Introduction

In this laboratory, you will become familiar with auscultation (listening to the sounds of the body) and the measurement of blood pressure. The exercises involve measuring your blood pressures using a stethoscope, blood pressure cuff and sphygmomanometer. You will also assess changes in peripheral circulation and the effects of cuff location.

Background

The pressure in the arteries varies during the cardiac cycle. The ventricles contract to push blood into the arterial system and then relax to fill with blood before pumping once more. This intermittent ejection of blood into the arteries is balanced by a constant loss of blood from the arterial system through the capillaries. When the heart pushes blood into the arteries there is a sudden increase in pressure, which slowly declines until the heart contracts again. Blood pressure is at its highest immediately after the ventricle contracts (systolic pressure) and at its lowest immediately prior to the pumping of blood into the arteries (diastolic pressure).

Systolic and diastolic pressures can be measured by inserting a small catheter into an artery and attaching the catheter to a pressure gauge. Such a direct measurement may be accurate, but is invasive and often inconvenient and impractical. This was, in essence, the method by which blood pressure was first measured by the Rev. Stephen Hales in 1714 on a horse (Figure 1). Simpler estimates of blood pressure can be made with acceptable accuracy using noninvasive, indirect methods.

Traditionally, systemic arterial blood pressure is estimated using a stethoscope and a blood pressure cuff connected to a mercury column or other sphygmomanometer (Figure 2). The cuff is placed on the upper arm and inflated to stop arterial blood flow to the arm from the brachial artery; the high pressure in the cuff causes the artery to collapse. The pressure in the cuff is then released slowly. When the systolic pressure in the artery exceeds the cuff pressure, blood slowly flows to the arm through the partially collapsed artery. Because the flow is through a partially occluded vessel, the flow instead of being laminar is turbulent. And therefore this flow can be heard through the stethoscope. These sharp, tapping sounds are called Korotkoff sounds. When Korotkoff sounds are first heard, the cuff pressure approximates systolic pressure. As cuff pressure is reduced further, the sounds heard through the stethoscope increase in intensity and then suddenly become muffled. The cuff pressure at the point of sound muffling approximates diastolic blood pressure.
Eventually, as the cuff pressure is reduced even more, the sounds disappear completely, and normal flow through the artery is re-established. Since the disappearance of sound is easier to detect than muffling, and since the two occur within a few millimeters of mercury pressure, the disappearance of sound is commonly used to determine diastolic pressure. Note that, in some normal healthy people, the sound can still be heard at pressures appreciably below the true diastolic pressure. In these people, it is not possible to define their diastolic pressure accurately.

An alternative method makes use of a simple finger pulse transducer connected to the computer. The cuff is inflated to a pressure that obliterates the finger pulse. As the cuff pressure is released, the finger pulse returns and the pressure at which it reappears is a measure of the arterial systolic pressure.
The effects of position on the measured arterial blood pressure

It is conventional to reference all arterial blood pressure measurements to the position of the heart. One of the things that will be explored in this laboratory is the effect that position has on the magnitude of the pressure. At this stage, can you think of any factors that would change the pressure if the measurements were performed at levels different from the heart?

![Diagram of indirect measurement of arterial blood pressure]

**Figure 2. Indirect measurement of arterial blood pressure**

What you will do in the laboratory

During today’s class period you will complete four exercises:

1. **Measurement of blood pressure by auscultation.** You will learn how to measure the blood pressure using a sphygmomanometer cuff and a stethoscope, and appreciate the range of pressure that can be seen in normal people.

2. **Measurement of blood pressure with a microphone.** In this part of the laboratory, you will record cuff pressure and the Korotkoff sounds.

3. **Measurement of systolic pressure from the finger pulse.** Here, you will see if you can use pulse measurement to replace the stethoscope.

4. **Measurement of systolic pressure in the forearm.** Here you will examine the effects of arm position on the systolic pressure determined from finger pulse recordings.