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DETERMINING BASELINE BLOOD PRESSSURE IN PATIENTS FOR ELECTIVE SURGICAL PROCEDURES AT VARIOUS PRE-ANESTHETIC VISITS

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Abstract

Background: Blood pressure (BP) is volatile in nature and also it affects post-operative outcomes therefore, regular perioperative BP monitoring is essential. Intraoperative variability of BP is permitted in range and proportion to baseline BP according to various guidelines. Pre-operatively BP is measured many times and it is highly variable. In this study we attempt to predict which pre-operative BP can be used as reference during intraoperative monitoring.

Methods: This observational study was conducted at hamidia hospital, Bhopal. 260 normotensive patients undergoing elective surgery who got clearance during PAC were enrolled. BP was measured by gold standard mercury sphygmomanometer in PAC clinic (PAC_1), review PAC one day prior to surgery (PAC_2), morning BP in preoperative room (POR) and inside OT room (IOR) before surgery.

Results: In 260 enrolled patients males were slightly predominant 52.31%. Mean age was 34.68±11.63 years. Mean of Systolic BP (SBP) during PAC_1, PAC_2, Morning BP in POR and IOR prior surgery were 122.85±8.24, 118.18±8.08, 123.06±8.24 and 135.73±10.24 respectively and was significant (P<0.001). Mean of heart rate (HR/minute) during PAC_1, PAC_2, Morning BP in POR and IOR prior surgery were 79.77±7.22, 78.90±7.44, 80.40±7.49 and 89.15±7.60 respectively and was significant (P<0.001).

Conclusions: Aaaaaa Due to stress of surgery SBP and HR were significantly higher in IOR just prior surgery. Also, BP of PAC_2 at ward was lowest though not significantly lower than BP in PAC_1 or POR. Thus, BP of PAC_2 can be used as an ideal reference BP but larger study is required for further generalization.

Keywords: Systolic Blood Pressure, Diastolic Blood Pressure, Mean Blood Pressure

Introduction:

Intraoperative intensive pulse and blood pressure (BP) measurement are essential tools to determine surgical outcome[1]. There are various studies which correlate intraoperative hypotension or hypertension to surgical outcomes. Perioperative hypotension is associated with various unfavorable outcomes, including increased mortality[2], longer hospitalization[3], all-cause morbidity[4], acute kidney injury[5], and postesophagectomy anastomotic leakage[6]. Also, studies prove perioperative hypertension is associated with poor surgical outcomes like increased hospital stay, morbidity and mortality[7]. Intraoperative hypertension may also be associated with increased bleeding or myocardial ischemia during surgery[1]. Intraoperative hypotension defined by various studies include both absolute (eg, mean arterial pressure [MAP], <65 mm Hg) and relative (MAP reduction ≥20% baseline) thresholds. There is no clear definition of intraoperative hypertension but some studies use SBP > 160 mmHg without any duration specification[7]. Although BP play vital role in surgical and anesthetic outcomes but clear consensus on perioperative BP targets are never defined. In 2018 AHA tried to figure out various recommendation on the basis of type of surgery and baseline BP[1]

Clearly, baseline BP plays role in deciding perioperative BP targets but, baseline BP has various physiological determinants. Basic principle of hemodynamics is that BP is positively correlated to cardiac output and peripheral vascular resistance [8]. Cardiac output is equal to product of heart rate and stroke volume (depends on myocardial contractility and valve condition). Peripheral vascular resistance is regulated by sympathetic system. Thus BP depends on age, sex, autonomic activity and diurnal variation. It also depends on comorbidities and condition of patient undergoing sugery like, cardiac condition, CV, renal function, traumatic bleeding and septicemia. Surgery is a stressful situation and patients get anxious inside operative room, therefore BP measure inside operation theatre (OT) is upregulated by autonomic (sympathetic) regulation.

Methods

All normotensive patients admitted in Hamidia hospital or Sultania Hospital from Dec 2018 to Nov 2019 in various department undergoing elective surgery irrespective of type of surgery after proper preanesthetic checkup (PAC). The

patients should be investigated by various basic lab investigations (CBC, LFT, RFT, RBS, Electrolyte, ECG and chest X ray) to look for various comorbidies and risk factors during surgery. These patients should get clearance from various departments according to risk factor and comorbidities. These patients should undergo advance investigations as advised by various specialties while clearance. If any comorbidity that require pre operative correction should undergo correction first followed by review PAC clearance. While performing PAC, examination 1 day prior surgery and intraoperatively BP measurement is done with gold standard mercury sphygmomanometer as per guidelines recommended by AHA ie,

a) Patient should be seated comfortably, with uncrossed leg and back supported.
b) Cuff length and width should be 80% and 40% of arm circumference, respectively.
c) Cuff should be deflated at 2mm Hg/sec.
d) Column or dial should be read to nearest 2 mm Hg.
e) First audible Korotkoff sound is systolic pressure; last sound, diastolic pressure.
f) There should be no talking between subject and observer (or other person).

Inclusion criteria

All normotensive patients undergoing elective surgery for various reasons who underwent PAC checkup atleast 1 day prior and within 1 month are included in our study.

Exclusion criteria

- All emergency surgeries are excluded.
- Patient having baseline hypertension or chronic hypertensive controlled with antihypertensive medication are excluded.
- Patient with LV dysfunction, valvular heart disease and peripheral artery disease are excluded.
- Patient with atrial fibrillation or any other kind of arrhythimia leading to beat to beat variability of BP are excluded.

Results

In this study 260 Patients were recruited from one centre Hamidia Hospital Bhopal. All the recruited patients were non hypertensive and planned for elective surgery. Mean age of patients in our study was 34.68±11.63 years, out of 260 patients 136 (52.31%) were males. Majority of the patients in our study were of ASA grade I & II (72.6%). More than half of our patients had undergone general/orthopaedic surgery. 121(46.53%) patients underwent surgery in general anaesthesia. 85 /260 (32.69%) patients underwent surgery in spinal anaesthesia. 10% cases in our study received Brachial Block for orthopaedic surgery. In this study comorbidities were present in 100 (38.46%) patients with major contribution by diabetes of 20% of total patients. Majority of patients were without comorbidity of 61.54% **(Table 1)**.

In our study mean systolic B.P during 1st PAC at PAC clinic (PAC1) was 122.85±8.24 mmHg. While one day prior surgery during review PAC (PAC2), it was slightly lower with mean value 118.18±8.08 mmHg but was insignificant. However, mean SBP inside OT room (IOR) prior to surgery, it was significantly higher than rest of the three previous readings according to ANOVA test with mean value 135.73±10.24 mmHg. Similar pattern of findings were also seen for mean Diastolic BP (DBP) and mean of mean Blood pressure (MBP) **(Table 2, 3)(Figure 2)**.

Mean diastolic blood pressure & mean of MBP was lowest on PAC2 with value 77.8±6.97 mmHg and 91.27±7.12mmHg respectively. Both of mean DBP and MBP values were significantly higher on IOR than all previous recordings with values 86.38±6.95 mmHg and 103±7.43 mmHg respectively **(Table 2, 3)(Figure 2)**.
Mean H.R among all the three recordings other than IOR recording had insignificant difference with lowest value of PAC2. The value of mean HR at PAC 2 was 78.91±7.44 min **(Table 2, 3)(Figure 3)**. Mean HR during IOR was highest with value 89.15±7.60 and was significantly higher than other 3 readings according to ANOVA test.

Table 1: Demographic Table and Baseline characteristic

VARIABLE	N/Proportion
Age	34.68±11.63
Gender	136(52.31%
ASA	
I	80 (30.7%)
II	109 (41.9%)
III	45 (17.3%)
IV	26(10%)
TYPE OF SURGERY	
General	85 (32.69%)
Gynaecology	18 (6.92%)
Urology	20 (7.69%)
Neurology	10 (3.84%)
Orthopedic	81 (31.15%)
ENT	46 (17.69%)
COMORBIDITY	
COPD	22 (8.46%)
Diabetes	52(20%)
Cerebrovascular	13(5%)
Liver Disease	13(5%)
None	160(61.54%)
TYPE OF ANAESTHESIA	
General Anaesthesia	121 (46.53%)
Spinal Anaesthesia	85 (32.69%)
Combine Epidural Anaesthesia	28 (10.76%)
Brachial Block	26 (10%)

Table 2: Comparison of Mean Blood Pressure and Heart rate prior surgery

Variables	PAC_1 *	PAC_2 α	POR μ	IOR §	P-Value
Mean Systolic Blood Pressure	122.85±8.24	118.18±8.08	123.06±8.24	135.73±10.24	P<0.001
Mean Diastolic Blood Pressure	80.5±7.39	77.8±6.97	80.88±7.80	86.38±6.95	P<0.001
Mean Blood Pressure	94.62±7.50	91.27±7.12	94.94±7.63	103.49±7.43	P<0.001
Mean Heart Rate	79.77±7.22	78.91±7.44	80.4±7.49	89.15±7.60	P<0.001

* - First measurement at PAC clinic
α – review PAC one day prior to surgery
μ - Morning reading in preoperative room
§- Inside OT room before surgery

Table 3: T- Test For difference in Values of PAC_1 and PAC_2

Variables	PAC_1 *	PAC_2 α	P-Value
Mean Systolic Blood Pressure	122.85±8.24	118.18±8.08	P=0.09
Mean Diastolic Blood Pressure	80.5±7.39	77.8±6.97	P=0.08
Mean Blood Pressure	94.62±7.50	91.27±7.12	P=0.12
Mean Heart Rate	79.77±7.22	78.91±7.44	P=0.32

* - First measurement at PAC clinic
α – review PAC one day prior to surgery

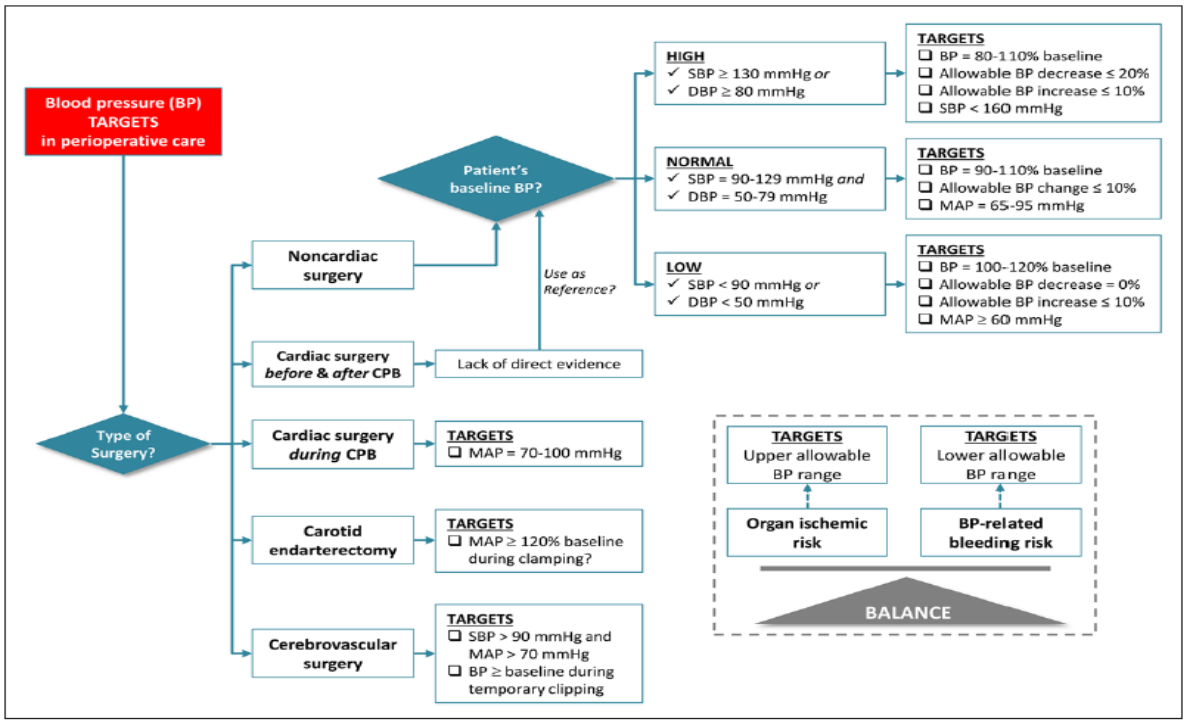

Figure 1: Perioperative BP targets based on type of surgery and baseline BP

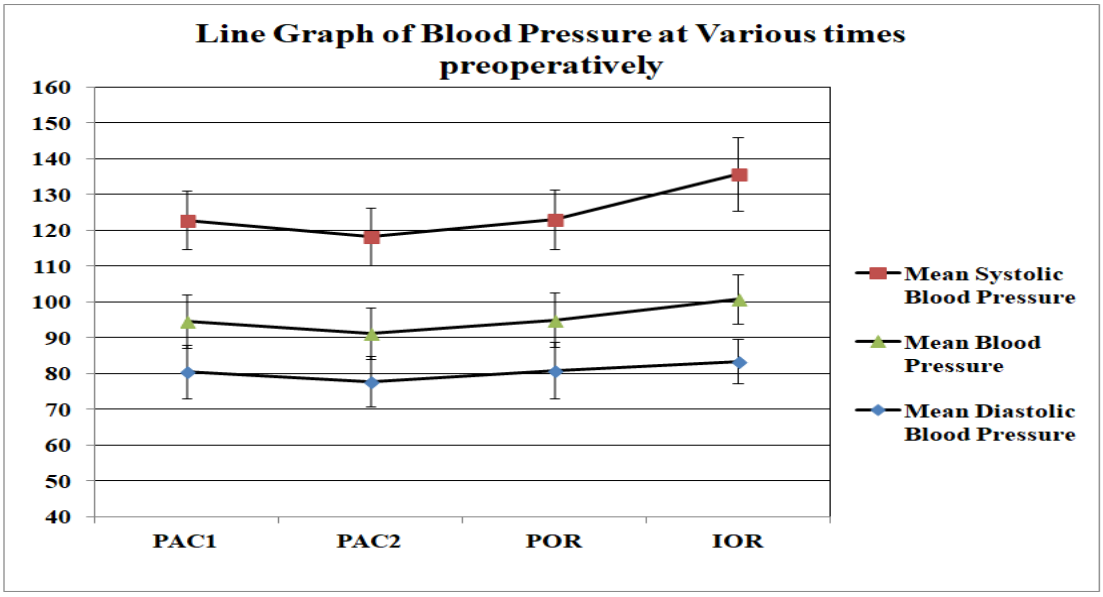

Figure 2: Line Graph of Blood Pressure at Various times preoperatively

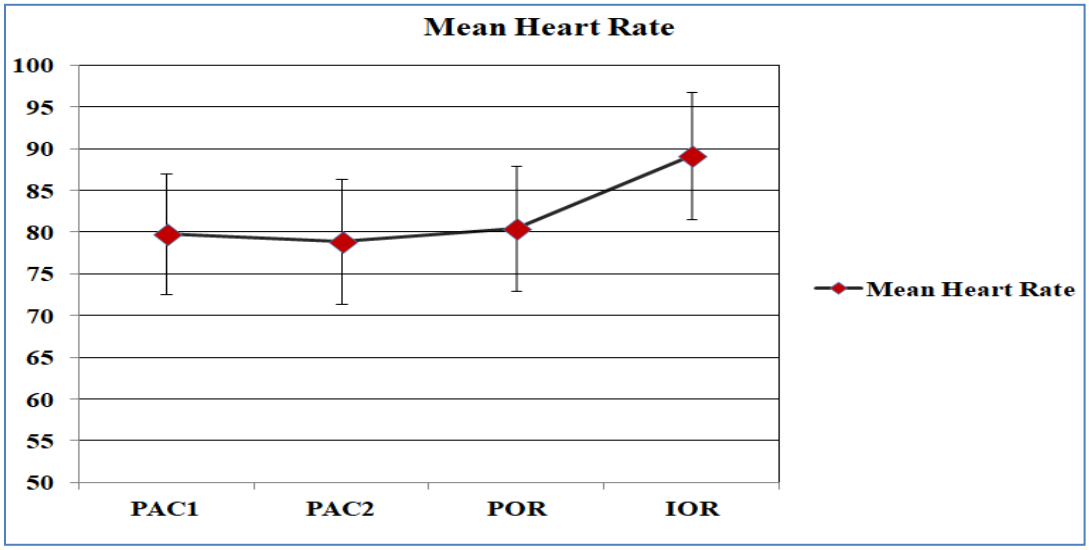

Figure 3: Line Graph of Mean Heart Rate during different times prior to surgery

Discussion

Intraoperative hypotension or hypertension during any noncardiac or cardiac surgery results in unfavourable outcomes[1,7,9,10]. However this intraoperative hypotension or hypertension is defined in the form of percentage of baseline blood pressure. The baseline blood pressure has disputed definition which surrounds around two schools of thought. One school of thought considers blood pressure inside operative room as baseline in contrary other considers blood pressure measured during PAC or measured in outside operative room as baseline blood pressure. In this study we attempted to define baseline blood pressure and also assessed the variations in blood pressure during various point of time from first PAC to inside OT room just prior surgery.

Intraoperative hypotension leads to poor outcome in the form of mortality, major morbidity, watershed stroke and AKI. While, intraoperative hypertension leads to stroke and post operative delirium.

In this study blood pressure was measured four times before surgery with the help of mercury sphygmomanometer. We observed that mean of SBP, DBP and MBP inside OT room just prior surgery was significantly higher than rest of the three readings with values 135.73±10.24mmHg, 86.38±6.95mmHg and 103.49±7.43mmHg respectively. Also, mean of SBP, DBP and MBP during PAC2 was lowest with value 118.18±8.08mmHg, 77.8±6.97mmHg and 91.27±7.12mmHg respectively. Although these values of PAC2 are lower than values of PAC1 numerically but didn't have significant difference statistically. Along with

mean of blood pressure, mean HR during IOR is significantly raised than other readings. These all observations can be explained on the basis of analogous phenomenon of white coat hypertension [11]. However in these cases blood pressure is not higher than normal but on the upper limit of normal range. The catecholamines plays crucial role in affecting the readings during IOR measurement. Stress induces sympathetic overdrive which itself leads to spillage of catecholamine. These catecholamines increase heart rate, produce ionotropic effect and increase in cardiac output. The combined effect of all of the above factors leads to increase in blood pressure and overestimation of baseline BP.

In a retrospective study from California it was demonstrated that SBP in operating room is 16mmHg higher than preoperating room. They also showed 7 month post surgery ABPM correlates better with blood pressure recorded during PAC or preoperative room [11]. Another Japanese study concluded that approximately 20mm of augmentation of SBP occurs inside operating room in comparison to hospital room[12]. The studies conducted by John L ard and colleagues among 2087 patients inferred that blood pressure measurement done prior to entrance in operating room differ significantly from BP measured inside OT room[13]. Therfore, BP readings prior to entrance in operating room can be considered as baseline BP.

Strength and limitations

This study tried to address preoperative blood pressure with three reference blood pressures with two readings excluding the BP on the day of surgery. BP measured perioperatively was by mercury sphygmomanometer though banned but a gold standard. The study was performed in good number of patients undergoing variety of surgeries though from single centre and small population group of particular ethnic group and race.

Conclusion

Perioperatively many factors affect hemodynamic parameters including operative stress. These hemodynamic parameters independently affect the outcomes. This study suggested PAC_2 can be used as reference BP to define relative hypotension or hypertension to predict outcome. IOR BP is a poor reference BP parameter to predict hemodynamic detoriation. Larger and multicentric study is required to generalize the finding of this study

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