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Science and Technology for Human development : Advancement of Blood Pressure Measurement

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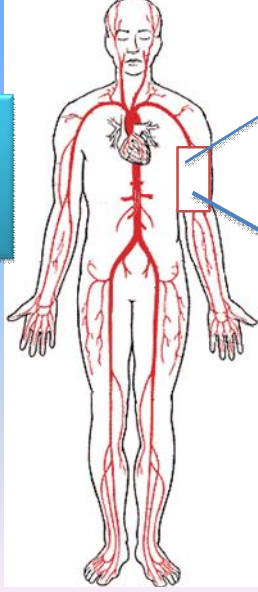
( Slide 1) Good morning to everyone. It's generally believed, introducing an idea, and developing an presentation and make it equally interesting to listener needs 15-20 min. Beyond that the listeners slowly lose their concentration on the topic under discussion. Still I try to restrict myself to the given timeline.

**How science and technology change  
Blood pressure measurement from ancient time  
to present 21<sup>st</sup> century evidence based medicine.**

( slide 2) The topic i choose is how science and technology change the measurement of blood pressure from ancient time to current 21st century evidence based medicine. The understanding of blood pressure has undergone a sea of change as science advances and technology to measure blood pressure is perfected.

### What is being measured


Pulse pressure  
Systole – Diastole = Pulse pressure  
120-80 = 40mmHg



120 mmHg  
SYSTOLE


BP = 120/80mmHg

80 mmHg  
DIASTOLE




( slide 3)Everyone here will have some understanding on their own way what blood pressure is. It is simply a pressure measured in our arm by a doctor using a device called sphygmomanometer and express the value in numbers in numerator and denominator. The normal pressure at the arm is expressed as 120/80. This normal pressure value has a cut of value or thresh hold beyond that the increase pressure may cause cardio vascular events like, heart attack, stroke, and renal failure.

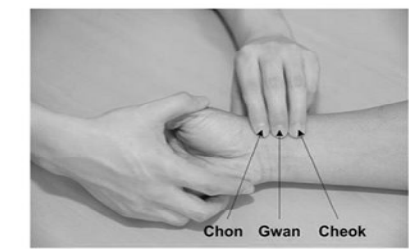
### Ancient Pulse tracing in East



6<sup>th</sup> century BC Ayurvedic Medicine



KAPHA	PITTA	VATA
Hamsa Gati (Swan)	Manduka Gati (Frog)	Sarpa Gati (Cobra)
Hasti Gati (Elephant)	Timiraka Gati (Partridge)	Jalauka Gati (Leech)
Kamala Gati (Lotus)	Kaka Gati (Crow)	Krumi Gati (Worm)
	Lāvaka Gati (Common Quail)	



Chon Gwan Cheok

( slide 4)The first civilisation to spot the blood pressure was ancient eastern civilisation. The picture ancient Indian Rishis palpating the pulse and diagnosing the disease was known and documented in 6th century BC but at the same time Egyptians, Korean and Chinese were also recording the pulse by palpation to diagnose and treat various diseases. One similarity in palpating the pulse is they all identify the pulse by three fingers and categorising them by three distinct names. In Ayurveda we called them as Kapha, pitta and Vata and in Korean they called them as Chon, Gwan and Cheok.

It took thousands of years for the west to get interested in the palpation of pulse to diagnose the disease. It's very surprising how great minds of many curious inventors, philosophers and scientist were so ignorant and not suspicious when they witnessed blood sporting from the injured artery by sharp objects mostly by swords and spears which were frequently used in the ancient and medieval ages.

## 18<sup>th</sup> Century Pulse Tracing in West



(Slide 5)18th century western physicians start showing interest in pulse by palpating and feeling the pressure in the radial artery similar to what east physicians did in early ancient ages. The emblem of British Royal college of physician association itself showing GOD himself palpating the artery, shows the importance of pulse pressure measurement in 18th century.

# 18<sup>th</sup> Century Pulse Tracing in West



Reverent Stephen Hales.

First blood pressure measurement 18<sup>th</sup> Century (1677-1761)



( Slide 6) Finally Reverent Stephen Hales a preacher, astronomer, botanist, mathematician and also interested in medicine revolutionised the blood pressure measurement. He changed the way the blood pressure measurement was looked at after 2000 yrs of palpating the artery in your wrist. Yes he actually measured the pressure not at the wrist but exactly at the neck close to the heart. He was the first one to do an experiment which is concern with blood pressure.

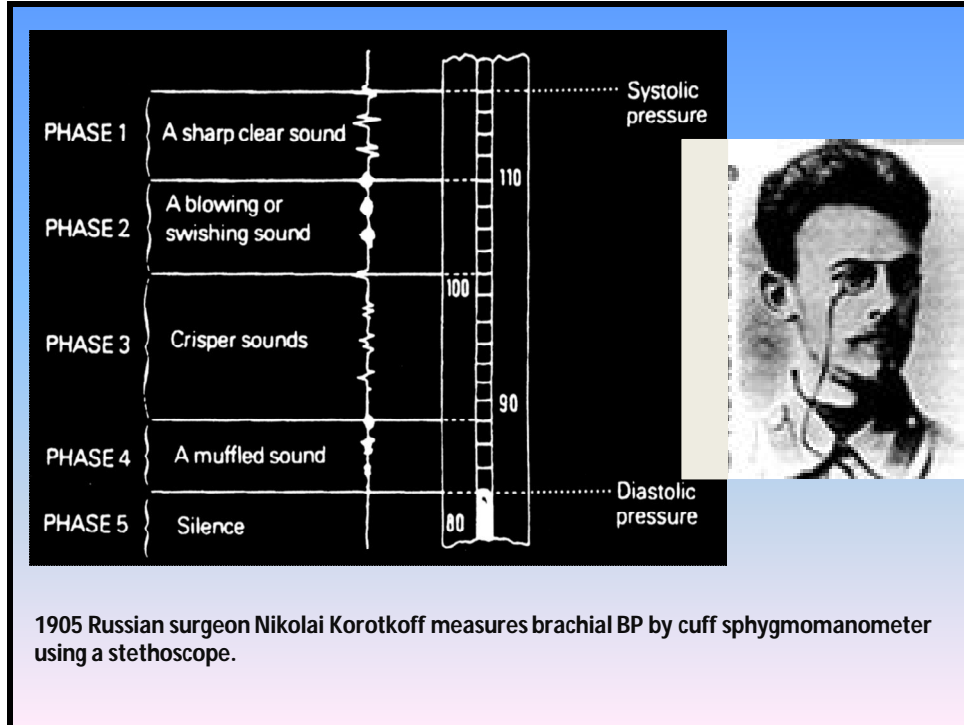
He achieved this by making a horse lie down and inserted a brass pipe and connected it to the glass tube and ask his assistant to hold the glass tube. when he untie the ligature of the artery he has occluded the blood rose in the glass tube 8 feet and 3 inches perpendicular above the level of the heart. This was a violent revolution which changed the modern medicine. First time ever blood pressure was measured and quantified by numbers.

## MODERN TECHNOLOGY



**Acceptance of the cuff sphygmomanometer (Scipione Riva Rocci in 1896 - upon which modern devices are based).**

( Slide 7)Hundred year have passed for the next curious mind to probe in to the problem. Many devices are introduced and then advanced by improving the accuracy and ease of application for clinical use. Scipione Riva-Rocci an Italian physician finally device an equipment similar to our modern day blood pressure measuring device and able to measure blood pressure non invasively. It was he who gave those two numbers systole and diastole more accurately by applying pressure through a cuff and by palpating the appearance and disappearance of the pulse.



(Slide 8) Later it was improvised by a Russian scientist Nikolai korotkoff by introducing stethoscope to hear the sound rather than palpating it in the artery. For next hundred years until today the measurement of blood pressure by a simple technique perfected by Scipione Riva Rocci and advanced by Korotkoff stood the test of time.


### Blood pressure in Text Books




In 1920, the art of measuring blood pressure has been perfected

(Slide 9) The art of measuring blood pressure was almost complete with a book written by Sir James Mackenzie in 1920 mentioning about blood pressure measurement in detail for physicians.


## First cardiac catheterization



[Werner Forssmann](#)  
(1930)

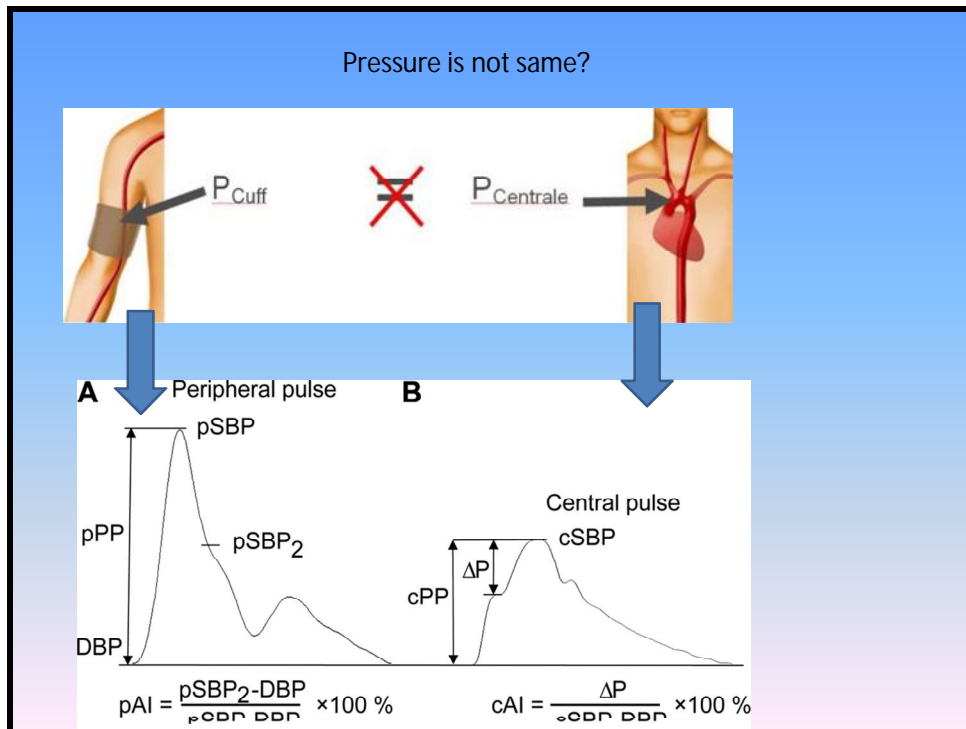


Werner Forßmann



Dr. A.V.M. White performs the first heart catheterization at Calgary's Foothills Hospital in October 1980. *Hearts, Minds & Vision* details the evolution of cardiac care in the Calgary area.

( Slide 10) In 1930 another German physician Dr. Werner Forssmann did something different to measure blood pressure close to the heart. He pushed a uretic catheter through the vein in his arm and positioned it in the right atrium of his heart under the guidance of the x ray. In 1940 systemic measurement of pressure in the heart and arteries was done using cardiac catheterisation. Then by 1980 cardiologist where able to use invasive catheter specially design and position it inside the heart and then in to coronary arteries.



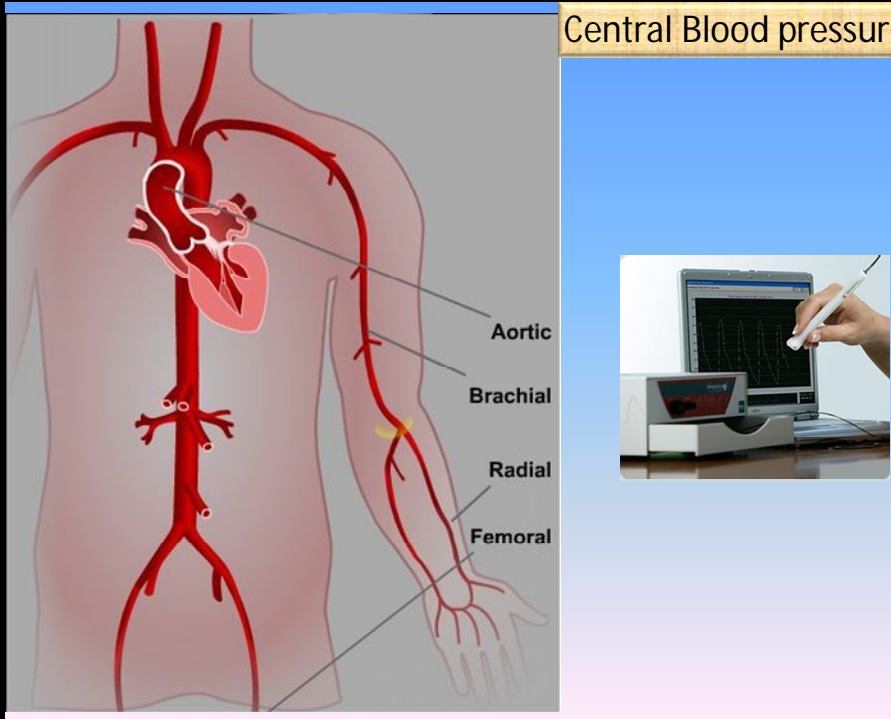
( Slide 11) During this cardiac catheterisation it was invariably found when they pull the catheter from the heart in to the central aortic artery and then out through the arm, the measurement of blood pressure in the central aorta was difference from that of the pressure measured in arm. Unfortunately it was never probed further and measuring the blood pressure in the arm was continued in use assuming the pressure in the arm and central artery close to the heart are similar even though evidence are not in support of it.

### Which one?

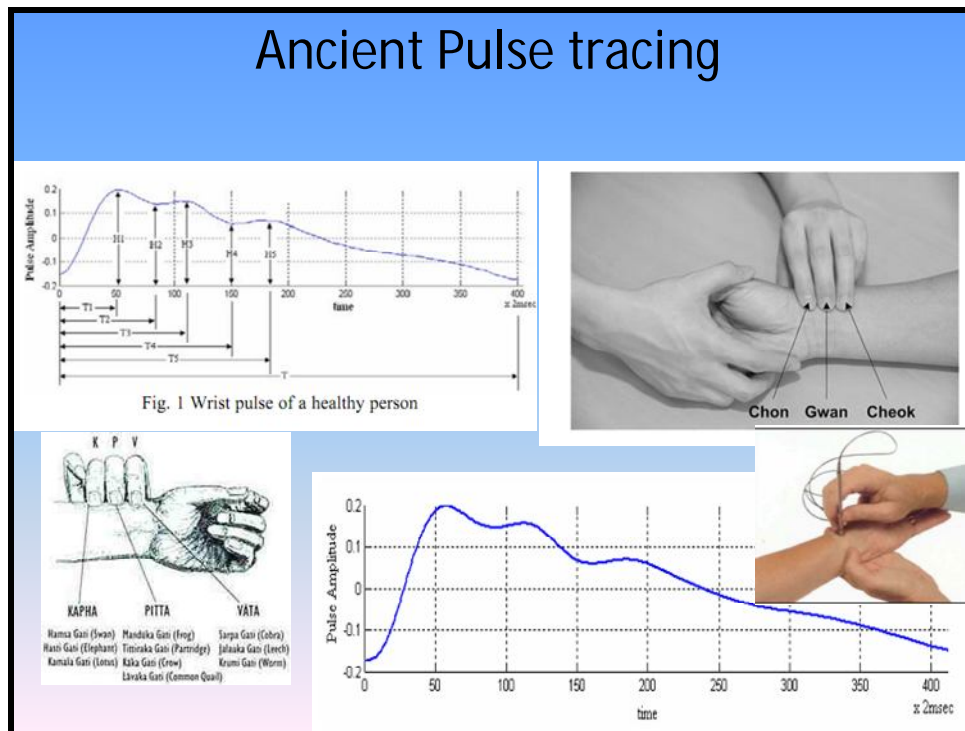


( Slide 12) The possible reason for continuing the same procedure is, if you need to measure blood pressure close to the heart it can be achieved only by invasive catheterisation of the heart. Since it cannot be practised , simple office based blood pressure measurement was continued to be used .

### Central Blood pressure

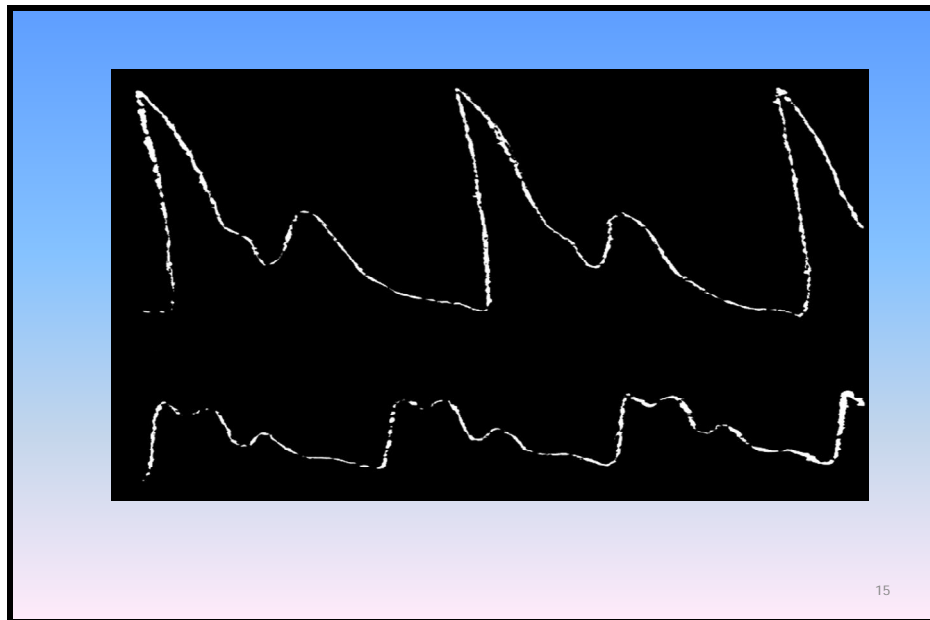


( Slide 13) It is only at 21st century that advanced technology introduces medical device called SphygmoCor ,which can able to accurately estimate the central aortic pressure non invasively. This is achieved by placing a tonometer ( pen like device) on your wrist artery ( radial artery) and using radial artery pressure can able to accurately estimate the blood pressure close to the heart ( central aortic blood pressure) by using mathematical calculations.




( Slide 14) When the tonometer measurement on the radial artery is analysed in waveform, it revealed three distinct bump. This curiously correlate with the ancient eastern method of the palpation using three fingers. This method of three finger palpation is still practised by current Ayurvedic physicians. The knowledge of measuring blood pressure would have been known in ancient times but the perfection, advancement and technology to measure was given to the physician by the western scientist only in late 18th century. The fact is, we did initiate the knowledge about blood pressure 2000 yrs ago but we didn't pursue it further.





( Slide 15) The two waveform in the slide shows how the ancient palpation method would have differentiated the two pressure waveform by experience . The top one is from a healthy individual and the lower one with hypertension. Now as technology advances even a non expert is able to see the difference in the waveform between person of normal and hypertension.



**“Scientific advancement is not evolutionary, but rather is a series of peaceful interludes punctuated by intellectually violent revolutions, and in those revolutions one conceptual world is replaced by another**

**Thomas Kuhn 1962**

( Slide 16) Scientific advancement is not evolutionary, but rather is a series of peaceful interludes punctuated by intellectually violent revolutions, and in those revolutions one conceptual world is replaced by another. ( Thomas Kuhn 1962)



Thank you for listening

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( Slide 17)The wisdom of knowing and measuring the blood pressure has a history of 2000 yrs. In the Indian science congress tall claims have been made about ancient practise and discovery of plastic surgery and Aircraft engineering but coming back to blood pressure it will be very provocative to say just because we have some knowledge about pressure in the artery, we cannot claim the invention of blood pressure measurement which revolutionised the medicine. Unless technology advances along with science invention to help human development cannot be contemplated. Thank you for listening. We love science and proud to contribute innovation to Indian society.