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Pilot Retrospective Study Investigating ETCO2 in Stroke Patients for Emergency Thrombectomy using JED (Jaw Elevation Device).

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Background

More than three-quarters of a million patients experience acute ischemic stroke (AIS) annually in the United States. Up to half of these patients present with large vessel occlusion (LVO) of a major intracranial artery.[1]

Several recent reviews of multicenter prospective random controlled trials have concluded that there is "strong evidence" that endovascular therapy in addition to intravenous thrombolysis improves outcome in patients with AIS secondary to anterior circulation LVO.[1,] Subgroup analysis of these data reveals that patients with LVO who underwent endovascular therapy demonstrated marked improvement in functional outcome and independence at three months.[1,3] Acknowledgement of the role of successful team approach for the acute immediate management of ASI patients with LVO has promoted the development of acute stroke care teams around the world.[2] By maximizing outcome with the understanding that "Time Is Brain" [Khatri 2009], and that "Door-to-Groin" times[2] are essential indicators of patient outcome in LVO, the anesthesiologist is positioned as an ideal leader to direct the patient from the ambulance bay, into the interventional radiology suite, and through recovery.

Currently there is some controversy of whether patients undergoing endovascular therapy for LVO are best managed with a general anesthesia (GA) or conscious sedation (CS). Several investigators have highlighted superior outcomes with CS , and greater anesthesiologist preference for CS. Arguments for CS include avoidance of inhalational agents with concurrent hypotension , cerebral hypoperfusion, intracerebral steal ,and prevention of marked systemic and cerebral perfusion derangements during induction and emergence following GA.[11] One of the challenges of managing patients with AIS with LVO under CS is maintaining the airway during procedures that require field avoidance and adequate depth of anesthesia to prevent significant patient movement. These procedures can be complicated by hypoxia and hypoventilation. Hypercarbia may lead to marked hemodynamic and cerebrovascular instability. Lack of adequate depth of anesthesia may lead to patient movement with resulting vascular injury and intracranial hemorrhage.[10]

The Neuroanesthesiology, Interventional Radiology, and Neurosurgical teams at our institution, a large academic tertiary care center located in an urban setting, prefer CS for endovascular therapy for anterior circulation LVO. To avoid the compilations of airway obstruction and inadequate anesthetic depth, we have adopted the routine use of The Jaw Elevation Device - The JED (LMA of North America, San Diego, CA) for endovascular treatment of LVO during CS. The JED is an externally applied, noninvasive device which assists the anesthesiologist in performing a jaw thrust maneuver while comfortably maintaining the patients head in a fixed position. The need for the anesthesiologist to manually maintain a jaw thrust during the procedure and use of radiation is eliminated and the use of The JED insures that the anesthesiologist does not interfere with radiographic image.

Table 1 Demographics for CS and JED patients

	Age (years)	Male |Female (%Male Total)	BMI
CS	68.16	30 | 23 (56%)	29.62
JED	60.25	3 |5 (38%)	31.82

Materials and Methods

After IRB approval, all patients undergoing acute thrombectomy for stroke from January 1, 2017 through April 30, 2018 were reviewed in the EPIC EMR at our institution. Patients were segregated into GA, CS, and CS with JED (JED) groups. Both CS and JED groups received CS at discretion of attending anesthesiologist.

The hemodynamic, oxygenation, and ventilatory data were obtained by using a propriety algorithm written in PHP to parse and aggregate all SBP, DBP, HR, SpO2 and ETCO2 on all patients undergoing CS or JED.

Demographics are presented in Table 1. The results were analyzed using a student one-sided t-Test with correction for unequal variance with the Microsoft Excel statistical package. Based on our interest in the fluctuation of the hemodynamic and ventilatory values of these parameters, we also analyzed the variances using the same student t-Test. P-value < 0.05 was considered statistically significant.

Results

There were 83 patients who underwent thrombectomy. 22 underwent GA and were excluded. 53 were in the CS group and 8 were in the JED group. Means of ETCO2 were significant for the JED group to p < 0.05.

Means of variance for the ETCO2 were significant for the ETCO2 group p < 0.005.

Mean SpO2 was not significant for the two groups, however, t-Test of variances for the two groups was significant (Table 2). Hemodynamic data including SBP, DBP and HR did not differ between the two groups.

Table 2 ETCO2, SpO2 and Hemodynamic Data for CS and JED patients

Parameter	Mean | Variance	Value (CS | JED)	Statistical Significance (p)
ETCO2	Mean	20.54 | 27.22	0.049*
	Variance	74.47 | 29.90	0.0005*
SpO2	Mean	0.980 | 0.978	>0.05
	Variance	0.0005| 0.0002	0.015*
HR	Mean	78.68 | 76.67	>0.05
	Variance	69.46 | 60.51	>0.05
SBP	Mean	138.49 | 127.43	>0.05
	Variance	259.30 | 176.59	>0.05
DBP	Mean	81.73 | 83.86	>0.05
	Variance	136.74 | 178.65	>0.05

Conclusion

While this is a small retrospective review, it highlights that the use of the JED may provide more reliable ventilation with less fluctuation in ETCO2 and SpO2.

The use of the JED *may* facilitate more reliable ventilation in these patients with less intrusion during procedure from anesthesiologist.

The study also shows that the JED is a practical device for use during neuroangiography and thrombectomy.

Other factors to be explored in the future will include the ability to give a more generous sedation regimen without airway obstruction.

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