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In Geriatric patients there is an estimated 3-fold increase in mortality related to surgical procedures. Numerous data are available for review but essentially all interpretations reach the same conclusion. There are anatomic as well as physiological changes in cardiovascular and respiratory systems. The older patients have markedly reduced ability to respond to induced hypoxia or hypercapnia. Cardiac reserve is less. Hypertension is common and there is decreased ability to withstand stress, shock anaesthesia and surgery as compared to the younger person.

Severe arterial hypoxaemia may occur even during the most meticulously administered anaesthetics. Prolonged moderately severe hypoxia may be associated with pre-existing cardiac disease which is common in geriatric patients and a continuous, non-invasive monitoring of oxygen saturation by Pulse Oximetry may be of immense help in detecting hypoxaemia early.

Pulse Oximetry:

Pulse oximetry is a continuous and non-invasive monitoring of saturation of Haemoglobin in arterial blood.
and recording of pulse. Pulse oximeter represents probably the most important advance in monitoring during anaesthesia since the introduction of the sphygmomanometer. The oximeters have all the advantages of a tissue plethysmograph and also display continuously the saturation of haemoglobin in arterial blood. In most devices there is a time-averaged digital or analogue display and an audible beat-by-beat sound, the tone of which is modulated by degree of haemoglobin saturation. These advices are accurate to one percent in the clinically important range of saturation (greater than 80%) (Yelderman & New, 1983; Taylor and Whitwam, 1986) have suitable response times, and are generally also superior plethysmographs in pulse detection (Griffiths et al, 1987). Although they detect haemoglobin saturation rather than O₂ tension, they have, for practical purposes, replaced percutaneous polarographic oxygen monitoring in adults.

The basis of oximetry is to shine light of particular wave-length through tissue and to measure the amount of light which is either absorbed or transmitted. The lobe or pinna of ear, the nail bed of the finger, or the wrist or ankle of a neonate, or even the septum of the nose may be used. The light is absorbed and scattered by the various tissues, skin, and haemoglobin in venous capillary and arterial blood.
The fundamental law governing the absorbance of light is known as Beer's law:

\[ \frac{I_t}{I_0} = e^{ecd} \]

where
- \( I_0 \) = Intensity of the incident light
- \( I_t \) = Intensity of the emerging light
- \( e \) = Base of natural logarithms
- \( c \) = Concentration of the substance through which the light passes in a path length of \( d \).
- \( Ecd \) = absorbance or optical density.

Therefore, for a given light path and for light of a particular wavelength the absorbance is a function of the (molar) concentration, \( c \), of the substance in solution.

In the case of haemoglobin, the concentration may be determined by measurements made at two different wavelengths, at 805 nm (which is an isobestic point, i.e. at which the absorbance is the same for reduced haemoglobin as it is for oxyhaemoglobin) and at 650 nm where the difference in absorbance between the two forms is largest. This comparison permits the amount of oxyhaemoglobin to be estimated.

The pulse oximeter has been developed from the technological advances of microprocessors and light
emitting diodes. However, Beer's law does not strictly apply to non-invasive oximeters, and because saturation cannot be calculated theoretically it is estimated by an empirically derived algorithm based on clinical data.

The pulse oximeter utilizes two light emitting diodes (LEDs) at the required wavelengths and analyses the changes in the light signal produced by the arterial pulsations by a rapid arithmetical subtraction process involving about 30 instantaneous calculations of saturation per second with averaging of 90 or 180 of these samples to produce a mean for 3 sec. or 6 sec. response.

Because pulse oximeters use two wavelengths only, other forms of haemoglobin e.g. methaemoglobin, carbonylhaemoglobin and sulphaemoglobin, cannot be distinguished. Saturations may be under-estimated in patients with hyperbilirubinaemia (as bilirubin absorbs light at the relevant wavelength) and in patients with tricuspid incompetence (as the venules may also pulsate). 

Electrocardiography:

The electrical activity of heart is recorded as electrocardiograph. The electrocardiogram may be used as a heart rate meter, to detect and characterize arrhythmias, and to provide some indication of myocardial ischaemia. Also, should a major problem occur unexpectedly,
the immediate availability of an ECG trace may be of great value. However, major disadvantages are that the ECG provides no indication of the adequacy of the circulation, and may provide a false sense of security if used as the only continuous monitor of the circulation.

Although ECG monitoring does provide additional information not provided by peripheral pulse-activated devices, it does not release the anaesthetist from monitoring the circulation continuously. Routine ECG monitoring is considered a 'minimum standard' by the Harvard group (in addition to some other monitor of the circulation) (Elchchorn et al, 1986), and has also been recommended in the U.K. An ECG should be used, only therefore, when other measures have been taken already to monitor a pulse continuously.

The goal of monitoring during anaesthesia is to detect untoward events and prevent them. An effective monitor assesses (ideally continuously) one or more markers of potential injury. The monitored information should enable the anaesthesiologist to alter therapy. Finally, the use of the monitor to manage therapy should objectively improve outcome. Keeping this in mind, it was therefore thought worthwhile to evaluate changes in oxygen saturation and electrocardiogram simultaneously in geriatric patients undergoing surgery under general anaesthesia and sub-arachnoid block.