

Risk factors for post-induction hypotension in children presenting for surgery

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Introduction

- Hypotension after the induction of anesthesia and prior to incision is frequently observed in children.
- Pre-incision hypotension (PIH) may be a perioperative risk factor for morbidity in children.
- Exact incidence, clinical consequences, risk factors, as well as need for specific interventions, are often unclear
- We retrospectively assessed the incidence of and the feasibility of predicting PIH in low-risk children (ASA physical status I and II) with no preoperative hypotension or significant comorbid conditions.

Methods

- Study included data review of 200 patients aged 2-8 years scheduled for non-cardiac surgery.
- ASA status 1-2.
- Heart rate and blood pressure data reviewed after induction of anesthesia at 0, 3, 6, 9 and 12 minutes after induction.
- Exclusion criterion - preoperative SBP <5th percentile for age with SBP percentiles calculated using NIH guidelines and taking into account age, gender, and height-for-age Z-score.
- Other factors analyzed were type of induction, premedication use, preoperative SBP, preoperative HR.

PIH definition for the study

SBP <5th percentile for age:

- At any time point within 12 minutes of induction;
- Median SBP obtained during the 12 minute study period; or
- At ≥ 2 time points including final point at 12 minutes after induction

We examined incidence of PIH defined as >20% decrease in SBP from baseline:

- At any time point within 12 minutes of induction;
- Median SBP obtained during the 12 minute study period; or
- At ≥ 2 time points including the final point at 12 minutes after induction

Table 1. Characteristics of study sample according to presence of pre-incision hypotension at any time point 0-12 minutes after anesthesia induction (N=189).

Variable	PIH defined as SBP <5 th percentile for age at any time point			PIH defined as SBP >20% decrease from baseline at any time point		
	PIH absent (n=137)	PIH present (n=52)	P	PIH absent (n=82)	PIH present (n=107)	P
	Mean (SD) or N (%)	Mean (SD) or N (%)		Mean (SD) or N (%)	Mean (SD) or N (%)	
Age (y)	4 (2)	4 (2)	0.990	5 (2)	4 (2)	0.047
Female	60 (44%)	16 (31%)	0.103	37 (45%)	39 (36%)	0.228
BMI-for-age category			>0.999			0.998
Underweight	10 (7%)	4 (8%)		6 (7%)	8 (7%)	
Normal weight	90 (66%)	34 (65%)		54 (66%)	70 (65%)	
Overweight	37 (27%)	14 (27%)		22 (27%)	29 (27%)	
ASA			0.034			0.271
1	42 (31%)	8 (15%)		25 (30%)	25 (23%)	
2	95 (69%)	44 (85%)		57 (70%)	82 (77%)	
Type of induction			0.878			0.624
Inhalational	114 (83%)	44 (85%)		68 (83%)	90 (84%)	
IV	6 (4%)	1 (2%)		2 (2%)	5 (5%)	
Combined	17 (12%)	7 (13%)		12 (15%)	12 (11%)	
Premedication	52 (38%)	19 (37%)	0.857	26 (32%)	45 (42%)	0.145
Preoperative SBP (mmHg)	110 (11)	106 (11)	0.017	104 (9)	112 (11)	<0.001
Preoperative HR (bpm)	106 (19)	100 (17)	0.041	105 (21)	104 (17)	0.906

BMI, body mass index; HR, heart rate; IV, intravenous; PIH, preincision hypotension; SBP, systolic blood pressure; SD, standard deviation

Measure and time point after induction	Change from preoperative value		
	Mean (SD)	95% CI	P
SBP (mmHg)			
0 min	-10 (18)	(8, 13)	<0.001
3 min	-14 (18)	(12, 17)	<0.001
6 min	-18 (16)	(15, 20)	<0.001
9 min	-17 (15)	(15, 19)	<0.001
12 min	-16 (16)	(14, 18)	<0.001
DBP (mmHg)			
0 min	-12 (15)	(10, 14)	<0.001
3 min	-18 (15)	(16, 20)	<0.001
6 min	-23 (13)	(21, 24)	<0.001
9 min	-24 (12)	(22, 26)	<0.001
12 min	-23 (12)	(22, 25)	<0.001
MAP (mmHg)			
0 min	-11 (16)	(9, 13)	<0.001
3 min	-16 (16)	(14, 19)	<0.001
6 min	-20 (13)	(19, 22)	<0.001
9 min	-21 (13)	(19, 23)	<0.001
12 min	-20 (13)	(19, 22)	<0.001
HR (bpm)			
0 min	+12 (26)	(8, 15)	<0.001
3 min	+16 (28)	(12, 19)	<0.001
6 min	+11 (23)	(8, 14)	<0.001
9 min	+10 (21)	(7, 13)	<0.001
12 min	+12 (23)	(9, 15)	<0.001

Table 2. Hemodynamic changes in preincision period, compared to preoperative baseline values (n=189).

Results

- PIH prevalence according to each definition ranged from 4 to 57%.
- Pairwise agreement among definitions ranged from 49% to 91%.
- SBP percentile for age and SBP percent decline from baseline showed poor agreement.
- At all time-points after induction, there were significant decreases in average SBP, diastolic blood pressure (DBP), and mean arterial pressure (MAP), relative to baseline values (Table 2).
- No sequelae of PIH were noted..
- In stepwise multivariable analysis predicting PIH, no covariates were statistically significantly associated with PIH when it was defined as SBP <5th percentile-for-age at median observation, or sustained SBP <5th percentile-for-age (definitions 2 and 3).

Discussion

- In our relatively healthy cohort, accurate prediction of PIH appears to be hampered by lack of agreement between definitions.
- When PIH was defined according to a decline in SBP >20% from baseline, the estimated incidence of PIH was higher, but measures of PIH based on SBP percent decline from baseline demonstrated poor agreement with measures of PIH based on SBP percentile-for-age
- Further studies could validate a single definition of PIH in normotensive children.

References

- Nafiu OO et al. Incidence and risk factors for preincision hypotension in a noncardiac pediatric surgical population. Paediatr Anaesth 2009;19:232-239.
- Stewart M et al. Association of elevated preoperative blood pressure with preincision hypotension in pediatric surgical patients. Paediatr Anaesth 2016;26:844-851