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How to take manual blood pressure (BP)

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Key Facts

1. A blood pressure reading is calculated by obtaining a systolic and diastolic reading and is documented as a fraction:

   Systolic / Diastolic = 120 / 80
2. Blood pressure is measured in millimetres of mercury (mmHg)
3. Blood pressure can be obtained manually, via electronic methods and invasively.

Introduction

As part of the BJN clinical skills series, this article will focus on non-invasive blood pressure (BP) measurement, using the manual technique. This vital observation is practised by all nursing fields within primary and secondary healthcare environments.

What is blood pressure?

A BP measurement in its simplest form is a determinant of individual cardiac output (the volume of blood pumped out of the heart and into the aorta per minute) and the systematic vascular resistance (the diameter of the arterial blood vessels) (Foley, 2015). BP measurement is widely recognised as being a routine observation that can be used as a way to assess cardiac output and its effectiveness for adequate tissue perfusion (Odell, 2013). Thus, the presence of a BP is a requirement for human

existence (Beevers and Lip, 2015), and BP measurement, which includes interpreting results and taking appropriate action, is considered a key clinical skill to acquire and maintain as results can determine patient care (Doughty and Lister, 2015).

There are multiple factors which can influence a BP reading such as, age, sleep, emotions and activity; consequently, evidence with the literature varies as to what constitutes as a normal BP reading, and optimal parameters are often used instead (Moore, 2017). Dougherty and Lister (2015) state that a normal BP at rest ranges between 110-140mmgs for the systolic and 70-80mmhg for the diastolic. Hypertension (high BP) refers to BP measurements that exceed the resting systolic parameters and hypotension (low BP) refers to measurements which fall below the resting systolic parameters (Perry, Potter and Ostendorf, 2014). Hypertension and hypotension if left undetected and managed can have serious implications to an individual, including reduced tissue perfusion if hypotensive and cardiac ischemia if hypertensive (Wallymahmed, 2007).

BP measurement consists of two readings, which are documented as a fraction (Moore, 2017). The uppermost reading, known as the systolic, is the first measurement taken and is associated with the peak force of blood exerted from the heart, when the left ventricle contracts and pushes blood into the aorta, causing an increase in pressure (Fetzer, 2014: Foley, 2015). Whilst the lower reading, the diastolic, relates to the exerted blood force, on the walls of the blood vessels while the heart relaxes and refills (Bishop, 2009). BP can be measured using a number of different arteries; however, due to ease of access, the manual technique is generally associated with measuring the brachial arterial pressure, a major blood vessel that runs through the upper arms before dividing below the anti-cubital fossa (ACF) (Bishop, 2009; Netter, 2014).

What is involved when taking a manual BP?

To take a manual BP, two main pieces of equipment are required; an aneroid sphygmomanometer (Figure 1.1) and a stethoscope (Figure 1.2). The sphygmomanometer consists of a cuff which houses an inflatable bladder, a manometer (dial) and a mechanism to pump up the cuff, known as the inflation bulb. In order to measure BP, the inflation bulb is depressed, and the air inside is forced into the bladder in the cuff, once the bulb is released, air re-enters the bulb, and the process is repeated. During this process, the pressure within the bladder situated in the cuff will fill to a point where the cuff pressure exceeds the blood flow in the brachial artery. The cuff, therefore, acts like a tourniquet, as it temporarily excludes blood flow to the artery (Bishop, 2009). By opening the valve attached to the inflation bulb, air is slowly released from the bladder, the cuff pressure falls, and when the systolic pressure becomes greater than the pressure remaining in the cuff, a sound will be heard through the stethoscope (Levick, 2010). The sounds that can be heard are referred to as Korotkoff sounds, and these can often be described as a tapping, thudding or ticking sound, it is the first Korotkoff sound that is used to determine the systolic reading (Foley, 2015). As air continues to be released from the bladder, the pressure in the cuff decreases further, restrictions on the arteries are reduced, blood flow starts to return to normal, and the Korotkoff sounds will disappear indicating the diastolic reading (Fetzer, 2014).

Electronic versus manual devices

While the manual auscultation technique is considered the gold standard for BP measurement, advances in medical technology have led to a number of alternate ways to measure and monitor BP (James and Gerber, 2017). The Nursing and Midwifery Council (NMC) (2018) and The National Institute for Health and Care Excellence

(NICE) (2011) advocate the use of manual and technological devices. However, as there are advantages and disadvantages to both methods, a level of clinical knowledge and skill for manual and electronic measurements are a requirement within clinical practice. Moreover, while electronic devices have become the “go to method”, remaining skilled and confident with the manual method is essential (Moore, 2017) especially for patients with hypertension, hypotension or pulse irregularities. As pulse irregularities can cause inaccuracies in electronic readings (NICE, 2011; Foley, 2015) and this can lead to false diagnosis and incorrect treatment (Bishop, 2009).

Additionally, if there are any doubts over an electronic BP reading, a manual reading should be obtained in order to verify a patient's BP (Dougherty and Lister, 2015). Using clinical judgement when doubts arise within clinical practice is often associated with the art of noticing (Tanner, 2006: Watson and Rebair, 2014: Lancaster, Westphal and Jambunathan, 2015). Failure to interpret and ultimately respond appropriately to clinical cues to uncover clinical signs of deterioration (Lancaster, Westphal and Jambunathan, 2015) linked to changes in BP, can lead to serious consequences (Watson and Rebair, 2014). Therefore, while electronic devices might give a BP reading that is within normal parameters, doubts with the devices accuracies can arise from being able to clinically notice signs of deterioration in relation to BP.

How to take a manual BP BJN to tabulate this

Poor technique is another factor that can lead to inaccuracies in BP measurements; therefore, it is important to follow the correct technique (Moore, 2017).

1. Ensure you adhere to infection prevention (i.e. hand hygiene, personal protective equipment (PPE), decontaminate equipment).
2. Communicate with the patient, explain the procedure fully and gain consent.

3. Position your patient (i.e. supine, seated or standing) and choose an appropriate arm to take the BP reading (i.e. avoid fistulas, broken areas of skin, mastectomy sites, and cannula sites).
4. Gather, check and prepare the equipment. All BP devices should be checked and calibrated according to the manufactures instructions (i.e. check for damage, and check that the dial is at zero. Not checking or calibrating the equipment can lead to inaccuracies). Ensure that the cuff size is correct for the patient, as if the cuff is too large for the patient, the BP reading can be underestimated. Cuff sizes are often displayed in picture form on the outside of the cuff (Figure 1.3). Ensure the stethoscope is in full working order, this will require you to twist the stethoscope head clockwise and to gently tap on the diaphragm. If a loud sound can be heard the stethoscope is working correctly.
5. Locate the patient's brachial artery (Figure 1.4).
6. Wrap the cuff securely around the patient's bare arm, ensuring that the patient side of the cuff is placed against their skin, with the lower edges of the cuff 2-3cm above the brachial pulse. The cuffed arm should be at the level of the patient's heart to ensure an accurate reading (a pillow can be used to position the arm if required).
7. Ensure the patient is rested (patients should be seated comfortably for at least five minutes prior to taking a BP), and ask them not to talk or eat. Ensure their legs are uncrossed as crossed legs can increase blood pressure.
8. Relocate the brachial pulse, once found, palpate the pulse while inflating the cuff. When the brachial pulse can no longer be felt deflate the cuff, ensuring that you take note of the reading on the manometer (dial). To estimate the systolic pressure add 30mmhg to the measurement you recorded, this is known as the

patient's approximate systolic BP. Gaining an approximate systolic is considered good practice as this is used as an indication of a patient's BP and further acts as a gauge to reduce the risk of the systolic reading being missed. It also reduces the potential discomfort that can be caused if the cuff is unnecessarily overinflated.

9. Place the stethoscope into your ears, ensuring the earbuds are facing forward and position the diaphragm of the stethoscope over the patient's brachial pulse (Figure 1.5).
10. Inflate the cuff to the approximate systolic previously noted.
11. Slowly deflate the cuff 2-3 mmHg per second, while simultaneously listening for the first Korotkoff sound (tapping sound notifying the systolic reading) and the Kororkoff disappearing (this signifies the diastolic reading).
12. Once Korotkoff sounds can no longer be heard, open the valve to deflate the cuff fully. If you need to re-check the BP ensure you wait 1-2 minutes.
13. Remove the cuff, decontaminate the equipment and document the reading. (Dougherty and Lister, 2015: O'Brien, 2015: Moore, 2017: British and Irish Hypertension Society, 2017).

Common causes for errors

Top tips for using a stethoscope

Inaccuracies with the readings often result from reduced hearing, caused by the incorrect opening of the diaphragm of the stethoscope and incorrect insertion of the stethoscope earpieces (being inserted in the wrong direction into the ear canal).

- Before inserting the stethoscope make sure the earpieces are pointing forwards towards the bridge of your nose.

- Once the stethoscope is in-situ check the diaphragm is open by taping the end of the diaphragm gently, if a loud sound can be heard, the diaphragm is working correctly. If no sound can be heard, turn the stethoscope head 180 degrees and repeat the above process.
- Some stethoscopes have duel auscultation devices (diaphragm and bell). The diaphragm is identified by its flat larger surface area which makes it easier to control when using a one-handed technique.
- Ensure that the diaphragm is placed over the brachial artery and not the bell.

Tops tips for cuff application

Loose and incorrectly placed cuffs are a common problem associated with inaccurate BP measurements.

- The midline of the bladder should be placed 2-3cm above the brachial pulse. Most cuffs now have an arrow to indicate the midline point. The arrow needs to be pointing down toward the brachial (Figure 1.7 & Figure 1.8)
- The cuff should be secured so it is comfortable and cannot slip off the arm.

Tops tips for using the valve on the inflatable bulb and reading the measurements on the dial

Opening, closing and controlling the valve, in particular, the speed is common problems that cause inaccuracies in readings.

- Before carrying out the procedure, confirm which direction opens and closes the valve.

- Opening and closing the value slowly comes with practice. Practising a one-handed technique for slowly opening and closing the valve is essential.
- Ensure the sphygmomanometer is placed at eye level and that the dial on the meter is visible.

(Wallymahmed, 2007; Tomlinson, 2010; Dougherty and Lister, 2015)

Images for taking a manual BP
(all images are the property of Northumbria University)

Figure 1.1

Figure 1.2

Figure 1.3

Figure 1.4

Figure 1.6

Figure1.7

Figure 1.8

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