Absolute values of blood pressure fluctuations as independent risk factors for postoperative delirium: Secondary, exploratory analysis of the randomized controlled “Surgery Depth of anaesthesia and Cognitive Outcome”- (SuDoCO) trial

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Background: Postoperative delirium (POD) is an acute onset of disturbance in attention / consciousness combined with cognitive deficits. It is unclear if fluctuations in intraoperative blood pressure are independent risk factors for POD.

Goal: Secondary analysis of a randomized controlled trial, primarily aimed to test the efficiency of bispectral index (BIS) guided anaesthesia for the prevention of POD.

METHODS: The “Surgery Depth of anaesthesia and Cognitive Outcome”- (SuDoCO) trial, carried out between 03-2009 and 04-2010, included ≥ 60-year-old patients scheduled for elective non-cardiac surgery of ≥ 60 minutes operation time under general anaesthesia¹. Intra-operative hand written blood pressure record sheets were digitalized and analysed using univariate and multivariate analyses. Endpoint was the cumulative POD incidence (defined according to DSM-IV) within seven post-operative days. Blood pressure fluctuations were defined as the sum of the absolute differences between two consecutive measurements during anaesthesia (see Figure 1).

RESULTS: Overall 917 complete data sets on all independent variables as well as the outcome were available. The mean age was 70.0 ± 6.5 years and n=489 (53.3%) were males. The median operation time was 2.3 (range: 0.1 to 10.1) hours and 197 patients (21.5%) developed POD. In univariate analysis, patients with POD showed higher mean systolic blood pressure (117.1 ± 10.5 vs. 114.9 ± 11.0 mmHg, p= 0.014) while there were no differences in diastolic blood pressure and mean arterial pressure (MAP, defined as [(2 x diastolic blood pressure) + systolic blood pressure] / 3). The absolute values of blood pressure fluctuations in systolic and diastolic blood pressure as well as in MAP were significantly higher in patients with POD compared to patients without POD (see Table 1). After adjustments for randomization status, age, gender, ASA physical status, MMSE pre-operatively, site of surgery, length of hospital stay, antihypertensive medication, and operation time, systolic blood pressure fluctuations (p= 0.018, see Table 2), diastolic blood pressure fluctuations (p= 0.071) as well as fluctuations in MAP (p= 0.027) were associated with POD, independently from their interactions with operation time (p= 0.063, p= 0.086, and p= 0.055, respectively).

Figure 1: Fluctuations in systolic blood pressure in five consecutive measurements, hypothetical scenario; numbers showing absolute differences in mmHg between two consecutive measurements.

Fluctuations in blood pressure (in mmHg)	All patients (n=917)	Patients with POD (n=197)	Patients without POD (n=720)	p
Systolic	260 (30 - 1,680)	330 (40 - 1,680)	240 (30 - 130)	< 0.001
Diastolic	120 (0 - 640)	160 (10 - 640)	120 (0 - 550)	< 0.001
MAP	163 (20 - 927)	207 (20 - 927)	153 (23 - 633)	< 0.001

Table1: Fluctuations in blood pressure in patients with and without postoperative delirium (POD), n = 917
Data shown as median (min - max); p-values deriving from Mann-Whitney-U-Tests; MAP = mean arterial pressure.

Predictors	Odds Ratios	p
Fluctuations in systolic blood pressure, per 10mmHg	1.025 (1.004 - 1.045)	0.018
Operation time, per hour	1.38 (1.14 – 1.67)	0.001
Fluctuations*operation time	0.996 (0.993 – 1.000)	0.063

Table2: Odds ratios of predictors of postoperative delirium, results of a multiple adjusted logistic regression model, n = 917.

CONCLUSION: Fluctuations in systolic blood pressure and in MAP, although showing a tendency for interaction with operation time, seem to be independent predictors of POD. Future studies should evaluate whether a strict blood pressure regimen, avoiding fluctuations, prevents POD, or whether patients with blood pressure fluctuations have a common risk factor for POD.

References:
¹Radtke FM et al. Br J Anaesth. 2013;110 Suppl 1:i98-105.

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