

A COMPARATIVE STUDY OF EFFECT OF 6% HESTAR AND RINGER'S LACTATE ON INTRAOPERATIVE BLOOD SUGAR LEVELS DURING LOWER ABDOMINAL SURGERIES UNDER SPINAL ANAESTHESIA

R. Raghu¹, P. Indira², R. Pandu Naik³

¹Assistant Professor, Department of Anaesthesiology, Osmania Medical College and Hospital, Hyderabad.

²Assistant Professor, Department of Anaesthesiology, Osmania Medical College and Hospital, Hyderabad.

³Associate Professor, Department of Anaesthesiology, Osmania Medical College and Hospital, Hyderabad.

ABSTRACT: BACKGROUND: Crystalloids and Colloids are extensively used as maintenance fluids in the perioperative period to maintain normal Homeostatic mechanisms. Ringer's Lactate and Hydroxy Ethyl Starches produce significant levels of free glucose residues.

AIM: To compare blood glucose levels by preloading with Ringers lactate solution at 20 ml/kg body weight versus 6% Hydroxy Ethyl starch @10ml/ kg body in non diabetic patients posted for elective surgeries under spinal anaesthesia.

MATERIALS AND METHODS: 60 non-diabetic adult patients of ASA Physical Status I and II posted for elective lower abdominal surgeries under spinal anaesthesia were randomly divided into two groups of 30 in each group. Group -R to receive Ringers lactate – 20 ml/kg and Group -H received 6% Hestar -10 ml /kg over half an hour prior to subarachnoid block as preloading fluid. Serial random glucose measurements were taken thereafter at specified time intervals upto 180 minutes.

RESULTS: Group R (RL), maximal mean blood glucose levels of 94.72mg/dl were found at 60 mins from the onset of preloading indicating an increase of 12.8mg/dl from the baseline which was found to be statistically significant $p=0.031$ ($p<0.05$). This was followed by a gradual fall upto 93.88mg/dl at end of study period of 180 min. In Group-H the difference between the reading at the end of 180mins and the baseline was 13.88mg/dl and this difference was found to be still statistically significant $p=0.022$ ($p<0.05$).

CONCLUSION: In addition to stress response to surgery, use of Ringers lactate and HES 6% significantly raised the blood sugar levels more with Hydroxyethyl Starch 6%. So their use in the perioperative period should be judicious as inadvertent usage can result in potential ill effects.

KEYWORDS: Capillary blood glucose, 6% Hydroxy Ethyl starch, Hyperglycemia, Ringers Lactate, Spinal anaesthesia.

HOW TO CITE THIS ARTICLE: R. Raghu, P. Indira, R. Pandu Naik. "A Comparative Study of Effect of 6% Hestar and Ringer's Lactate on Intraoperative Blood Sugar Levels During Lower Abdominal Surgeries Under Spinal Anaesthesia". Journal of Evidence based Medicine and Healthcare; Volume 2, Issue 47, November 12, 2015; Page: 8326-8329, DOI: 10.18410/jebmh/2015/1128

INTRODUCTION: Crystalloids and Colloids are used prophylactically for preloading to limit consequences of sympathetic block under spinal anaesthesia and are an integral part of perioperative fluid management. Stress response to surgery and anaesthesia produces significant hyperglycemia^{1,2}. Starches are made up of glucose polymers and are metabolized by serum amylases to produce smaller molecules of starch polymers and free glucose residues which carry a potential to accelerate blood glucose levels subsequent to intravenous administration³. Both these factors lead to severe Hyperglycemia and potentiate ischemic damage to Heart, Kidney and Brain and is known to impair wound healing by interfering with WBC function. Considering ill-effects of hyperglycemia with use of crystalloid and colloid in peri-operative period the following study was carried out to examine and compare effects of 6% HES and Ringers lactate on blood sugar

levels in elective lower abdominal surgeries under spinal anaesthesia.⁴

Hydroxyethyl Starch: (HES/HAES) is a non-ionic starch derivative and is one of the most frequently used volume expanders. Composition of 6% Hydroxy Ethyl Starch: In each 100ml contains: Hydroxy Ethyl starch (450/0.7). 6.0gm, Sodium chloride (450/0.7) 0.9gm, Average molecular weight is 45000 daltons, Degree of molar substitution -0.70, Osmolality is 350mosm/l: Sodium 154 meq/ltr: Chloride 154 meq/ltr: pH 5.9–6.3 Water for injection (450/0.7) q.s.

It is contraindicated in patients Hypersensitive to hydroxyethyl starch, patients with Kidney failure not related to low blood volume and patients on dialysis, with severe increases in blood levels of sodium or chloride, with intracranial bleeds.

Lactated Ringer's solution, is a nonionic sterile, nonpyrogenic solution for fluid and electrolyte replenishment in single dose containers for intravenous administration. It is capable of inducing diuresis depending on the clinical condition of the patient. Lactated Ringer's Injection, USP produces a metabolic alkalinizing effect. Lactate ions are metabolized ultimately to carbon dioxide

Submission 27-10-2015, Peer Review 28-10-2015,

Acceptance 04-11-2015, Published 11-11-2015.

Corresponding Author:

Dr. R. Raghu, H. No. 16-2-723/f/5,

Asmangadh, Malakpet, Hyderabad-500036.

E-mail: raghu.rajula@gmail.com

DOI: 10.18410/jebmh/2015/1128

and water, which requires the consumption of hydrogen ions. Each 100ml contains Sodium lactate solution USP equivalent to Sodium lactate 0.32gm Sodium chloride 0.600gm Potassium chloride 0.040gm Calcium chloride.

MATERIALS AND METHODS: This prospective randomized study was carried out at Osmania General Hospital following an approval from Institutional Ethics Committee. 60 non-diabetic adult patients undergoing elective lower abdominal surgeries under spinal anaesthesia were enrolled in the study.

Inclusion Criteria: ASA Grade-I and II non-diabetic patients in the age group of 20 to 60 yrs, weighing 40 to 70 kgs undergoing elective lower abdominal surgeries under subarachnoid block which were anticipated to complete within 2hrs.

Exclusion Criteria:

- Patients on steroids and vitamin C.
- Patients with Hct less than 30%.

- All procedures which are prolonged beyond two hours and requiring Blood transfusion.
- Patients developed allergic reactions to preloading fluids.

Patients were randomly divided into two groups of 30 patients in each group.

Group R: Patients preloaded with Ringer’s Lactate 20ml/kg

Group H: Patients preloaded with 6% Hydroxy ethyl starch.

Pre loading was done over a period of 30 mins prior to spinal anaesthesia. Patients were informed about procedure and Informed consent taken from all of them.

RESULTS: 60 non-diabetic adult patients of ASA Physical Status I and II posted for elective surgery under spinal anaesthesia were randomly divided into two groups 30 in each group. Group-R to receive Ringers lactate–20 ml/kg and Group-H received 6% Hestar-10 ml /kg over half an hour prior to subarachnoid block as preloading fluid results of serial measurements of random blood glucose are follows.

	Number in Group –R (RL)	Number in Group-H(6% HES)
Age (yrs)		
21-30	6	4
31-40	8	8
41-50	6	7
51-60	5	6
Gender		
Male	13	12
Female	15	10
Weight in kgs		
41-50	5	6
51-60	10	12
61-70	10	7

Table 1: Demographic details

The demographic data in both the groups were comparable, mean age being 39.8yrs in Group R and 41.12 yrs in Group H. The mean weight in both age groups were 58.96 kg and 55.88kg respectively.

Time in Minutes	RBS in Group-RL Mean ±SD	RBS in Group-(6% HES) Mean ±SD
0	81.92±1.382	85.80±0.94
15	84.16±1.857*	88.48±0.51*
30	91.60±0.91*	95.36±0.29*
60	94.72±1.23*	102.4±1.32*
120	94.36±1.977*	96.00±1.82*
180	91.48±1.54*	93.88±1.28*

Table 2: Random glucose level in both the groups

Group R (RL), maximal mean blood glucose levels of 94.72±1.27 were found at 60 mins from the onset of preloading indicating an increase of 12.8mg/dl from the baseline which was found to be statistically significant p=0.031 (p<0.05). This was followed by a gradual fall upto 91.48 at end of study period of 180 min.

In Group-H (HES) the difference between reading at the end of 180mins and the baseline was 93.88 and this difference was found to be still statistically significant p=0.022 (p<0.05).

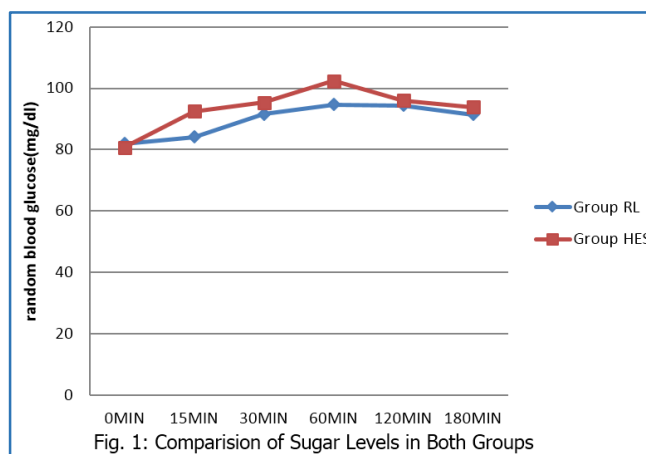


Fig. 1: Comparison of Sugar Levels in Both Groups

DISCUSSION: Crystalloids are non-ionic solutions remain the first choice of intravenous fluids, and their use provides essential benefit in the replacement of blood losses by correcting water and sodium deficits in the interstitial compartment and are used to replace ECF. Colloids are large molecular weight (nominally MW>30,000) substances and are important in capillary fluid dynamics because they exert an osmotic force and are distributed in intravascular space. Starches are polydisperse colloid solutions produced from amylopectin which has been stabilised by hydroxyethylation to prevent rapid hydrolysis by amylase. Hydroxyethyl starches are modified natural polysaccharides.^{5,6}

Crystalloids and Colloids have an impact on blood coagulation and also have an effect on metabolism causing hyperglycemia, and the same has been evaluated in our study. A majority of the studies conducted on starch solutions have evaluated their volume expansion properties and their impact on blood coagulation.^{7,8,9} Very few studies have examined the possibility of starches producing hyperglycaemia, Lactated ringers contains 3gm/L of lactate, which is a direct precursor to the gluconeogenic cycle, thus indirectly raising blood sugar level via Cori's cycle. One possible explanation for the minimal change in blood glucose level after LR infusion has been briefly discussed in an editorial by Simpson et al.¹⁰ The article suggests that the 29 mmol/L of lactate from Hartmann's solution (or 28 mmol/L from LR) could yield 14.5 mmol of glucose at most, which converts to an approximate increase of 261mg/dL in blood glucose. Commercially available Hydroxyethyl starches contain large ethylated starch molecules or glucose polymers and are metabolised by serum amylases to produce smaller molecules of starch polymers and free glucose residues, these carry a potential to induce or potentiate hyperglycemia, subsequent to intravenous administration. In present study subarachnoid block was used as a technique of choice in both groups and level of sensory block was fixed above T8 so as to standardize the stress response to anaesthesia and surgery and isotonic 0.9% normal saline was used intraoperatively in all the patients as subsequent intravenous fluid. Our study demonstrated a sustained and statistically significant increase in blood sugar ($p<0.05$) levels from baseline, with

Ringers lactate infusion and Hydroxy ethyl starch 6% which peaked at the end of one hour in both the groups. It was observed that in the first 15 min of infusion, in group RL it is 84.16 ± 1.857 and in group HES it is 88.48 ± 0.511 which is not of significant raise when there was no stress owing to anaesthesia or surgery there were different trends seen in both study groups. In Group R (RL), the rise in mean capillary blood glucose level was only 2.2mg/dl, which was not significant statistically, in Group H (HES) it was also not statistically significant increase of 3.3 mg/dl in mean capillary blood glucose level.

When the clinical data obtained in Group H (HES) was compared with Group R (RL) it was found that there was a significant increase in blood glucose levels seen with HES group of 102.4 ± 1.32 . A high statistically significant increase in Mean Blood glucose readings from baseline values at various time intervals was seen with the HES group. The mean readings at the end of 180min in both study groups were significantly higher than their respective mean blood glucose readings.

Murty et.al.,¹¹ studied effects of 6% HES, Pentastarch 200 and Ringers lactate as preloading fluids in spinal anaesthesia on blood sugar levels and concluded starches significantly increased blood sugar levels ($p<0.05$), with peak at the end of two hours with HES 6%, Pentastarch 200 at the end of 3hours, RI however did not increase blood sugar levels. Abhiruchi Patki and VC Shelgaonkar.¹² concluded that Ringer's lactate and Hydroxyethyl starch 6%-450 significantly raise the blood sugar level, albeit within physiological limits. So our study is in correlation with study done by previous authors.¹³

The mean readings at the end of four hours in study groups were significantly higher than their respective mean baseline blood glucose readings in two groups.

CONCLUSION: Crystalloids and colloids are being used extensively in the perioperative period to maintain normal Homeostatic mechanisms. Ringers lactate and HES 6% significantly raise the blood sugar levels under surgical stress, more with Hydroxyethyl Starch 6%. So their use in the perioperative period should be judicious to avoid potential ill effects.

REFERENCES:

1. Schierhout G, Roberts I. Fluid resuscitation with colloid or crystalloid solutions in critically ill patients: A systematic review of randomised trials. *BMJ*. 1998; 316: 961–4.
2. Martin P. 3rd ed. Philadelphia: Churchill Livingstone; 2007. Colloid and crystalloid resuscitation. In: *The ICU Book*; pp. 233–54.
3. Hankeln K, Beez M. Haemodynamic and oxygen transport correlates of various volume substitutes in critically ill in-patients with various aetiologies of haemodynamic instability. *Intern J Intens Care*. 1998; 5: 8–14.
4. hoemaker WC, Schluchter M, Hopkins JA, Appel PL, Schwartz S, Chang P. Fluid therapy in emergency resuscitation: Clinical evaluation of colloid and crystalloid regimens. *Crit Care Med*. 1981; 9: 367–8.
5. Nussmeier NA, Searles BE. The next generation of colloids: Ready for “prime time”? *Anesth Analg*. 2009; 109: 1715–7.
6. Ertmer C, Rehberg S, VanAken H, Westphal M. Relevance of non-albumin colloids in intensive care medicine. *Best Pract Res Clin Anaesthesiol*. 2009; 23: 193–212.
7. Ibister JP, Fischer MD. Adverse effects of plasma volume expanders. *Anaesth Intensive Care*. 1980; 8: 145–51.
8. Kortilla K, Grohn P, Gordin A. Effect of hydroxyethylstarch and dextran on plasma volume, blood hemostasis and coagulation. *J Clin Pharmacol*. 1984; 24: 273–82.
9. Linder P, Ickx B. The effects of colloid solutions on he-mostasis. *Can J Anesth*. 2006; 53: s30–9.
10. Simpson AK, Levy N, Hall GM. Peri-operative i. v. fluids in diabetic patients—don't forget the salt. *Anaesthesia*. 2008 Oct; 63(10): 1043–1045.
11. Murty SS, Kamath SK, Chaudhari LS. Effects of hydroxyethylstarches on blood sugar levels: A randomised double blind study. *Indian J Anaesth*. 2004; 48: 196–200.
12. Patki A, Shelgaonkar VC. Effect of 6% hydroxyethyl starch-450 and low molecular weight dextran on blood sugar levels during surgery under subarachnoid block: A prospective randomised study. *Indian J Anaesth* 2010; 54: 448-52.
13. Westphal M, James MF, Kozek-Langenecker SA, Stocker R, Guidet B, Van Aken H. Hydroxyethyl starches. Different products-different effects. *Anesthesiology*. 2009; 111: 187–202.