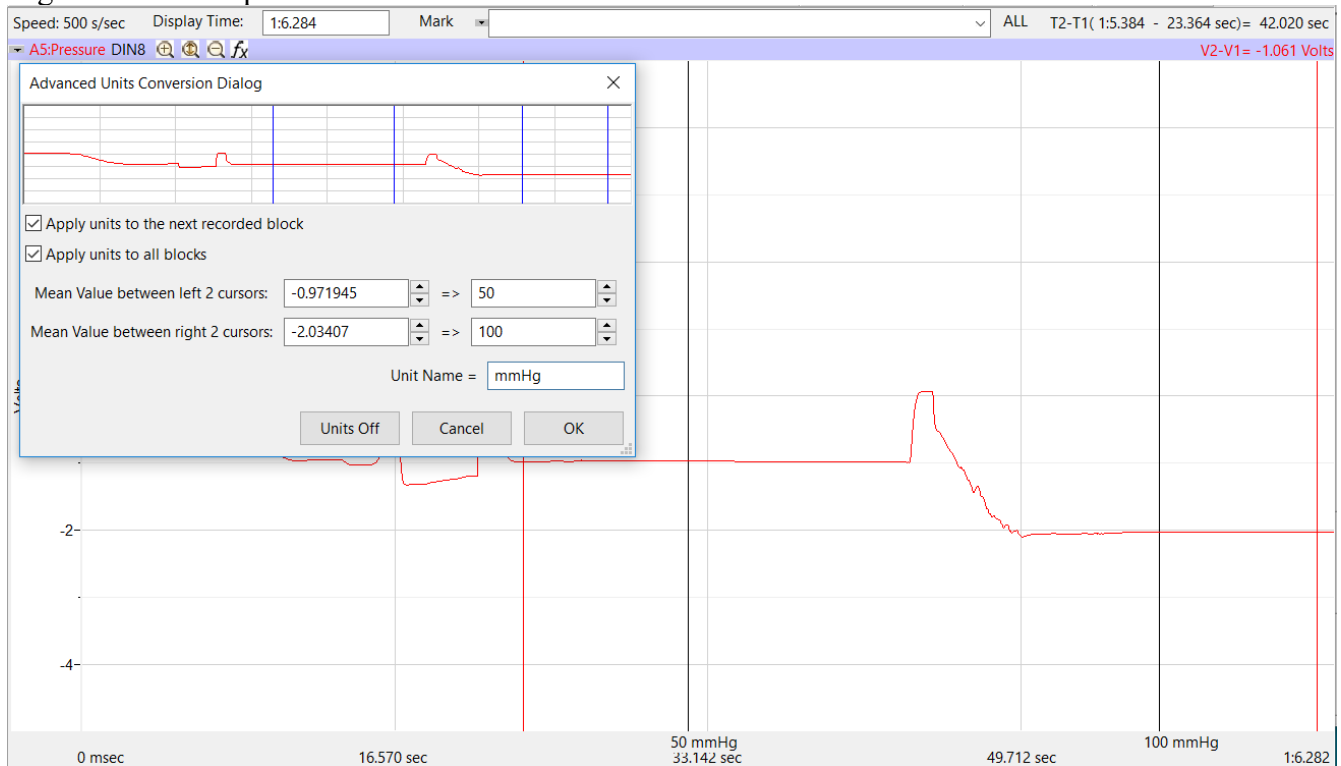
Mark the record in LabScribe with "50 mmHg"

Increase the pressure, using the bulb to 100 mmHg. Hold the pressure steady for a few seconds.

Mark the record in LabScribe with "100 mmHg"

Stop recording.

Right click on the pressure channel and choose Units→Advanced.



In the Advanced Units dialog,

- place the left 2 cursors over the region that corresponds to 50mmHg.
- place the right 2 cursors over the region that corresponds to 100mmHg
- Check the Apply units to the next recorded block
- Check the Apply units to all blocks. This will apply the units to channel on all the previously recorded blocks
- Set the values in the right side text boxes to 50 and 100
- Set the units to mmHg.
- Click OK.

The Channel is now calibrated to read in mmHg.

Animal Preparation and Methods for Recording

An overnight fasted (minimum period of 8–10 h) rat is used in the experiment. The animal is anesthetized with urethane (1200 mg/kg)/ketamine (80 mg/kg, i.p.) and xylazine (16 mg/kg, i.p.) or pentobarbital sodium (60 mg/kg, i.p.).^[4,5] The reflexes of the animal are checked, and it is placed on a suitable rodent surgical table or a flat movable surface. The surface must not be electrically conductive, and it is helpful to record the electrocardiogram of the animal. The skin on the ventral side of the neck, right hind leg, and chest is carefully shaved and disinfected.

The following procedure is adapted from to [Arterial Pressure Monitoring in Mice](#)

- Anesthetize, shave and place mouse in supine position.

Depending on experimental design and the experience of each individual laboratory the choice of anesthesia will vary,

- Make a 1-2 cm midline neck incision from just below the mandible to the thoracic inlet. Under a dissecting microscope, the right carotid artery is exposed and carefully separated from other neighboring structures including the vagus nerve.
- Once the carotid artery has been isolated, place a silk suture (7-0 or 6-0) distally (closer to the head) for the complete ligation of the vessel. Place a second silk suture proximally (closer to the heart) to allow temporary obstruction of blood flow. Finally, place a third silk suture loosely between the first two ligatures and make a small incision (arteriotomy) distal to the middle ligature (i.e., between the first and the third suture)
- Insert the tip of a catheter into the carotid artery via the arteriotomy in the direction of the heart and secure it in place by tying the mid (i.e., the third) suture once that catheter has been advanced past the ligature.
- Release the proximal ligature and re-ligate after the catheter has been advanced for about 11-12 mm into the ascending aorta or 18-20 mm into the left ventricular chamber.
- Place the mouse in the right lateral recumbent position (i.e., right side down), and subcutaneously tunnel and externalize the catheter through a mid-scapular skin incision on the back.
- Close the neck incision with 6-0 nylon sutures and fix the external portion of the catheters in the back to the underlying muscle.
- Record arterial pressure