Objective digital analysis of pulse diagnosis using tonometry

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Dr. Raphael Nogier places his left thumb on the patient's left radial artery over the styloïd process to read Vaso-Autonomic-Signal (VAS).

Dr Raphael Nogier published a book named "Introduction pratique a l'auriculomedicine, La photoperception cutanee" in French. In this book, he described that VAS following the light stimulation was a subjective feeling of the examaminer's finger tip as if the pulse became stronger with the increase in the pulse pressure. However, the pulse recording did not show the increase in pulse pressure but showed the slurred upstroke of the first wave of the pulse.

The determination of radial pulse by a strain gage pressure transducer is very difficult, because the reading of radial pulse changes by the angle and hold down pressure of the transducer.

It is difficult to position manually such a sensor precisely over the radial artery. Recently, Nihon Colin Company marketed Jentow which is the radial artery tonometry which has an array of 30 sensor elements. These sensor arrays greatly simplified the task of positioning the sensor over the artery. These sensors were automatically regulated to obtain the greatest deflection (pulse pressure) by incorporated computer.

The following is the step to determine radial artery pressure by Tonometry :

1. Apply wrist stabilizer in hyper extended position, with magic tape to palm and forearm. Put blood pressure cuff on.
2. Palpate the pulsation of radial artery on the styloid process.
3. Place transducer head exactly on the radial pulse, with proper pressure indicated on the apparatus.
4. Turn on electric supply to Jentow, which is the analog recording of radial pulse, and to computer for digital conversion with the frequency of 250 Hz..
5. Tonometry starts to look for the highest deflection in 30 elements indicating the location of probe, hold down pressure, cuff blood pressure, tonometry blood pressure and pulse rate on the display.
6. Turn on GMS soft to convert analog wave to digital wave in high CPU computer.
7. Auricular acupuncture study : Control recording of pulse in 10 seconds. Search meter probe of Agiscop DT is applied to Placebo point (no buzz) and Stomach point (buzz on continuously, <5mA) and each 10 seconds recording were performed. Subjects did not feel any stimulation.
8. Light response study : Control recording of pulse while the subjects open their eyes. Light from 3 volts flash light was applied on the right side of cheek of the subject, then pulse recording was done for 10 seconds.

Eye mask was placed on the subject to shut out the light, then control recording was done. The same light was applied to cheek and pulse recording was performed.

9. Argorythm of computer soft detects the lowest and the highest point of each consecutive radial pulse, and calculates the upward slope dividing pulse pressure by the time from the lowest

point to the highest point (mmHg/msec). At the same time pulse pressure (mmHg) and peak to peak interval (msec) are recorted.

10 Statistical analysis : Values between Stomach point detection minus control values, and placebo detection minus control values in the upward slope, pulse pressure and peak to peak interval were compared.

Difference in each value was compared and analyzed by student t - test.

Results.

Auricular acupuncture study : Eleven subjects were studied. Statistical analysis showed significant increase in upward slope of the first wave ($p<0.05$, $t=2.593$), pulse pressure ($p<0.05$, $t=2.299$) and peak to peak interval ($p<0.05$, $t=2.375$), following the Stomach point detection.

Vaso-autonomic-signal appeared to be as the significant increase in upward slope and pulse pressure. Peak to peak interval also increased by Stomach point detection, which can be elucidated by the vagal stimulation but could not explain the increase in upward slope of the first wave and pulse pressure.

Light response study : Eight subjects were studied. Six out of eight subjects showed similar significant change in the slope of the first wave and pulse pressure ($p<0.01$) even subject's eyes were completely covered. VAS following the light application was proved as significant changes in above three dimensions.