Impact of Predictive Hemodynamic Monitoring on Intra-operative Hypotension and Postoperative Complications in Multi-level Spinal Fusion Surgery

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INTRODUCTION:

Prior studies report that intraoperative hypotension over 15 cumulative minutes increases the risk of complications in noncardiac surgeries. However, the occurrence of intraoperative hypotension as a modifiable risk factor for complications and prolonged hospital stay has not been widely studied. The purpose of this study is to determine if the use of Artificial Intelligence enabled predictive hemodynamic monitoring (PHM) decreases episodes of intra-operative hypotension during elective multi-level posterior instrumented spine fusions and if PHM is associated with a decrease in complications.

METHODS: Patients where PHM was used and a similar set of patients in whom PHM was not used (Non-PHM) were identified. The number of minutes of hypotension (MAP<65mmHg) and hypertension (MAP≥100mmHg), volume of fluids, blood products and vasopressors administered intra-operatively, urine output, volume of fluids and blood products administered within the first 4 hours post-operative and the number and type of post-operative complications were also collected.

RESULTS:

The 47 cases in the PHM group and 70 in the Non-PHM group were comparable in terms of demographic and operative variables. A shorter duration of intra-operative hypotension was seen in the PHM group (8.13 mins) compared to the Non-PHM group (13.28 mins, p=0.029); and a shorter duration of intra-operative hypertension seen in the PHM group (0.46 mins, range, 0-5 mins) compared to the Non-PHM group (1.38 mins, range 0 to 17 mins, p=0.032).

There was a smaller number of patients in the PHM group who had a surgical site infection (2.% vs 13%, p=0.027), postoperative nausea and vomiting (0 vs 14%, p=0.004) and post-operative cognitive dysfunction (6% vs 19%, p=0.049) compared to the Non-PHM group. There was also a statistically significant shorter length of hospital stay in the PHM (4.62 days) compared to the Non-PHM group (5.99 days, p=0.017).

DISCUSSION AND CONCLUSION:

The use of predictive hemodynamic monitoring to manage intraoperative hemodynamic instability is associated with a shorter duration of intra-operative hypotension and hypertension, lower prevalence of complications and decreased length of stay in multi-level spinal fusion surgery.

Table 1	Non-HPI	HPI	
	70	47	
Males, N (%)	38 (54%)	24 (51%)	0.850
Age, Mean (SD)	62.0 (11.9)	61.1 (13.0)	0.358
Body Mass Index, kg/m2, Mean (SD)	31.9 (6.4)	32.6 (7.2)	0.216
ASA Grade, Mean (SD)	2.8 (0.6)	2.9 (0.5)	0.210
Number of Surgical Levels, Mean (SD)	4.6 (2.6)	4.4 (2.4)	0.593
Estimated Blood Loss, mL, Mean (SD)	556.3 (445.2)	611.3 (619.0)	0.601
Operative time, minutes, Mean (SD)	260.2 (87.2)	267.8 (88.0)	0.649

Table 2	Non-HPI	HPI	
	Mean (SD)	Mean (SD)	
Duration of hypotension, mins	13.5 (19.1)	8.1 (10.7)	0.029
Duration of hypertension (MAP≥140mmHg), mins	1.4 (3.23, 0-17)	0.5 (1.0, 0-5)	0.032
Intra-operative			
Intravenous Fluids, mL	2644.1 (858.7)	2780.0 (751.0)	0.184
Colloids, mL	357.1 (293.6)	457.4 (326.9)	0.047
pRBC transfused, mL	96.0 (200.9)	116.8 (231.4)	0.348
Cell Saver Infused, mL	192.4 (237.1)	206.1 (235.5)	0.123
Fresh Frozen Plasma, mL	0	7.2 (49.3)	0.161
Vasopressors, mcg	912.2 (2671.4)	530.2 (453.2)	0.294
Post-operative			
Intravenous Fluids, mL	251.4 (194.2)	183.3 (165.2)	0.179
Colloids, mL	57.5 (362.5)	16.0 (80.8)	0.161
pRBC transfused, mL	48.0 (125.9)	59.6 (174.5)	0.383
Fresh Frozen Plasma, mL	0	23.8 (163.4)	0.169
Urine Output, mL	619.8 (475.5)	819.1 (542.5)	0.022
Urine Output, mL/Kg/Hr	1.7 (1.3)	2.3 (1.7)	0.020
Length of Hospital stay, days	6.0 (4.4)	4.6 (2.4)	0.017