Clinical Skills

Vital Signs Monitoring

Clinical Skills and Simulation Team
Aims & Outcomes

The aim of this module is to facilitate understanding of vital signs monitoring.

Learning Outcomes

At the end of the session the student should be able to:

- Define the reasons why the monitoring of vital signs is essential.
- Describe how basic monitoring forms the basis for a track-and-trigger system for identifying acute illness.
- Demonstrate, to a level expected of the student’s stage of training, competence in the procedural steps required to perform basic monitoring of vital signs, and accurately record them using an observation chart such as NEWS in a simulated or clinical setting.
- Appreciate the need for acting on the recommendations of a NEWS chart when a patient observation score falls into a category that requires intervention.
- Display the ability to use the handover tool SBAR.
- Evaluate own learning and recognise how improvements can be made.
Introduction

Ward patients are routinely monitored by the measurement and recording of basic physical signs. For diagnostic purposes, these signs need to be supplemented by special investigations such as blood tests, X-rays or other investigations that are generally more invasive. The results of these tests tend to be more specific in terms of giving an indication of a particular medical problem. Basic physical signs are however, extremely valuable as early indicators of deterioration in health, and scores derived from these basic signs are used to provide a trigger for more urgent investigation or management. The signs most commonly recorded are blood pressure, heart rate, respiratory rate, temperature and conscious level. Blood haemoglobin oxygen saturation is often added to these basic measurements.

When scores are recorded for each (according to the amount of deviation from normal values), they form the basis for track and trigger systems such as the New Early Warning Score (NEWS). They are designed to draw attention to patients at risk of deterioration, and may be used to prioritise patients for urgent treatment. These are now used in the majority of hospitals in the UK.
National Early Warning Score - NEWS

NEWS is based on a simple scoring system in which a score is allocated to six physiological measurements already taken in hospitals – respiratory rate, oxygen saturations, temperature, systolic blood pressure, pulse rate and level of consciousness. The more the measurements vary from what would have been expected (either higher or lower), the higher the score. The six scores are then aggregated to produce an overall score which, if high, will alert the nursing or medical team of the need to escalate the care of the patient.

NEWS also has detailed recommendations on the actions for each score. For example, a medium score should prompt an urgent review by a clinically skilled person with competencies in the assessment of acute illness – usually a ward-based doctor or acute team nurse, who should consider if a critical care outreach team is needed.

To learn more about how to record patient observations on a NEWS chart, watch this video kindly provided by Cardiff and Vale University Health Board Resuscitation Team

[National Early Warning Score (NEWS)](https://www.youtube.com/watch?v=aY8u0LFs9mg) (Opens YouTube in a new window) or type link into browser: http://youtu.be/aY8u0LFs9mg
SBAR Handover Tool

The score on the NEWS chart may require you to seek assistance from a senior colleague. The pneumonic below should be used to handover key information and your recommendations.

A now widely used tool to structure communication, particularly during handover of patient information.

✓ It is used to reduce the barriers to effectively communicate across different disciplines and levels of staff.
✓ It creates a shared mental model
✓ It acts as a memory prompt
✓ It encourages prior preparation for communication
✓ It reduces the incidences of missed communications

The NHS provide excellent resources, please refer to ‘Resources and Useful Links’ for more information
Blood Pressure

Blood pressure may be measured directly (by introducing a needle or catheter into the lumen of an artery, or indirectly, by occluding the vessels in a limb by means of a tourniquet technique. The indirect method is less accurate, but less invasive and quicker, and is used in the vast majority of cases where blood pressure needs to be measured routinely.

Automated indirect blood pressure measurement is common in a hospital environment, but manual measurement of blood pressure is still used. It is generally regarded as more accurate than automatic measurement and more portable.

The manual indirect method involves listening over vessels distal to an occluding cuff. When the pressure in the cuff is reduced, characteristic sounds are heard (Korotkov sounds) as first the arterial blood supply, then the venous blood supply returns to the limb. The accuracy and consistency of manual measurement depends on the use of appropriate equipment and the correct technique.
## Taking a Blood Pressure - Equipment

The equipment consists of an occluding cuff connected to a pressure gauge. The width of the cuff should be approximately the circumference of the arm. A cuff that is too small will over-read a blood pressure, and too large a cuff will under-read. In practice, there are only four sizes of cuff generally available, but this usually suffices. If there is limited availability, it is better to use too large a cuff rather than too small.

For many years, the standard method of blood pressure measurement involved using a mercury manometer. Because of the difficulties associated with dealing with mercury spillage, simple aneroid gauges are more commonly used. Automatic and semi-automatic methods of measuring blood pressure are becoming cheaper and more commonly used.

The cuff is inflated by closing a valve near the rubber bulb and repeatedly compressing the bulb until the desired pressure is shown. The cuff is deflated by slowly releasing the valve.
**Taking a Blood Pressure - Procedure**

Check the equipment. The cuff should be the correct size, the cuff should be leak-free, and the pressure gauge should be at zero.

The procedure should be explained to the patient and verbal consent obtained. The patient should be sitting comfortably, and the arm should be positioned so that it is level with the heart. Use a pillow or other soft surface to support the arm.

If the patient is anxious or in pain, the blood pressure will be artificially elevated. If the patient has only recently arrived in the ward or surgery, a period of rest of at least 10 minutes should be allowed before the blood pressure measurement can be relied upon.
Taking a Blood Pressure - Procedure

- Apply the cuff at the mid-point of the upper arm, 2.5 cm above the antecubital fossa so that the bladder of the cuff is over the anterior surface. The brachial artery (identified by palpation) should align with a mark on the cuff (if present). The palm of the hand should face upward (Fig 1.)

- Palpate the radial pulse at the wrist. Close the valve near the rubber bulb and inflate the cuff until the radial pulse disappears. The pressure in the cuff should be above systolic (Fig 2.)

- Apply the stethoscope over the brachial artery below the cuff. No sound will be audible at this point (Fig 3.)

- Slowly deflate the cuff, watching the pressure dial. Sounds will be heard as the blood starts flowing in the artery. Note the pressure at which this occurs – this is the systolic blood pressure.

- As the cuff is further deflated, a rapid decrease in the volume of sound will occur. Note this pressure – this is the diastolic pressure.

- Fully deflate the cuff.
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Blood Pressure

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Taking a Blood Pressure - Procedure

Repeat the whole procedure if you are unsure about the measurement, otherwise remove the cuff completely from the patient's arm and note the systolic and diastolic pressures that you measured. Also check the patient's arm for signs of bruising, which can occur if the cuff is inflated to too high a pressure, or for too long a time.
Pulse Rate

Pulse rate is easily measured by palpating a peripheral artery (such as the radial) and timing the number of beats per second with a watch with a second hand. Time the beats for at least 30 seconds then record on the observation chart as beats per minute. Pulse rate may be slightly lower than heart rate, which is measured by listening to the chest. In the vast majority of patients the two measurements are the same.

You should be able to describe the rate and character of the pulse (e.g., regular, irregular, thready).

It may also be measured by a pulse oximeter or an ECG monitor if available.

Heart rate is raised in a large number of conditions such as shock, pyrexia, pain, anaemia etc. It is regarded as a more sensitive sign of shock than blood pressure.
Respiratory Rate

This is a very simple sign that was previously neglected, but is actually one of the best early indicators of physiological deterioration.

Respiratory rate may be increased by shock, pain, pyrexia and any problem that increases the work of breathing. It is reduced by opiate analgesics. A sudden reduction may be a late sign of physiological decompensation.

Respiratory rate is measured by observing the patient and timing the respirations with a watch over a period of one minute. Respiratory rate monitors are available, but tend to detect chest movement, which may or may not correlate with respiratory rate. Record the number of respirations per minute on the observation chart.

Fig 1 Measuring respiratory rate.
Temperature

Temperature is now routinely measured by infra-red probes that are inserted into the external auditory meatus for a few seconds. The temperature recorded by these devices is a reasonable estimate of core body temperature. If the ear is blocked (for instance by wax) the reading may not be accurate.

In certain situations (such as poor arterial supply to a limb) it may be useful to measure skin temperature with a thermistor probe. The difference between the core and peripheral temperature may then be used as an indicator of a change in arterial blood supply, shock etc.

Temperature is raised in systemic infections, haematoma and a large number of other pathologies. A low temperature (hypothermia) is also an important clinical sign, and when very low may need to be actively treated.
**Temperature**

The temperature probe is protected from contamination by a transparent plastic cap. A separate cap is used for each patient and is discarded immediately after use by pressing an eject button.

The protected probe is inserted into the external auditory meatus with the pinna pulled gently upward and outward. This straightens the external auditory meatus. Pressing a button displays the temperature on a LED screen.
**Conscious Level**

Conscious level is traditionally measured by the Glasgow Coma Scale, a 15 point scale typically used to measure the neurological status of patients following a head injury. This is a useful measure, but is more dependent on the skills of the observer than a more simple 4 point scale such as the AVPU. The letters stand for Alert, Verbal (response to verbal stimuli), Pain (response to pain) and Unresponsive. Both methods may be used in ward patients, but the AVPU is easier and more generally applicable.

<table>
<thead>
<tr>
<th>Alert (A)</th>
<th>The patient is awake and alert</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voice (V)</td>
<td>The patient responds to verbal stimulation</td>
</tr>
<tr>
<td>Pain (P)</td>
<td>The patient responds to painful stimulation</td>
</tr>
<tr>
<td>Unresponsive (U)</td>
<td>The patient is completely unresponsive</td>
</tr>
</tbody>
</table>
Haemoglobin Oxygen Saturation

The haemoglobin oxygen saturation of the blood is most easily measured by a pulse oximeter. This fits on a finger and comprises a diode that emits light at a particular frequency, and a detector measures the absorption of that light. The haemoglobin in the finger absorbs the light, and the measurement occurs when a 'pulse' is detected and the finger is engorged with arterial blood. This gives a reasonable estimate of the arterial oxygen saturation, and is a far better indicator than clinical signs such as skin colour and cyanosis. Usefully, the pulse rate is also displayed.

Pulse oximetry is a very useful measurement at the bedside because it is continuous and non-invasive. Although it gives a good estimate of arterial oxygen saturation, arterial blood gases are still needed, particularly for estimation of carbon dioxide partial pressures and hydrogen ion concentration.

Although it is a continuous measurement, because of the small number of these machines in a general ward setting, measurements tend to be made intermittently and recorded on the bedside chart.
Vital Signs Monitoring
Haemoglobin Oxygen Saturation

Haemoglobin Oxygen Saturation

Measuring haemoglobin oxygen saturation (top) and heart rate (bottom measurement).
What are blood glucose levels?
Blood sugar levels are literally the amount of glucose in the blood, sometimes called the serum glucose level. Usually, this amount is expressed as millimoles per litre (mmol/l) and stay stable amongst people without diabetes at around 4-8mmol/L. Spikes in blood sugar will occur following meals, and levels will usually be at their lowest in the early mornings. When it comes to people with diabetes, blood glucose levels fluctuates more widely.

Monitoring blood glucose levels
Keeping an accurate idea of a patients blood glucose levels is an integral part of successful diabetes management. Often, patients that are unwell have unstable or fluctuating blood glucose levels. It is therefore very important whilst in hospital that the levels of blood glucose are closely monitored. Generally, this is done using a glucometer. The blood glucose reading or BM as it is known was often written on the NEWS or patient monitoring charts, but are now generally documented on a separate BM chart.

Urine testing may also be important (to check for the presence of ketones).
How to take a blood glucose reading using a glucometer?

The following slide presentation is kindly provided by the Queen Mary’s School of Medicine and Dentistry via a Public Information Clinical Skills Site.

Please note the steps required to carry out Capillary Blood Glucose monitoring. You will be carrying out this procedure in the Practical Skills Session (or, if you do not want to participate, will observe the procedure).

http://www.cetl.org.uk/learning/blood-glucose-monitoring/player.html
Carry out hand hygiene.

The necessity for all procedures should be explained to the patient and verbal consent obtained.

**Blood Pressure**

- Ensure that the patient is lying or sitting. Also ensure that the sphygmomanometer is positioned at heart level, with the palm of the hand facing upwards.
- Use appropriate cuff size. Measure arm circumference if in doubt.
- Apply the cuff of the sphygmomanometer snugly around the arm, 2.5cm above the anticubital fossa, with the cuff level with the patient's heart.
- Inflate cuff until radial pulse can no longer be felt, providing an estimation of systolic pressure.
- Inflate to a pressure 30mmHg higher than the estimated systolic blood pressure.
- Deflate the cuff slowly.
- Record the systolic and diastolic pressures and compare the present reading with the previous readings.
- Completely remove the cuff from the arm.
- Record on chart.
Checklist

Heart rate
- Palpates the peripheral artery
- Times the number of beats per minute using second hand of a watch (can time for 30 seconds then double).
- Record on chart.

Respiratory Rate
- Measure the respiratory rate for a full minute by timing chest movements with a watch.
- Record on chart.

Temperature
- Cover the temperature probe with a transparent cap.
- Gently lift the external pinna of patients ear upwards and outwards and insert probe.
- Measure temperature by pressing appropriate button and recording displayed temperature.
- Discard transparent cap.
- Record on chart.
Vital Signs Monitoring

Checklist

**Conscious Level**
- Measure conscious level with AVPU scale
- Record on chart.

**Haemoglobin Oxygen Saturation**
- Apply a pulse oximeter to patient finger, and rest hand to avoid motion error.
- Record on chart.

**New Early Warning Score (NEWS)**
- Add scores together to calculate NEWS, take appropriate action.

- If the NEWS score requires you to seek senior support, use the SBAR pneumonic to hand over the information to the senior colleague.
References


Web Resources

Blood Pressure:
http://www.cetl.org.uk/learning/bpm/player.html

Koroktoff Sounds:
http://www.cetl.org.uk/learning/BP_Korotkoff_sounds/player.html

Royal College of Physicians July 2012. National Early Warning Score (NEWS). Standardising the assessment of acute-illness severity in the NHS