Experimental research for skull vibration from vocalization impact on cerebrospinal fluid circulation

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Summary
This experimental research was inspired by the Jindrak Hypothesis brought up in 1988 by Jindrak K.F. and Jindrak H. After some acoustical tests, a personal vibro-acoustical spell can be composed leading to strong skull vibration when it was read by the specific person. 6 subjects, who were randomly chosen from 18 people who had a personal vibro-acoustical spell, were undergoing a MRI scan before and after reading the spell for 15 mins. The results was that all of the 6 subjects` cerebrospinal fluid forward flow volume in aqueduct of sylvius were increased. The cerebrospinal fluid forward flow volume in aqueduct of sylvius is positively correlated to the cerebrospinal fluid circulation flow rate. The conclusion is that the skull vibration from vocalization could accelerate the cerebrospinal fluid circulation.

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1. Introduction

Human skull is composed of 23 bones. Most of the bones in human body are joined in joints. However, the bones of the skull are joined by sutures, a structure that difficulted to move but easy for vibration transfer. [1] Jindrak Postulate was brought up in 1988 by American doctors Karel F. and Heda Jindrak, concerning that the vibration of human skull, as produced by loud vocalization, exerts a massaging and cleaning effect on brain.[2] The effects can be summarized into four items. First, skull vibration from vocalization promotes the diffusion process in brain. Second, it accelerates the flow and cycle of cerebrospinal fluid (CSF). Third, it facilitates the nutrition of the arterial wall cells in brain. Fourth, it helps cleaning the arteriosclerosis plaques on the arterial wall in brain.
The second effect that the skull vibration from vocalization accelerating the flow and cycle of CSF is the only one that could be observed and proved by Magnetic Resonance Imaging (MRI) scan. This paper will detailed explain the method, calculation and analysis of this whole process.

2. Experiment

This experimental research was conducted in Biomedical Imaging Research Center of Medical School, Tsinghua University. The 6 subjects were randomly chosen from 18 people who attended the Acoustic Research on Brain Healthy Speech Vibration [3] obtaining a vibroacoustic spell. The vibroacoustic spell is a personal poem composed with the words leading to strong skull vibration when being pronounced. The vibration energy of reciting the vibroacoustic spell for 10min is equal to the vibration energy of speaking randomly for 100min.
Subjects were asked to remove all metal items including jewelry, watches, cell phones, glasses, etc. before the brain MRI scan. After a 10~15 mins` preparation, subjects entered the MRI room

having the first-time brain MRI scan including CSF flow speed test for about 40 mins. Then subjects read the vibroacoustic spell for 15 mins remaining lying on their back. The second-time brain MRI scan only focused on CSF flow speed taking about 12 mins. The whole experiment takes about 80 mins. Figure 1 is the flow chart of this experiment.

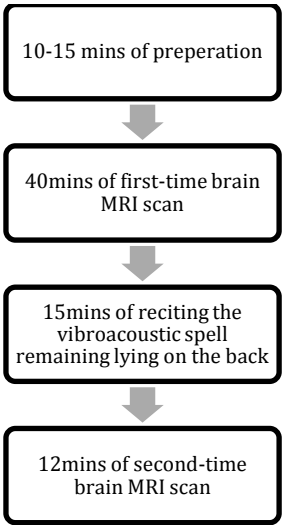

Figure 1. Flow chart of this experiment

Figure 2. Picture of a subject during MRI scan

3. Analysis and Calculation

There is a CSF circulation in human brain. The CSF from the lateral ventricles goes into the third ventricle through the interventricular foramen, and then into the fourth ventricle combined with the CSF generated from the third ventricle through the aqueduct of sylvius, and finally into the subarachnoid space with the CSF generated from the fourth ventricle through the median aperture and the lateral apertures. [3] Among all the pass ways of the CSF circulation, the aqueduct of sylvius is the only one in the shape of tube, which makes it easy to test the flow velocity and volume. So, the CSF flow velocity test is testing the flow velocity of CSF in the aqueduct of sylvius.

Figure 3 and Figure 4 are the test results of flow velocity of CSF in the aqueduct of sylvius before and after one subject, Ms. G, spending 15 mins reciting the vibroacoustic spell remaining lying on the back. Figure 3 and Figure 4 both show the data of one single cardiac cycle, and the red circles in the pictures are the location of aqueduct of sylvius.

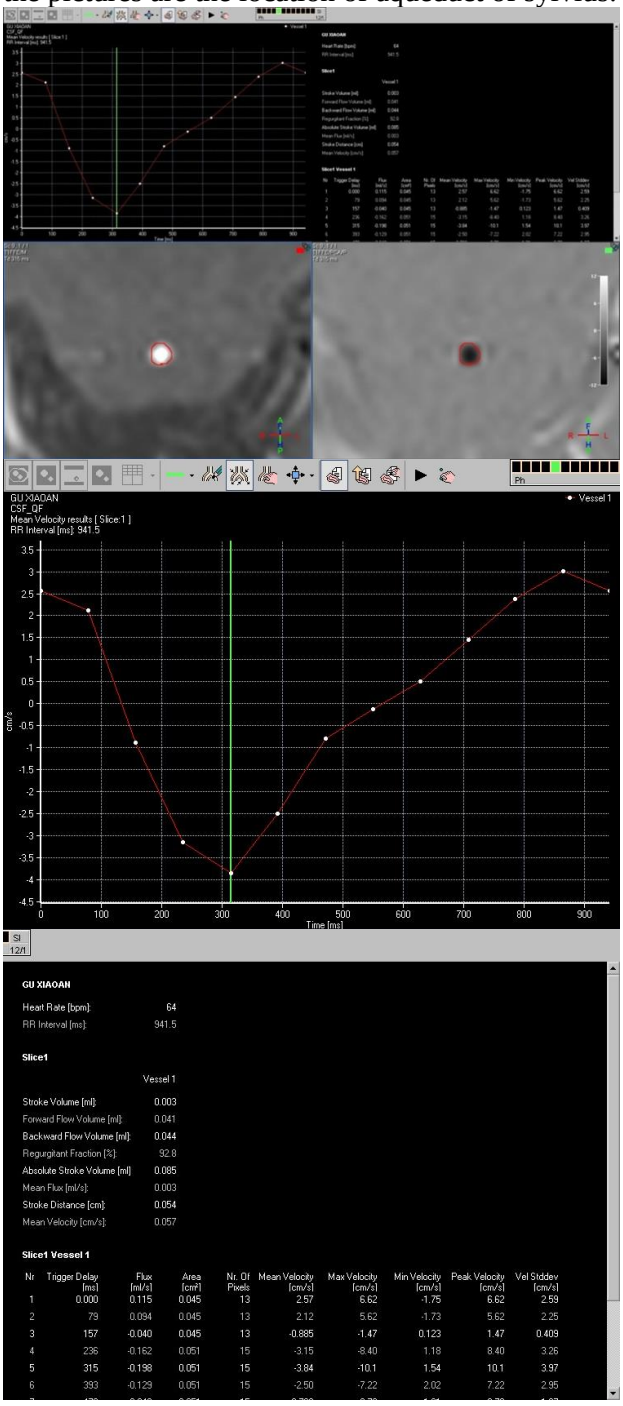

Figure 3. Mr. G`s MRI scan results before reciting the spell

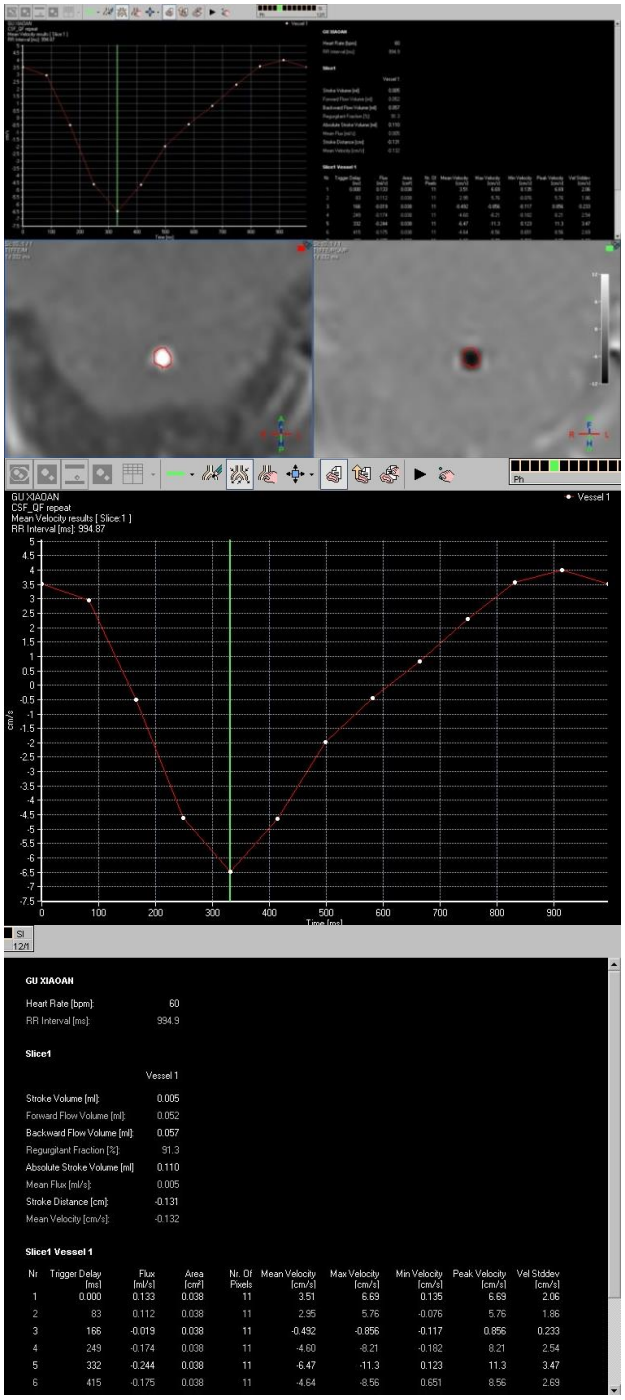

Figure4. Mr. G`s MRI scan results after reciting the spell

During a cardiac cycle, there are diastole, the atria and ventricles of heart being relaxed and beginning to fill with blood, and systole, the atria and ventricles of heart being contraction and starting to pump out blood. During systole, the CSF in aqueduct of sylvius flow from the third ventricles of brain to the fourth ventricles, and that flow reverses during diastole. [4] The data shows heart rate, RR interval, stroke volume, forward flow volume, 'back flow volume, regurgitate fraction, absolute stroke volume, mean flux, stroke distance and mean velocity.

The CSF circulation is a dynamic equilibrium process. The volume of CSF secretes from choroid plexus in lateral ventricles, third ventricle and fourth ventricle must equal to the volume of CSF leaving subarachnoid space. The volume of CSF in third ventricle and fourth ventricle is also a dynamic equilibrium process. New CSF generated from lateral ventricles, third ventricle leads to the increasing of flow velocity in aqueduct of sylvius, and then it leads to the increasing of CSF flow velocity leaving subarachnoid space through arachnoid granulations to the veins. So, the CSF velocity in the aqueduct of sylvius is positive related to the flow velocity of CSF circulation. Since the data in MRI results are all related to the RR interval, the aqueduct of sylvius in a unit of time, for example 1min, can be referred to equation 1.

$$L_{fpm} = \frac{L_f}{T_{RR}} * 1000 * 60 \qquad \text{ml/min (1)}$$

L_{fpm}——the forward flow volume of CSF in the aqueduct of sylvius per minute, ml/min;
L_f——the forward flow volume of CSF in the aqueduct of sylvius, ml;
T_{RR}——the RR interval, ms.

The MRI scan data and the calculation results of the forward flow volume of CSF in the aqueduct of sylvius per minute before and after reciting the vibroacoustic spell for 15 mins are shown in Table 1. And the "(BR)" and "(AR)" in Table 1 refers to "before reciting" and "after reciting". It is shown in Table 1 that all of the 6 subjects accelerates the flow rate of CSF circulation after reciting vibroacoustic spell for 15 minutes.

Table I. The results of the forward flow volume of CSF in the aqueduct of sylvius per minute before and after reciting the vibroacoustic spell for 15 mins

Subjects	T_{RR} (BR) /ms	T_{RR} (AR) /ms	L_f (BR) /ml	L_f (AR) /ml	L_{fpm} (BR) /ml/min	L_{fpm} (AR) /ml/min
G	941.50	994.87	0.041	0.052	2.61	3.14
L	941.59	906.07	0.045	0.045	2.87	2.98
S	852.84	830.46	0.033	0.039	2.32	2.82
W	1140.92	1111.65	0.034	0.035	1.79	1.89
Y	805.54	776.25	0.06	0.058	4.47	4.48
D	770.00	754.00	0.019	0.019	1.48	1.51

4. Conclusion

The CSF velocity in the aqueduct of sylvius is positively related to the flow velocity of CSF circulation. By comparing the forward flow volume of CSF in the aqueduct of sylvius per minute before and after reciting the vibroacoustic spell for 15 mins, it shows that all the 6 subjects accelerate the CSF circulation by vibroacoustic stimulation. This experiment proves the second item of Jindrak Postulate that the skull vibration from vocalization accelerating the flow and cycle of CSF.

References

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