[N-70] Ventricular Pacing for Controlled Hypotension in a Toddler

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An 18 month old with history of traumatic brain injury presented for resection of basilar artery pseudoaneurysm (Figure 1). After induction of anesthesia, placement of an endotracheal tube and appropriate monitors, right ventricular pacing wires were placed via femoral venous access. Defibrillator pads were placed. Motor and sensory evoked potential monitoring was employed. The feasibility of inducing hypotension with rapid ventricular pacing was confirmed; a ventricular rate of 300 beats per minute lowered the MAP to 23 mm Hg. Ventricular pacing facilitated surgical dissection and clip placement at seven time points during the procedure (Table 1). A ventricular pacing rate of 300 bpm produced an average MAP of 26 mm Hg. We noted rebound hypertension of decreasing magnitude throughout the procedure (Figure 2). After the final episode, cessation of pacing resulted in ventricular fibrillation. The patient responded promptly to asynchronous defibrillation. Post-procedure, the patient remained sedated and ventilated in the Pediatric Intensive Care Unit. Cardiac troponins remained less than 0.01 ng/dl. Cerebral aneurysm clipping requires balance between cerebral perfusion pressure (CPP) and the aneurysm transmural pressure gradient (TMPG)(1). The requirement for discreet periods of hypotension complicates the competing goals of maintaining CPP and minimizing TMPG. Current options are often limited to pharmacologic agents. Inhalational agents decrease systemic vascular resistance and MAP but increase cerebral blood volume(2). Direct acting peripheral vasodilators, such as sodium nitroprusside and nitroglycerin, result in increased cerebral blood flow. Nitroglycerin also exhibits a ceiling effect for hypotension in children(3). Nicardipine is a cerebral vasodilator which reliably decreases MAP, but return to baseline is prolonged(4). Adenosine causes decreased cardiac output and decreased SVR2 but duration is unpredictable. Rapid ventricular pacing is an alternative to pharmacologic options. The uncoupling of atrial and ventricular synchrony decreases ventricular filling and cardiac output, avoiding the problems of increased cerebral blood volume. This technique has been successfully employed in adult patients for placement of thoracic aortic endografts(5). In our patient, pacing provided periods of discrete hypotension allowing surgical dissection. A limitation of this technique is the possibility of ventricular fibrillation post-pacing due to hypotension-induced myocardial ischemia. Our experience highlights an alternative technique for inducing predictable and defined periods of hypotension for neurosurgical procedures in children. Further study is intended to confirm safety and feasibility of this technique.

1. Br J Anaesth. 2007;99(1):102-118.
2. Paediatr Drugs. 2002;4(7):439-453.
3. Anesthesiology. 1986;65(2):175-179.
4. J Pediatr Orthop. 1996;16(3):370-373.
5. Ann Thorac Surg. 2006;81(5):e21-23.

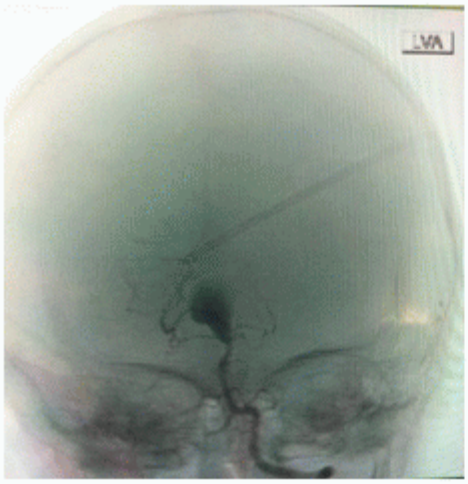

Figure 1. Angiographic image of basilar artery pseudoaneurysm, measuring 21 x 17 mm.

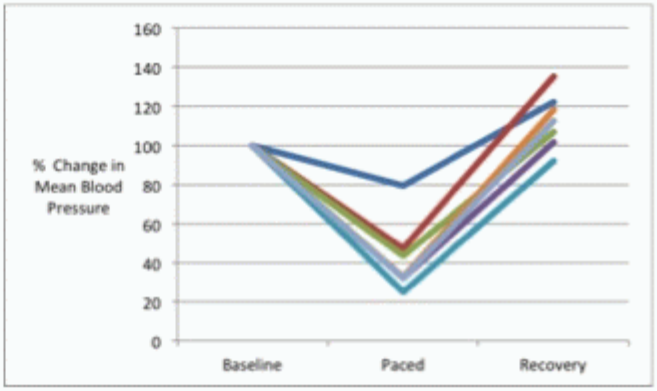

Figure 2. Line Plot demonstrating the percentage change in blood pressure from baseline (2 minutes prior to ventricular pacing) to during pacing and 2 minutes following the cessation of pacing.

Blood Pressure (MAP) 2 Minutes Prior to Pacing	Blood Pressure (MAP) During Pacing	Percent change	Bispectral Index	Blood Pressure (MAP) 2 Minutes After Pacing	Percent change
100/44 (63)	88/35 (50)	79	67	126/52 (77)	122
90/41 (57)	44/19 (27)	47	57	125/53 (77)	135
110/52 (71)	40/27 (31)	44	51	122/53 (76)	107
91/48 (62)	23/18 (20)	32	58	92/48 (63)	101
93/50 (64)	19/15 (16)	25	23	82/47 (59)	92
76/45 (55)	23/15 (18)	33	26	87/54 (65)	118
74/47 (56)	22/16 (18)	32	23	86/52 (63)	112

Table 1. Blood pressures, percentage changes from baseline and post-pacing, and Bispectral Index values during pacing episodes.