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WHAT TYPE OF PRESENTATION

1. **Case example or small case series (<10)**
2. **Research study (n>10)**

Impact of inhalational anesthetic agents on the baseline monitorability of motor evoked potentials (MEPs) during spine surgery: A review 16,559 cervical procedures.

INTRODUCTION/BACKGROUND: During cervical spine surgery**,** motor evoked potentials (MEPs) are often utilized to monitor both spinal cord and spinal nerve root function. While there are reports evaluating the impact of anesthesia on the reliability of MEPs to monitor spinal cord function, less is known about the impact on monitoring spinal nerve root function.

METHODS: Baseline MEP data from a total of 16,559 extradural cervical spine procedures utilizing multimodality intraoperative neuromonitoring (IONM) including MEPs between January 2017 and March 2020 were obtained from a multi-institutional database. Patients younger than 18, and procedures involving tumor resection were excluded.

Two cohorts were delineated based on the anesthetic regimen: a total intravenous anesthesia (TIVA) regimen versus a regimen balanced with volatile inhalational and intravenous agents. The objective was to compare the baseline monitorability and amplitude of MEPs between the two cohorts.

At the start of every procedure, the baseline monitorability of each muscle MEP was evaluated by the IONM team in real-time, communicated to the surgeon, and recorded in the patient's electronic medical record. The relationship between the anesthetic regimen and baseline monitorability was estimated using mixed effects logistic regression. A random subset of the procedures was retrospectively reviewed and the amplitude of each muscle MEP at baseline was measured. A mixed-effects linear regression models was used to estimate possible differences in average amplitude associated with anesthesia regimen.

RESULTS: Baseline MEPs were reported monitorable from all targeted muscles at the start of surgery in 86.8% of procedures in the TIVA cohort but in just 59.3% of procedures in the Balanced cohort, yielding a raw disparity of 27.5%. The model-adjusted monitorability disparity between cohorts for a given muscle MEP ranged from 1.0% -16.6% but was smallest for distal intrinsic hand and foot muscle MEPs (1.1 and 1.0% respectively) and was largest for proximal upper extremity muscle MEPs (deltoid: 10.8%, biceps brachii: 8.8%, triceps: 13.0%) where the monitorability was significantly decreased in the Balanced cohort relative to the TIVA cohort ($P < 0.0001$) (Table 1).

For both anesthetic cohorts, median proximal muscle MEPs were smaller in amplitude (deltoid, biceps, triceps) that the distal hand MEPs, and between cohorts, the median amplitude of MEPs from all muscles were smaller in the Balanced cohort relative to the TIVA cohort (Figure 1). The effect of the anesthetic regimen was especially pronounced on the upper extremity muscles as the model-adjusted disparity in amplitude (% smaller) was largest for the proximal muscle MEPs (deltoid: 74.3%, biceps: 78.0%, triceps: 54.9.0%; $P <0.01$) between the two anesthetic cohorts (Table 2).

CONCLUSION: TIVA is the preferred anesthetic regimen for optimizing MEP monitoring during cervical spine surgery. Inhalational agents significantly decrease MEP monitorability and amplitudes for most muscles, and this effect is especially pronounced for proximal limb muscles such as the deltoid, biceps, and triceps, which have inherently smaller baselines regardless of anesthetic regimen. This likely explains, in part, discordant reports of the sensitivity of MEPs in diagnosing nerve root dysfunction during cervical spine surgery.

Table1: Selected descriptive and inferential results for baseline MEP monitorability for each anesthesia cohort. Muscles by anesthesia cohort with a model-adjusted P-Value <0.0001 are highlighted in grey.

Muscle	Anesthesia Cohort (n)[a]	Percent Reported Monitorable (95% CI)	Model-Adjusted Percent Monitorable (95% CI)	Model Adjusted Disparity	P-Value
Deltoid	TIVA (12992)	96.3 (96.0-96.6)	**98.5 (98.1 - 98.8)**	**10.8%**	**<0.0001**
	Balanced (3086)	77.1 (75.6 - 78.6)	**87.7 (84.3 - 90.4)**		
Biceps Brachii	TIVA (5616)	94.3 (93.7 - 94.9)	**98.1 (97.6 - 98.5)**	**8.8%**	**<0.0001**
	Balanced (2847)	78.6 (77.1 - 80.1)	**89.3 (86.2 - 91.7)**		
Triceps	TIVA (9971)	92.9 (92.3 - 93.4)	**96.2 (95.2 - 97.0)**	**13.0%**	**<0.0001**
	Balanced (2229)	73.1 (71.2 - 74.9)	**83.2 (78.7 - 86.9)**		
Intrinsic Hand	TIVA (11707)	92.6 (92.1 - 93.0)	95.8 (94.8 - 96.7)	1.1%	0.0176
	Balanced (2826)	90.3 (89.1 - 91.3)	96.9 (95.9 - 97.7)		
Intrinsic Foot	TIVA (12852)	89.2 (88.7 - 89.8)	93.3 (91.7 - 94.6)	1.0%	0.207
	Balanced (3362)	83 (81.6 - 84.2)	92.3 (90 - 94.1)		

FIGURE 1: Raw peak-to-trough amplitude data in ?V for the upper extremity muscles from each anesthesia cohort (TIVA: blue; Balanced: yellow). Each measurement is plotted (circles) and the box plots show median amplitudes with interquartile ranges. MEPs greater than 8000 ?V in amplitude were plotted at 8000 ?V.

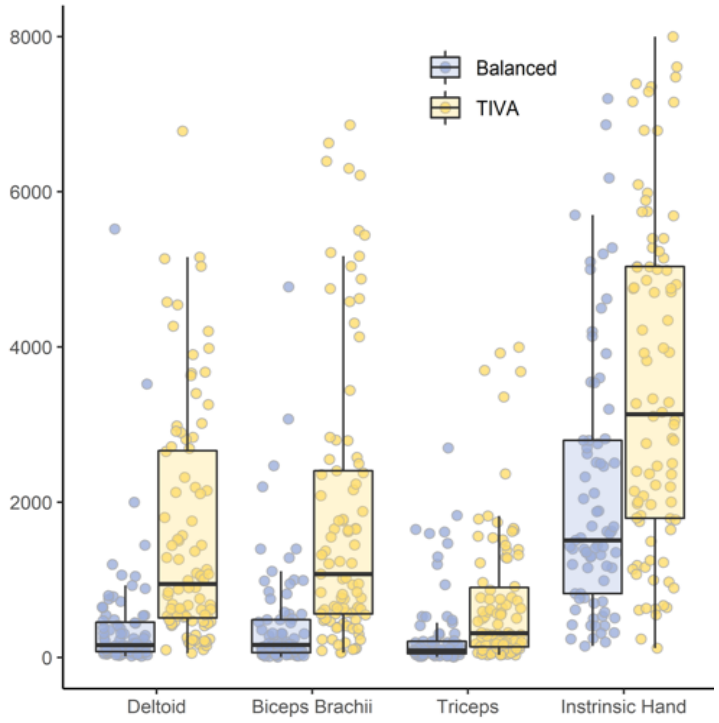

TABLE 2: Selected descriptive and inferential results for baseline MEP peak-to-trough amplitude for each muscle by anesthesia cohort. Muscles by anesthesia cohort with a disparity >50% are shown in grey.

Muscle	Anesthesia Cohort	Median Amplitude in μV [IQR]	Model-Adjusted Average Amplitude in μV (95% CI)	Model Adjusted Disparity in Amplitude	P-Value
Deltoid	TIVA	1002 [522 - 2711]	944 (667 - 1336)	**74.3%**	**<0.0001**
	Balanced	162 [76 - 456]	243 (157 - 377)		
Biceps Brachii	TIVA	1142 [564 - 2474]	1000 (707 - 1415)	**78.0%**	**<0.0001**
	Balanced	165 [62 - 488]	220 (142 - 341)		
Triceps	TIVA	314 [140 - 904]	326 (230 - 461)	**54.9%**	**0.0099**
	Balanced	92 [51 - 211]	147 (95 - 229)		
Intrinsic Hand	TIVA	3578 [1866 - 5618]	3578 [1866 - 5618]	42.1%	0.3174
	Balanced	1572 [824 - 2914]	2071 (1334 - 3214)		