

## Comparison of efficacy of colloid pre-load versus combination co-load in prevention of hypotension during spinal anesthesia for elective inguinal hernia repair

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### Abstract:

**Introduction:** Hypotension following spinal anesthesia occurs due to sympathetic blockade which leads to decreased venous return and cardiac output. Various methods to prevent it are used in surgical patients. This randomized controlled study was done to compare the efficacy of colloid pre load versus combination co-load in prevention of hypotension during spinal anesthesia for elective inguinal hernia repair in Department of Anesthesia and General Surgery at DHQ Teaching Hospital, Haripur.

**Objective:** To determine efficacy of colloid pre-load versus combination co-load in prevention of hypotension during spinal anesthesia for elective inguinal hernia repair.

**Settings:** Department of surgery and anaesthesia DHQ Teaching Hospital, Haripur.

**Study design:** Randomized controlled study

**Duration:** Six months from 1<sup>st</sup> August 2018 to 31<sup>st</sup> January 2019.

**Material and Methods:** In this study, 96 patients needing elective inguinal hernia repair were included. Inclusion and exclusion criteria were applied. Patients were randomly assigned into 2 groups by blocked randomization of 48 each. Colloid pre-load group received 500ml of 6% penta starch and combination co-load group received 250ml of 6% penta starch and 750ml of Ringer's lactate solution. Subarachnoid block with 2ml of .75% heavy bupivacaine was given and blood pressure was monitored till end of surgery. Hypotension was taken as systolic blood pressure <80% of baseline at two different occasions. It was treated with 50 micrograms of aliquots of phenylephrine.

**Results:** Age range was from 18 to 35 years with mean age of  $28.708 \pm 2.86$  years in colloid pre-load group while  $27.750 \pm 3.07$  in combination co-load group. Mean weight was  $73.291 \pm 9.70$  kilograms in colloid pre load group and  $77.875 \pm 7.09$  in combination co-load group. Efficacy was 5 (10.4%) patients in colloid pre load group as compared to 17 (35.4%) patients in combination co-load group ( $p=.003$ ).

**Conclusion:** Incidence of hypotension was better reduced by crystalloid co-load combination compared to colloid preload over a hydration period of 15 minutes.

**Keywords:** Hernia, Hypotension, crystalloid co-load, colloid preload (CPL), subarachnoid block, heavy bupivacaine.

### Introduction:

Hypotension following spinal anesthesia (SA) occurs in 25 to 75% population.<sup>1</sup> In present mini review effects of pre loading and co-loading with fluids to prevent hypotension in patients were evaluated. Pathophysiology of events reveals that hypotension occurs secondary to sympathetic blockade that initiates series of events

leading to decreased cardiac output (CO).<sup>2</sup>

Efficacy of preloading especially with crystalloids results in rapid redistribution of fluid into extra vascular compartment thus off-setting benefits.<sup>3</sup> In one study, frequency of hypotension was 97% in colloid preload (CPL) group as compared to 68% in combination co-load

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(CCL) group after spinal anesthesia.<sup>4</sup>

Although the use of mean arterial pressure to define hypotension is physiologically logical, traditionally most studies have been based on changes in systolic blood pressure (SBP). Common definition of hypotension include a proportional decrease in SBP e.g. <70% to 80% of baseline) or decrease in SBP below an absolute value (e.g. <90 to 100 mmHg). During SP, heart rate, blood pressure, oxygen saturation is continuously monitored & managed accordingly. Automated oscillometric measurement of blood pressure is standard method of monitoring used in most operation theatres.

Intravenous pre-hydration with crystalloid is most popular non pharmacological method for preventing hypotension. Rationale for it, is to maintain or augment cardiac output (CO) and thus prevent or attenuate hypotension.

One study showed only moderately decreased incidence of hypotension from 71% to 55% with this method.<sup>5</sup>

Recently colloid solutions (with long intravascular stay) showed better results in preventing hypotension.<sup>6</sup>

#### **Material and Methods:**

Objective of the study was to compare the efficacy of CPL versus CCL in prevention of hypotension during spinal anesthesia for elective inguinal hernia repair.

Efficacy was defined as no hypotension before the end of surgery. Hypotension was defined as systolic blood pressure <80% of baseline value after SP at two different occasions before end of surgery.

Randomized study was conducted at Department of Anesthesia and Surgery DHQ Teaching Hospital, Haripur from 1<sup>st</sup> August 2018 to 31<sup>st</sup> January 2019.

Estimated sample size n=96 (48 in each group) was calculated using WHO software for health studies.

Formula for two population proportion (two sided) is used with following assumptions

Statistical significance= 5% Statistical power= 80%

Anticipated hypotension in population of CPL=91%

Anticipated hypotension in population of CCL=68%

Non-probability consecutive sampling was done.

Prior permission for study was taken from Ethical committee of DHQ Teaching Hospital, Haripur.

All inguinal hernia patients with age range from 18 to 35 years who required elective surgery were included in study. Those with history of hypertension, cerebrovascular accidents, allergy to drugs used or with American Society of Anesthesiologists (ASA) III, IV, V and VI grade and having contra-indications to spinal anesthesia due to any medical condition were excluded from trial.

Patients fulfilling the inclusion criteria were randomly assigned by blocked randomization to two groups (CPL and CCL) of 48 each after obtaining permission from Ethical Committee and informed consent.

After baseline demographic (age and weight) entry and admission to surgery ward, all patients received 50mg of intravenous ranitidine for gastric acid aspiration prophylaxis. CPL group received 500ml of 6% penta starch 10 to 15 minutes before SA and CCL group received a combination of 250ml penta starch and 750ml of Ringer's lactate solution immediately after SA. All patients received 2ml of 0.75% heavy bupivacaine at L2/L3 or L3/L4 intervertebral space with 25 gauge spinal needle by anesthetist in sitting position over 12 seconds. Patients were immediately lied down and blood pressure monitoring started every 5 minutes. Hypotension was taken as SBP <80% of baseline value at two

Table 1: Mean± SD of age and weight in both groups

Demographic variables	CPL group	CCL group
	Mean ± SD n=48	Mean ± SD n=48
Age (years)	28.708±2.86	27.750±3.07
Weight	73.291±9.70	77.875±7.09

Table 2: Frequency and percentage of efficacy in both groups n=96

Efficacy	CPL group	CCL group	P value
	n=48	n=48	
Yes	5(10.4%)	17(35.4%)	0.003
No	43(89.6%)	31(64.6%)	
Total	48 (100%)	48(100%)	

Table 3: Stratification of efficacy with respect to age in both groups

Group	Efficacy		P value
	Yes	No	
For age group 18-25 years			
CPL Group	3(37.5%)	5(62.5%)	0.769
CCL Group	7(43.8%)	9(56.2%)	
For age group 26-35 years			
CPL Group	2(5%)	38(95%)	0.003
CCL Group	10(31.2%)	22(68.8%)	

Table 4: Stratification of efficacy with respect to weight in both groups

Group	Efficacy		P value
	Yes	No	
For weight ≤ 80			
CPL Group	5(15.6%)	27(84.4%)	0.152
CCL Group	9(31%)	20(69%)	
For weight > 80			
CPL Group	0(0%)	16(100%)	0.003
CCL Group	8(42.1%)	11(57.9%)	

different occasions before end of surgery. Hypotension when occurred was managed with 50 micrograms aliquots of phenylephrine. Efficacy was finally assessed if there was no hypotension.

SPSS 20 was used for data analysis. Mean±SD was used for quantitative variables like age and weight. Chi-square test was applied to compare efficacy of both groups taking  $p \leq 0.05$  as significant.

#### Results:

Age range was from 18 to 35 years with mean age of 28.708±2.86 years in CPL group and 27.750±3.07 years in CCL group. Mean

weight was 73.29±9.70 kg in CPL group and 77.875±7.09 kg in CCL group as shown in table I.

Efficacy was seen in 5(10.4%) patients in CPL group and 17(35.4%) patients in CCL group ( $p=0.003$ ) as shown in table II.

Stratification of efficacy in both groups with regard to age and weight are shown in table III and IV respectively.

#### Discussion:

Spinal anesthesia is widely used in lower abdominal general and obstetrical surgery and lower limb surgical procedures.

In this study combination of intravenous fluids reduced incidence of hypotension better than colloid alone. These results are comparable to Vercautern et al.<sup>6</sup> Riley ET et al<sup>7</sup> in another study also showed superiority of combination therapy.<sup>7</sup>

The time for establishment of spinal anesthesia should be less than intra vascular half-life of fluids in order to prevent redistribution to interstitial space. Rout et al.<sup>5</sup>, rapidly administered crystalloid fluid for elective procedure but incidence of hypotension after spinal anesthesia did not decrease.

In our study incidence of hypotension was 91% when 500ml of 6% penta starch was used as pre load while Ueyma et al.<sup>8</sup>, has 58% incidence with same volume of colloid.<sup>8</sup> It could be that there was more time for osmotic effect of colloid in Ueyma et al study, with 30 minutes as pre-loading time against 15 minutes pre loading time in our study. Sharma et al., reported 52% incidence of hypotension.<sup>9</sup> Another study reported 39% incidence of hypotension.<sup>10</sup>

The observation that pre loading does not eliminate hypotension after spinal anesthesia was further established by our study. Some studies, although, reported no hypotension after preloading for spinal anesthesia but agents and quantities used for pre loading could have been responsible for this observation.<sup>11,12</sup>

In this study total rescue phenylephrine used was lowest in CCL group because number of hypotensive patients were few. This reveals superior effect of combination of fluids in preventing spinal anesthesia induced hypotension, within time frame of 10 minutes outcome study. No adverse reaction to crystalloid or colloid occurred in this study, although some studies reported higher incidence of allergic reactions to colloids.<sup>13</sup>

#### Conclusion:

The incidence of hypotension was better reduced by combination of colloids and crystalloid compared to colloid only over a hydration period of 15 minutes. As there is presently no method to completely prevent hypotension in cases of patients after spinal anesthesia, vigilant monitoring of blood pressure every minute after spinal injection, with immediate treatment of hypotension by bolus phenylephrine is advocated.

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#### Role and contribution of authors:

Dr Javed Iqbal Khan, helped in preparation of proforma, operated upon patients and made final changes in article.

Dr Ateeq Afzal Malik, conceived the idea, collected data and monitored patients during surgery

Dr Tahir Iqbal Khan, helped in writing introduction, discussion and collection of references

Dr Nazia Suleman, helped in collection of data and writing discussion

Dr Usman Ghani, helped in writing introduc-

tion, statistical analysis and collection of references

Dr Mehwish Naz, helped in collection of data and post operative monitoring of patients and added few references.

#### References:

1. Kaimar P, Sanji N, Upadya M, Mohammed KR. A comparison of hypotension and bradycardia following spinal anesthesia in patients on calcium channel blockers and P blockers. *Indian J Pharmacol.* 2012;44(2): 193-6.
2. Lonjaret L, Lairez O, Minville V, Geeraerts T. Optimal perioperative management of arterial blood pressure. *Integr Blood Press Control.* 2014;7:49-59.
3. Chatrath V, Khetarpal R, Ahuja J. Fluid management in patients with trauma: restrictive versus liberal approach. *J AnaesthesiolClinPharmacol.* 2015;31(3):308-16.
4. Idehen HO, Amadasun FE, Ekwere IT. Comparison of intravenous colloid and colloid crystalloid combination in hypotension prophylaxis during spinal anesthesia for cesarean section. *Niger J ClinPract.* 2014;17:309-13.
5. Rout CC, Akoojee SS, Rocke DA, Gouws E. Rapid administration of crystalloid preload does not decrease the incidence of hypotension after spinal anesthesia for elective caesarean section. *Br J Anaesth* 1992;68:394-7.
6. Vercauteren MP, Hoffmann V, Coppejans HC, Van Steenberge AL, Adriaensen HA. Hydroxyethylstarch compared with modified gelatine as volume preload before spinal anaesthesia for Caesarean section. *Br J Anaesth* 1996;76:731-3.
7. Riley ET, Cohen SE, Rubenstein AJ, Flanagan B. Prevention of hypotension after spinal anesthesia for cesarean section: Six percent hetastarch versus lactated Ringer's solution. *Anesth-Analg* 1995;81:838-42.
8. Ueyema H, He YL, Tanigami H, Moshimo T, Yoshiya I. Effects of crystalloid and colloid preload on blood volume in the parturient undergoing spinal anaesthesia for elective Caesarean section. *Anesthesiology* 1999;91:1571-6.
9. Sharma SK, Gajraj NM, Sidawi JE. Prevention of hypotension during spinal anesthesia. A comparison of intravenous administration of hetastarch versus lactated Ringer's solution. *Anesth-Analg* 1997;84:111-4.
10. Buggy D, Higgins P, Moran C, Brien DO, Frances O, McCarroll M. Prevention of spinal anesthesia-induced hypotension in the elderly: Comparison between preanesthetic administration of crystalloid, colloids, and no prehydration. *Anesth-Analg* 1997;84:106-10.
11. Wollman SB, Marx GF. Acute hydration for prevention of hypotension of spinal anesthesia in parturients. *Anesthesiology* 1968; 29:374-80.
12. Mathru M, Rao TL, Kartha RK, Shanmugham M, Jacobs HK. Intravenous albumin administration for prevention of spinal hypotension during caesarean section. *AnesthAnalg* 1980;59:655-8.
13. Mitra S, Khandelwal P. Are all colloid same? How to select the right colloid? *Indian J Anaesth* 2009;53:592-607.