Just over 3,000 years ago at the time of the Yellow Emperor, the Chinese were the first to realise that a pulse that was difficult to compress was likely to lead to a stroke. Although the characteristic of the pulse at the wrist was indirectly related to blood pressure, it was not until 1733 that blood pressure was first directly measured in an artery by the English naturalist, the Reverend Stephen Hales. He carried out the following experiment:

“In December I caused a mare to be tied down alive on her back ... having laid open the left crural artery about three inches from her belly, I inserted into a brass pipe whose bore was one-sixth of an inch in diameter and to that by means of another brass pipe which was fitly adapted to it, I fixed a glass tube of nearly the same diameter which was nine feet in length. Then, untying the ligature on the artery, the blood rose in the tube to eight feet in length, three inches perpendicular above the level of the left ventricle of the heart.”

Hales went on to measure blood pressure in a number of animals and estimated that the blood pressure in humans would be approximately 7.5 feet, which if converted into millimetres of mercury corresponds to a systolic pressure of 176 mmHg.

This was not a practical way to measure blood pressure, although in around 1820 a French surgeon inserted a tube directly into a large artery in three patients prior to having their limb amputated. He found the pressure to be around 120 mmHg. Over the course of the next 20 years, various machines were developed which could trace out the pulse wave at the wrist. Frederick Mahomed, a very perceptive physician at Guy’s Hospital, was the first to use this method in a large number of people to roughly estimate blood pressure. He soon realised that it was an important measurement and that when it was high, there were fairly drastic consequences. Around 1870, he wrote:

“These persons appear to pass through life pretty much as others do and generally do not suffer from their high blood pressure except in the petty ailments upon which it imprisks itself. As age advances the enemy gains accession of strength. The individual has now passed 40 years, perhaps 50 years. His lungs begin to degenerate, he has cough in the winter time, but by his pulse you will know him ... headache, vertigo, epistaxis, a passing paralysis, a more severe apoplectic seizure (stroke) and then the final blow.”

An Austrian physician, von Basch (1876), then developed a convenient and simple way of measuring blood pressure by connecting a small balloon to either a mercury column or sometimes an aneroid manometer. The balloon was placed over the artery in the wrist and compressed until the pulsation of the artery in the wrist below the balloon was obliterated. The pressure at which the pulsation disappeared gave a reasonably accurate measurement of systolic pressure. He soon realised that the higher the systolic pressure, the greater the risk of stroke and kidney disease.
However, blood pressure first became easy to measure in 1896 when an Italian physician, Riva Rocci, developed what we would now recognise as a conventional mercury sphygmomanometer with a cuff around the arm, which was inflated until the pulsation of the artery could no longer be felt. This gave a very accurate measurement of systolic pressure, although it was subsequently found that it was more accurate if a wider cuff was used.

A few years later Nicolai Korotkoff, a Russian army surgeon (1904), realised that by listening with a stethoscope below the cuff over the artery at the elbow, characteristic sounds were heard at the systolic pressure, but also importantly at the lower pressure (diastolic) when the heart relaxes. It became very easy to measure both systolic and diastolic pressure accurately with a stethoscope.

The pressure in the artery was measured with a column of mercury, as this gave a convenient desk-top measurement as mercury is approximately 13.6 times heavier than water or blood. This meant that the column of mercury only needed to be about one foot high, rather than five to eight feet if it was a column of blood.

Remarkably, over the next 100 years there has been very little development in the measurement of blood pressure. It is still true to say that a conventional mercury sphygmomanometer when used in skilled hands with a stethoscope can give an accurate measurement of blood pressure, but in unskilled hands it is notoriously unreliable, and the mercury column needs regular servicing and can be prone to errors if not kept in good condition.

Semi-automatic machines have now been developed that accurately record both systolic and diastolic pressure. However, currently these machines do not need to be tested to verify their accuracy before being sold. If you are considering purchasing such a machine, which may be useful for monitoring your blood pressure at home, you must check that it is a machine that has been properly validated. This feature article on blood pressure measurement continues on pages 8-9 where you will find further details about measuring at home and what to buy.

The measurement of blood pressure in millimetres of mercury is convenient as it allows the pressure to be measured with a mercury column that fits on a desk, but this hides the fact that the pressure in the artery is much higher than we imagine. For instance, a blood pressure of 200/100 mmHg when converted into centimetres of blood comes out at 272 centimetres, or 2.72 meters, which is approximately nine feet, and the diastolic pressure comes out at 150 centimetres, that is 1.5 meters.

To make this more graphic, one could imagine that as in the same experiment by Stephen Hales on a horse, if a tube was inserted into the artery at the level of the heart, the blood would rise to a pressure 2.7 meters above the height of the heart, i.e., well through the ceiling. When blood pressure is lowered, the falls are quite large; say if pressure was lowered to the target pressure of 140/90 mmHg, this translates into a fall in systolic pressure of 80 centimetres, 0.8 meters, and blood pressure at that time would be 1.9 meters high at systolic and 1.04 meters at diastolic.

This way of expressing blood pressure could be a lot more meaningful to individuals. Perhaps in the doctor’s surgery there should be a column of blood coloured fluid to explain the height of the blood pressure and the need to reduce it. However, the surgery would need a very high ceiling! Nevertheless, our limited experience so far in telling individuals with high blood pressure the height of their blood pressure in meters or feet and inches gives them a much better concept of the risks of high blood pressure, and the importance of reducing it.

**HE SOON REALISED THAT THE HIGHER THE SYSTOLIC PRESSURE, THE GREATER THE RISK OF STROKE AND KIDNEY DISEASE.**

Austrian physician, von Basch (1876)