Neuroanesthesia Question of the Month

What is the evidence to support a maximum SBP of 140 during DBS insertion?

Summary:

There is minimal evidence to support the proposition that patients undergoing insertion of deep brain stimulation electrodes should have their systolic blood pressure maintained below 140 intraoperatively. However, several case series have consistently demonstrated that patients with *preexisting* hypertension undergoing this procedure have significantly higher rates of intracranial hemorrhage.

Discussion:

Several recent reviews of the anesthetic management of patients undergoing insertion of DBS electrodes state that the patient's sBP should be maintained below 140, or less than 20% over the patient's baseline, in order to reduce the risk of intracranial hemorrhage.[1,2,3] The basis for this recommendation is a single case series by Gorgulho *et al.* of 248 functional neurosurgical procedures for movement disorders at the UCLA Medical Center between 1994 and 2001.[4] The review papers either use the Gorgulho paper as their sole reference for the 140 threshold, or cite a second review paper, which in turn relies on Gorgulho as its sole reference. A review of the literature failed to uncover any additional evidence to support a 140 threshold.

Five instances of hemorrhage (2.02%) occurred in Gorgulho's series. All of the patients who suffered a hemorrhage had a maximum intraoperative sBP of at least 140 mmHg (range 140 - 180). Intraop blood pressures for those patients who did not hemorrhage were not discussed. Three hemorrhages occurred among the 28 surgeries performed on patients with a known past medical history of hypertension (10.71%) and two occurred in non-hypertensive patients (0.91%).

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[1] Venkatraghavan Anesthetic Management of Patients Undergoing Deep Brain Stimulator Insertion. Anesth Analg. 2010 Apr 1;110(4):1138-45.
[2] Grant R1, Gruenbaum SE, Gerrard J. Anaesthesia for deep brain stimulation: a review. Curr Opin Anaesthesiol. 2015 Oct;28(5):505-10.
[3] Chakrabarti R, Ghazanwy M, Tewari A. Anesthetic challenges for deep brain stimulation: a systematic approach. N Am J Med Sci. 2014 Aug;6(8):359-69.
[4] Gorgulho A, De Salles AA, Frighetto L, Behnke E. Incidence of hemorrhage associated with electrophysiological studies performed using macroelectrodes and microelectrodes in functional neurosurgery. J Neurosurg 2005;102(5): 888–96.

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The authors of the Gorgulho paper made no recommendations about intraoperative blood pressure targets. They stated:

> "the absolute values and the durations of the hypertension peaks were not extreme during the intra- and postoperative periods. Chronic hypertensive changes that occur in parenchyma vessels are possibly better determinants for bleeding occurrence than the hypertensive peak itself, based on our data evaluation..."

Despite this, the Gorgulho paper is the sole basis for the recommendation to keep a patient's sBP below 140. Subsequent authors appear to have seized upon the fact that all of the patients who hemorrhaged in Gorgulho had maximum intraop systolic blood pressures of 140 or greater. However, as mentioned above, the blood pressure data for patients who did not hemorrhage was not analyzed. Further, one hemorrhage patient in Gorgulho had a maximum post-operative blood pressure of 128/60. Using that logic it could be argued that systolic pressures should be maintained below 128 mmHg in the entire perioperative period. Gorgulho did not document patient baseline blood pressures so it is unclear where the recommendation to maintain pressures "less than 20% over the patient's baseline" originates from.

Pre-Existing Hypertensive Disease

Despite the lack of evidence around the 140 threshold, it appears relatively clear that patients with a past medical history of hypertension are at increased risk of an ICH associated with DBS electrode insertion.[5,6,7] In these papers, patient are variably defined as hypertensive if the diagnosis was noted in the medical record or if they used antihypertensive medication.

[5] *Ibid.*
[6] Sansur CA, Frysinger RC, Pouratian N, Fu KM, Bittl M, Oskouian RJ, et al. Incidence of symptomatic hemorrhage after stereotactic electrode placement. J Neurosurg 2007;107(5):998–1003.
[7] Binder DK, Rau GM, Starr PA. Risk factors for hemorrhage during microelectrode-guided deep brain stimulator implantation for movement disorders. Neurosurgery 2005;56(4):722–32. discussion 722–32.