Effect of Temporary Clipping on Intraoperative Somato-sensory Evoked Potentials and Stroke Rates After Clipping of Intracranial Aneurysms

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Introduction

Somato-sensory evoked potential (SSEP) monitoring can assist in cerebral aneurysm surgery by providing functional correlations of cortical activity when cerebral blood flow is impaired.[References 1,2] The outcomes of 663 patients (691 cases) were analyzed to determine the impact of temporary clipping on SSEP changes and post-operative stroke.

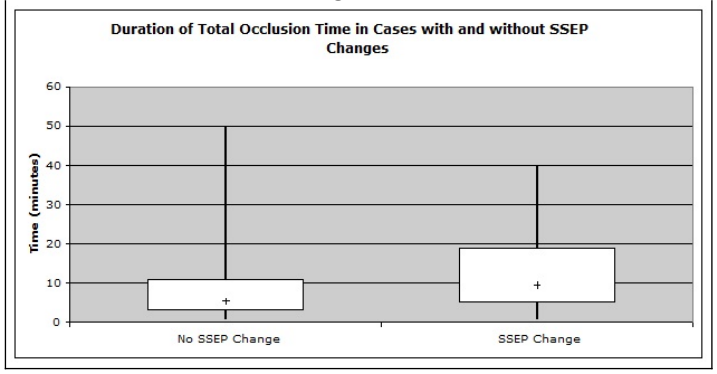
Methods

691 consecutive aneurysm cases from 2004-2009 at the Johns Hopkins Hospital were analyzed for significant change on intraoperative SSEP monitoring and for presence and total time of temporary clipping (minutes=min). Post-operatively, symptomatic patients underwent CT imaging to assess for clinically relevant ischemia. Outcomes were assessed at time of discharge and last follow-up using the Glasgow Outcomes Scale (GOS). Significance was calculated using Fisher's exact test for SSEP change and stroke rates and unpaired t-test for temporary clipping time and GOS outcomes.

Study Demographics

	Aneurysm Cases	Patients
Total analyzed in study:	691	663
Average patient age:	52.8 years	
Gender:	Female = 496 (74.8%)	
Total Aneurysms by Location:	Anterior circulation = 668 (96.7%) Posterior circulation = 23 (3.3%)	
Total Unruptured Aneurysms by Location:	Anterior circulation = 391 (97.0%) Posterior circulation = 12 (3.0%)	
Total Ruptured Aneurysms by Location:	Anterior circulation = 277 (96.2%) Posterior circulation = 11 (3.8%)	
Total Cases with Temporary Clipping	372 (53.8%)	
Unruptured Cases with Temporary Clipping	191 (27.6%)	
Ruptured Cases with Temporary Clipping	181 (26.2%)	
Average Time of Temporary Clipping	8.7 minutes (range = 1 – 50 min)	

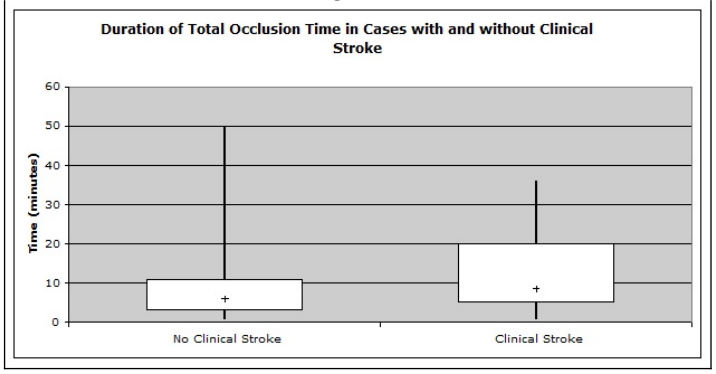
Figure 1



Results

Of the 691 cases, 373(54.0%) cases underwent temporary clipping with an average clipping time of 8.7min. The incidence of SSEP change in cases with temporary clipping was significantly higher than in cases without temporary clipping: 38 (10.2%)39(10.5%) vs. 8(2.5%)(p<0.0001). The incidence of clinically evident post-operative stroke was also significantly higher in cases with temporary clipping than in cases without temporary clipping: 36(9.7%) vs. 16(5.0%)(p=0.03). In cases with temporary clipping, the mean clipping time in cases with SSEP changes was 12.8min, significantly higher than the 8.9min in cases without SSEP changes(p=0.02) In cases with temporary clipping, the mean clipping time in cases with post-operative stroke was 12.0min, significantly higher than the 8.3min in cases without stroke(p=0.02). The median clipping time in cases with temporary clipping and SSEP changes was 9.5min compared to 5.5min in those cases with no SSEP changes (Figure 1). The median clipping time in cases with temporary clipping and stroke was 8.5min compared to 6min in those cases with no stroke (Figure 2). The average discharge GOS was significantly lower in cases with temporary clipping than in cases without temporary clipping(p=0.009). Although not significant, average follow-up GOS was 4.2 in cases with temporary clipping and 4.4 in cases without temporary clipping.

Figure 2



Conclusions

Temporary clipping was associated with a significant increase in rates of intraoperative SSEP change, post-operative stroke, and a significant decrease in discharge GOS score in this patient population. In patients with post-operative stroke, temporary clipping time was significantly longer than in patients without post-operative stroke.

Learning Objectives

1) Temporary clipping during aneurysm surgery may be associated with increased rates of SSEP change and post-operative storke.
2) In this series, temporary clipping time was significantly longer in patients with post-operative stroke than in patients without post-operative stroke.

References

1) Branston NM, Symon L, Crockard HA, Pazstor E. Relationship between the cortical evoked potential and local cortical blood flow following acute middle cerebral artery occlusion in the baboon. Exp Neurol. 1974;45(2):195-208.
2) Schick U, Dohnert J, Meyer JJ, Vitzthum HE. Effects of temporary clips on somatosensory evoked potentials in aneurysm surgery. Neurocrit Care. 2005;2(2):141-149.