



Deep Brain Stimulation (DBS) Surgery for Treatment-resistant Hypertension: A Promising Solution to a Silent Killer

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Introduction

Hypertension is a disease that affects approximately 1 billion people worldwide. It is estimated that as much as 5-30% of the hypertensive population are resistant. We present the first case of a hypertensive patient on quadruple medical therapy whose blood pressure was controlled with DBS of the ventral lateral periaqueductal grey (vIPAG); this led us to test out the stimulation effects in reverse translational studies.

Methods

A 55-year-old man developed an ischaemic internal capsular stroke. In the peri-stroke period, blood pressure readings ranged from 265/96 to 153/89 mm Hg and antihypertensive medication was prescribed: atenolol, diltiazem, perindopril and indapamide. Four months later, subsequent to multiple dose increases in the quadruple therapy, his blood pressure ranged from 153/87 to 134/72 mm Hg. Later when he developed post stroke pain, we implanted a DBS quadripolar electrode into the vIPAG which is a recognized target for treating refractory pain.

Results

Pain levels decreased initially but returned to pre-surgical levels at 4 months. Immediately after DBS, there was a gradual decrease in blood pressure that prompted withdrawal of all antihypertensive medications. At 27 months, DBS off-switching increased blood pressure by 18/5 mm Hg (p = 0.01) and during subsequent on-switching the blood pressure decreased by 33/13 mm Hg (p = 0.01). These effects were repeatable. Concomitant serum levels of cortisol and adrenaline did not show any significant differences. At 5 years post-surgery, the patient now remains on a single anti-hypertensive agent (Perindopril 4mg) with his blood pressure readings on ambulatory monitoring ranging from 110-125/60-85 mmHg. DBS effects were compared in a group of normotensive and spontaneously hypertensive rats (SH). In hypertensive rats low frequency PAG stimulation results in a depressor response resulting in a significant drop in arterial pressure suggesting sympathoinhibition; in contrast such a response was lacking in normotensive rats. We would also like to present muscle sympathetic nerve activity (MSNA) measured at 5 years.

Conclusions

Low frequency vIPAG stimulation has resulted in controlling refractory hypertension in a patient previously on multi-drug therapy. Experiments in hypertensive and normotensive rats have confirmed physiological findings in patients and provided further validation of this therapy.

Learning Objectives

Readers should at the end be able to under the role of PAG in pain and cardiovascular function; it's application in emerging indications such as hypertension and that the scope of neurosurgery is widening to include conditions outside what is conventionally considered neurological.

References

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