INTRODUCTION

Patients undergoing Renal Transplantation are subjected to a wide variety of intraoperative complications including hemodynamic instability, acid-base and electrolyte disturbances because of impaired renal function, and co-morbid diseases. Maintenance of intravascular volume during kidney transplantation is crucial to ensure optimal graft perfusion and function. Aim: This study compared the effects of normal saline (NS) and Plasma-Lyte-A on acid-base balance and electrolytes during living donor kidney transplantation. Methods: Patients were randomized to an NS group (n = 15) or a Plasma-Lyte-A group (n = 15). Arterial blood samples were collected for acid-base analysis after induction of anesthesia (base line), before clamp release, 1 hour after clamp release, and at the end of surgery. All samples were analyzed using a blood-gas analyzer. Results: In Normal saline group compared to Plasma-Lyte A there was a significant decrease in pH, bicarbonate and base excess. No patient in either group developed clinically significant metabolic acidosis. Conclusion: Although we found no difference in immediate graft function between the 2 groups, we concluded that using Normal saline resulted in decrease in pH and hyperchloremia. Such derangements can be prevented by using balanced crystalloids.

KEYWORDS: living donor kidney transplantation, normal saline, plasma-Lyte-A

INCLUSION CRITERIA:

- Patients with ESRD undergoing Living Donor Renal transplantation
- Age group 18 - 58 years

EXCLUSION CRITERIA:

- Diabetes mellitus
- Cadaveric kidney transplantation
- Liver dysfunction
- Severe cardiovascular disease

A Balanced plasma adapted solution is a solution qualitatively similar to plasma. Its use avoids development of hyperchloremic acidosis, while ensuring the same volume effect as unbalanced solutions, potentially reducing morbidity and mortality. They also reduce the effects on acid base balance. Mcfarlane et al. compared plasmalyte and normal saline in the intra-operative period and concluded that usage of Balanced salt solutions avoids intra operative changes in electrolytes and acid base status. However, Normal saline remains the most commonly used infusion solution during renal transplantation. 

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we designed a study comparing ionic and acid base status, and hemodynamics in Living Donor Renal transplantation patients, managed with Normal saline and Plasma-Lyte-A.

METHODS and METHODOLOGY:

Following approval of the Hospital Ethics Committee, written informed consent was obtained from all patients. The study was conducted at the Department of Anaesthesiology in cooperation with the Department of Urology of Nizam's Institute of Medical Sciences. This prospective, randomized observational study was conducted on 30 Patients of either gender, aged between 18 – 58 years, ASA III scheduled for Living Donor Kidney Transplantation.

Patients were randomized into two groups of 15 each using computer generated numbers.

- In Group NS, patients received intravenous infusion of Normal saline
- In Group PL, patients received Balanced Salt Solution, Plasma-Lyte

Patients were pre-medicated with oral Alprazolam 0.5 mg and Ranitidine 150 mg on the night before and morning of surgery. After shifting patient to operation theatre, 18 G intravenous and 20G arterial cannulation was done in all patients after local infiltration with 2% Lignocaine. Central venous catheter was inserted after induction of anesthesia in either internal jugular or subclavian vein. Baseline pulse rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure and Systolic pressure variation were noted. Baseline arterial blood gases were done.

All patients received epidural anesthesia at T9-T10 or T10-T11 level with the aid of an Epidural Anaesthesia set consisting of an 18 gauge epidural needle, a 20 gauge epidural catheter. Epidural catheters were fixed after advancing 5 centimeters into the epidural space. All patients received continuous epidural infusion of 0.25 % Bupivacaine
at the rate of 6 ml/ hour throughout the duration of surgery which was continued into post-operative period up to 24 hours.

All the patients were pre-medicated with Inj Fentanyl 2mcg/ kg followed by pre-oxygenation for 3 minutes. Then Inj. Thiopentone sodium 5mg/kg was given for induction to loss of eyelash reflex. After checking adequacy of mask ventilation, Inj Atracurium 0.5mg/kg was given for muscle relaxation. Patients were manually ventilated for 3min and then intubated with appropriate size endotracheal tube. Intra-operatively patients were maintained on nitrous oxide, oxygen and isoflurane mixture. Isoflurane administration was adjusted with goal of maintaining arterial blood pressure within 20% of baseline values. Fentanyl and atracurium were administered according to patients requirements. Mechanical ventilation was done by volume controlled mode with tidal volume of 8-11ml/kg and inspiratory and expiratory ratio of 1:2. Respiratory rate was set to keep the partial pressure of carbon dioxide in the ABG within 35±5 mm of Hg. Forced-air warming was used to keep patients normothermic.

Intra-operatively fluids were given based on the Hemodynamics and values of SPV and CVP. Systolic pressure variation ( SPV) was maintained between 5-15 and CVP was maintained from 10-15mm of Hg and CVP was monitored using a central venous catheter secured into either internal jugular or subclavian vein.

At the end of surgery patients were reversed with inj Neostigmine 0.05mg/kg and inj glycopyrrolate 0.01mg/kg. They were extubated after thorough oral suctioning and monitored in the post anaesthesia care unit.

Arterial blood samples were sent for analysis, at baseline, before clamp release, one hour after clamp release and at the end of operation for measurement of pH, PaCO2, PaO2, bicarbonate, Base excess, glucose, Anion gap, osmolality, serum sodium, potassium, chloride, calcium and lactate. All samples were analyzed using a blood-gas analyzer (ABL700, Radiometer, Copenhagen, Denmark). All hemodynamic variables were recorded throughout the duration of surgery for every 30 min. These include Pulse rate, Systolic blood pressure, Diastolic blood pressure, Mean arterial pressure, Systolic pressure variation and central venous pressure.

Statistical Methods:
Descriptive and inferential statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean ± SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5 % level of significance.

Student t-test (two-tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups (Inter group analysis) on metric parameters.

Chi-square/ Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups, Non-parametric setting for Qualitative data analysis. For all tests, values were considered to be statistically significant at P-value: P<0.05

Statistical software: The Statistical software namely SAS 9.2, SPSS 15.0, Stata 10.1, MedCalc 9.0.1, Systat 12.0 and R environment ver.2.11.1 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc.

RESULTS:-
The demographic characteristics of the recipients were similar in the two groups. Both groups were hemodynamically stable and comparable. No patient received colloid or blood products.

There was a decrease in pH value towards end of surgery in both groups when compared to baseline value. In NS group, pH decreased significantly from 7.43 to 7.33. Changes is base excess corresponded to those in pH with a significant fall in base excess in the saline group, from -1.37 to -5.56. Saline infusion also resulted in a significant decrease in bicarbonate levels in NS group from 22.59 to 20.48 mmol/L.

Lactate was not significantly changed in the two groups. No group experienced significant changes in serum potassium during the surgery. Other parameters were comparable in both groups.

### Results Table

<table>
<thead>
<tr>
<th></th>
<th>Base line</th>
<th>Before clamp release</th>
<th>One hour after clamp release</th>
<th>End of surgery</th>
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<tbody>
<tr>
<td>Group PL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>7.43±0.03</td>
<td>7.39±0.05</td>
<td>7.34±0.04*</td>
<td>7.33±0.04</td>
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<td>HCO3</td>
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<td>21.83±2.2</td>
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<td>19.09±1.48*</td>
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<td>23.19±2.8</td>
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<tr>
<td>pH</td>
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<td>0.92±0.42</td>
<td>1.04±0.46</td>
<td>1.34±0.60</td>
</tr>
</tbody>
</table>

*statistically significant
Lyte A during intraoperative period on ionic and acid base status and compared effect of Normal saline and balanced solution i.e., Plasma-Ringer’s lactate solution and balanced solution14. In our study, we lactate solution. There are limited studies comparing Normal saline to Plasma-Ringer’s lactate solution. There are several studies comparing Normal saline with Ringer’s lactate solution in hospitals. Normal saline is significantly hypertonic and contains a very high content of chlorides hence consequently causes hyperchloremic metabolic acidosis. Administration of large volumes of chloride-reduced potassium containing balanced solution resulted in a difference in hyperkalemia of no more than 17% when compared to use of 0.9NS and did not increase the need for postoperative dialysis. In our study, potassium level was similar between ‘2’ groups and no patient developed clinically significant hyperkalemia.

Most anaesthesiologists avoid potassium containing fluids during renal transplantation with the belief that it may worsen hyperkalemia in case of impaired graft function. However, in the study conducted by Eva Potura and Gregor Lindner et al18. use of acetate-buffered balanced crystalloid resulted in a difference in hyperkalemia of no more than 17% when compared to use of 0.9NS and did not increase the need for postoperative dialysis. In our study, potassium level was similar between ‘2’ groups and no patient developed clinically significant hyperkalemia.

Our study indicates that, in Normal saline group compared to Plasma-Lyte A there was a significant decrease in pH, bicarbonate and base excess. The absence of metabolizable anions like acetate in NS explains the cause for the declining trend of bicarbonate & BE. No patient in either group developed clinically significant metabolic acidosis. Our findings are similar to the findings seen in the study done by Hadimioglu et al.

Lactate levels were also comparable between groups. The glucose levels showed increasing trend in both groups. The gluconate in Plasma-Lyte A is thought to increase glucose levels. Except in one patient, all others have blood glucose levels below 200mg/dl. Calcium levels are maintained throughout study and no patient received calcium supplementation.

An ideal crystalloid resuscitation solution would resemble the electrolyte content of Plasma. Plasma-Lyte A is a balanced salt solution having similar electrolyte constitution to that of Plasma and is not associated with the disturbance of the acid base status caused by sodium chloride based fluids.

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Hypotension may occur after unclamping the iliac vessels and reperfusion of the graft. It is critical that patient is well hydrated, as renal function is critically dependent on renal perfusion. Hence to decrease the incidence of postoperative acute tubular necrosis, a liberal hydration policy is employed intraoperatively. The Lemmens etal19. suggested that Aggressive volume expansion is needed to target CVP of 10-15mmHg. This volume expansion is associated with increased renal blood flow and improved graft function.

A study by Tóth et al. showed that there was an increase in serum creatinine levels with MAP below 80 mmHg and decrease in serum creatinine with MAP above 100 mmHg, whereas it remained stable in patients with MAP of 80–100 mmHg. In our study, systolic blood pressure is maintained between 130–160 mm of Hg and CVP is maintained between 10-15 mm of Hg to optimize cardiac output and renal blood flow.

Human albumin does not improve early graft function in renal transplantation21.

The high potassium and calcium content of gelatins renders them inapplicable for perioperative care during renal transplantation22.

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prevent hypotension and hence graft dysfunction. The overall anesthetic goal for the newly transplanted kidney is to prevent acidosis, maintain intravascular volume and avoid decreased perfusion to the new kidney.

**BIBLIOGRAPHY**


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