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COMPARISON OF POSTOPERATIVE RENAL FUNCTION IN PATIENTS UNDERGOING LAPAROSCOPIC SURGERY IN TRENDELENBURG AND REVERSE TRENDELENBURG POSITIONS

Anaesthesiology

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ABSTRACT

Background: Perioperative acute kidney injury (AKI) is associated with significant morbidity and mortality. Even mild changes in renal markers can predict poor outcomes. During laparoscopic surgery, factors like pneumoperitoneum, intra-abdominal pressure (IAP), and patient positioning can impact renal perfusion. This study evaluates how these elements affect postoperative renal function in Trendelenburg (T) and Reverse Trendelenburg (RT) positions. **Aims & Objectives:** To assess the impact of laparoscopic surgery on renal function with respect to the Trendelenburg and Reverse Trendelenburg positions and to compare the effects of surgical position, duration, pneumoperitoneum, and IAP on postoperative renal function. **Methodology:** This prospective observational cohort study was conducted on 80 patients classified as ASA I, II, or III and undergoing laparoscopic surgeries lasting over two hours. Patients were divided into two groups: Group T (Trendelenburg) and Group RT (Reverse Trendelenburg), with 40 patients in each group. Data on surgical duration, pneumoperitoneum, and IAP were analysed using SPSS software. **Results:** Postoperatively, Group RT showed reductions in mean serum creatinine, blood urea, and estimated glomerular filtration rate (eGFR), although 22 patients experienced slight creatinine increases (0.01–0.12 mg/dL). In Group T, significant reductions in serum creatinine (P = 0.050*) and blood urea (P = 0.044*) were observed, alongside an eGFR increase (P = 0.028*). However, 15 patients in Group T showed slight creatinine increases, with one nearing the AKI threshold (0.22 mg/dL). Prolonged pneumoperitoneum time was correlated with increased blood urea in both groups (Group T: r = 0.332, P = 0.036; Group RT: r = 0.464, P = 0.003). Group T also showed worse renal outcomes with longer surgical durations (3.33 vs. 2.72 hours, P = 0.006). **Conclusion:** Patients in the Trendelenburg position exhibited a higher rise in creatinine (maximum 0.22 mg/dL) compared to those in the Reverse Trendelenburg position, despite shorter surgery and pneumoperitoneum durations. These findings highlight a greater risk of renal function impairment in laparoscopic surgeries performed in the Trendelenburg position.

KEYWORDS

INTRODUCTION

Acute kidney injury (AKI) during the perioperative period is a significant concern, characterized by a reduction in glomerular filtration rate (GFR) and the accumulation of nitrogenous waste products like urea and creatinine. Even mild forms of AKI can significantly increase mortality, emphasizing the importance of early detection and management in high-risk surgical settings.

Advancements in AKI diagnostic criteria, from the RIFLE (Risk, Injury, Failure, Loss, End-stage) to the Acute Kidney Injury Network (AKIN) and Kidney Disease Improving Global Outcomes (KDIGO) guidelines, have improved the ability to identify AKI at earlier stages. These guidelines use serum creatinine and urine output changes to classify AKI severity, with even minor deviations correlating with elevated mortality risks. However, while serum creatinine is a well-validated marker, urine output as a predictive parameter is less reliable due to factors like body weight variability and obesity.[1]

Laparoscopic surgeries introduce unique challenges to renal function due to the physiological effects of pneumoperitoneum and intra-abdominal pressure (IAP). These procedures often require CO_2 insufflation to create a working space, which elevates IAP and can compress the inferior vena cava, reducing cardiac preload and output. Additionally, surgical positioning—Trendelenburg (head-down) and Reverse Trendelenburg (head-up)—can further influence renal perfusion. Complications such as impaired renal autoregulation, ischemia-reperfusion injury, and oxidative stress are exacerbated by sustained pneumoperitoneum.

The neuroendocrine response during surgery, involving the release of antidiuretic hormone and activation of the renin-angiotensin-aldosterone system (RAAS), can also lead to oliguria and further renal compromise. The interplay between elevated IAP, oxidative stress, and hemodynamic changes makes patients undergoing laparoscopic surgery vulnerable to AKI.

Given the lack of validated renoprotective strategies for perioperative AKI in laparoscopic settings, this study aimed to evaluate the effects of laparoscopic surgery on renal function in relation to Trendelenburg (T) and Reverse Trendelenburg (RT) positions. Specifically, this research compares the effects of surgical position, duration, pneumoperitoneum, intra-abdominal pressure, and intraoperative hemodynamic parameters on renal function outcomes post-surgery, with the goal of identifying position-specific risks and potential intervention points for renoprotection in laparoscopic procedures.[2]

MATERIAL & METHODS

This prospective observational cohort study was conducted at a tertiary care hospital from June 2022 to January 2024, following approval from the Institutional Ethical Committee (BVDUMC/IEC/85) and registration with the Clinical Trials Registry of India (CTRI/2023/08/056751).

Inclusion and Exclusion Criteria

The study included patients aged more than 18 years and classified as American Society of Anesthesiologists (ASA) class I, II, and III, scheduled for laparoscopic surgeries lasting more than two hours. Patients provided informed consent before enrollment. Exclusion criteria were:

- Patients on hemodialysis
- Patients with chronic kidney disease (CKD) or transplanted kidneys
- Patients undergoing multiple surgeries during the same admission
- Patients on diuretics

Sample Size

Eighty patients were included in the study, divided into two groups: Group T (Trendelenburg position, n = 40) and Group RT (Reverse Trendelenburg position, n = 40). The sample size was calculated using standard formula parameters:

- $Z(1-\alpha/2) = 1.96$ (standard normal value at 5% significance)
- $Z(1-\beta) = 0.84$ (standard normal value at 80% power) Standard deviations, allowable errors, and mean differences were derived from reference studies.

Study Protocol

Positioning and procedure were determined by the operating surgeon. A comprehensive preoperative evaluation was conducted, including baseline laboratory tests for serum creatinine, blood urea, and urine analysis. Glomerular filtration rate (GFR) was calculated using the Cockcroft-Gault equation:

- For Males: GFR=([140-age] × weight in kg)/ (serum creatinine ×

72)
- For Females = ([140-age] × weight in kg)/ (serum creatinine × 72) x 0.85

Anaesthesia Protocol
- Pre-induction: IV Midazolam (0.05 mg/kg) and IV Fentanyl (up to 2 mcg/kg).
- Induction: IV Propofol (up to 2 mg/kg). Endotracheal intubation was facilitated using Atracurium (0.3–0.5 mg/kg) or Cisatracurium (0.15–0.2 mg/kg).
- Maintenance: Low-flow closed circuit using oxygen, air, and sevoflurane (1–3%), with top-up doses of muscle relaxants as required.
- Fluid management: IV crystalloids were administered at 2 ml/kg/hr preoperatively and 4 ml/kg/hr intraoperatively.

Intraoperative Monitoring

Vital parameters such as $ETCO_2$, peak airway pressure, urine output, and intra-abdominal pressure (IAP) were continuously recorded. Pneumoperitoneum duration was defined as the interval between insufflation and desufflation, while total surgical duration was measured from port incision to closure.

Postoperative Assessment

Approximately 30 hours after surgery, postoperative urine analysis, serum creatinine, and blood urea were measured. eGFR was recalculated, and these values were compared with preoperative baselines to assess renal function changes.

Statistical Analysis

Categorical variables were presented as counts and percentages, while continuous variables were expressed as mean ± standard deviation (SD). Inter-group comparisons were performed using the Chi-square test or Fisher's exact test for categorical variables, and independent sample t-tests for continuous variables. Intra-group comparisons were conducted using paired t-tests. Statistical significance was set at p<0.05. All analyses were performed using SPSS version 24.0 (IBM Corp., USA).[(3)(4)(5)]

RESULTS

Demographic Data and Baseline Characteristics
- The mean age of Group T participants was 45.55 ± 16.33 years, while Group RT participants averaged 48.02 ± 16.22 years, with no significant difference between groups (P = 0.210).
- In Group RT, patients with worsening renal function were significantly older (53.25 ± 14.63 years) compared to those without changes (42.80 ± 16.39 years, **P = 0.040**).

Renal Function Changes

Group T: (Graph 1, 2 & 3)
- **Serum Creatinine:** Significant reduction from 0.77 ± 0.16 mg/dL preoperatively to 0.75 ± 0.17 mg/dL postoperatively (**P = 0.050).** However, 26.66% of patients exhibited increases, with a maximum rise of **0.22 mg/dL**, approaching the AKI threshold.
- **Blood Urea:** Mean levels decreased significantly from 22.87 ± 8.86 mg/dL to 21.25 ± 8.81 mg/dL **(P = 0.044).**
- **eGFR:** Significant improvement from 99.28 ± 36.75 mL/min/1.73 m² to 103.00 ± 40.63 mL/min/1.73 m² **(P = 0.028).**

Group RT: (Graph 1, 2 & 3)
- **Serum Creatinine:** No significant change; preoperative values were 0.71 ± 0.21 mg/dL compared to 0.68 ± 0.18 mg/dL postoperatively (P = >0.05). A mild increase (0.01–0.12 mg/dL) was noted in 55% of patients.
- **Blood Urea:** Stable values, with a non-significant change from 18.52 ± 5.95 mg/dL preoperatively to 18.02 ± 6.88 mg/dL postoperatively (P = >0.05).
- **eGFR:** No significant change; preoperative levels were 105.52 ± 32.00 mL/min/1.73 m² versus 106.18 ± 27.24 mL/min/1.73 m² postoperatively (P = >0.05).

Intraoperative Findings

Surgical Duration and Pneumoperitoneum Time (Table 1 & Graph 4)
- Group RT had a significantly longer mean surgical duration (3.57 ± 0.85 hours) compared to Group T (2.89 ± 0.65 hours, **P = 0.001**).
- Pneumoperitoneum time was also longer in Group RT (2.86 ± 0.56 hours) versus Group T (2.44 ± 0.42 hours, **P = 0.032**).

Intra-abdominal Pressure (IAP) (table 2)
- There was no significant difference in IAP between groups at baseline, 30 minutes, 60 minutes, or before desufflation (P = >0.05).

Intra-group comparison of variables between patients showing worsening of Renal function parameters with patients not showing changes in Group T & RT

Group T: (Table – 3)
- The Average Duration of surgery in patients showing worsening of Renal function parameters 3.33 ± 0.67 against 2.72 ± 0.56 with **P value (0.006*)** difference was statistically significant.
- Interestingly the Pneumoperitoneum time and IAP did not show a statistically significant difference.
- Interestingly the Pneumoperitoneum time and IAP did not show a statistically significant difference.
- In Group T, the patients showing changes were older (higher mean Age), required significantly longer duration of surgery (higher mean duration of surgery), had compared to the group of non-changers **(P value = <0.05 for all)**.

Group RT: (Table – 4)
- Mean age in patients not showing changes 42.80 ± 16.39 against patients who showed worsening of changes **53.25 ± 14.63.** There was significantly higher range of age more than one decade (**P value 0.040***)
- Change in serum creatinine, eGFR was accompanied by significant change in urine PH postoperatively P value (0.041*) amongst patient showing changes.
- In Group RT, the patients showing changes were significantly older (higher mean Age), had significantly higher post-operative mean urinary pH level compared to the group of non-changers (**P-value<0.05 for all**).

Correlation Analysis Between Duration of Surgery, Pneumoperitoneum Time, Intraoperative IAP, and Vital Parameters with Postoperative Renal Function (Table - 5)

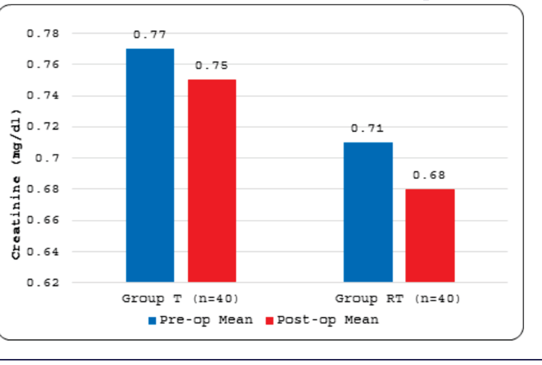
Group T:
- Pneumoperitoneum Time and Blood Urea: A positive correlation was observed, with (r = 0.332 and **P = 0.036***).

Group RT:
- Surgery Duration and Blood Urea: A significant positive correlation was observed, with (r = 0.424 and **P = 0.006****).
- Pneumoperitoneum Time and Blood Urea: A moderately positive correlation was noted, with (r = 0.464 and **P=0.003****).
- IAP and Blood Urea: A strong positive correlation was found, with (r = 0.631 and **P = 0.001****).
- Overall, in Group RT, the duration of surgery, pneumoperitoneum, and IAP all showed positive correlations with blood urea. In Group T, the duration of pneumoperitoneum showed a statistically significant positive correlation with blood urea.

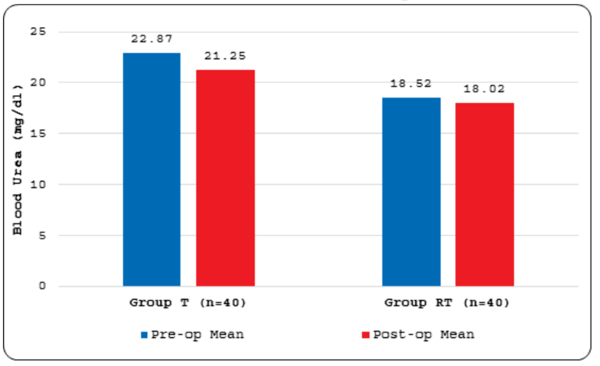
Table 1 - Comparison of Mean Duration of Surgery Between Study Groups

Duration of surgery (Hrs)	Group T (n 40)		Group RT (n 40)		P value
	Mean	SD	Mean	SD	
Duration of surgery (Hrs)	2.89	0.65	3.57	0.85	**0.001*** **

Graph 1 - Comparison of Mean Preoperative and Postoperative Serum Creatinine Levels Within and Between Groups.



Graph 2 - Comparison of Mean Preoperative and Postoperative Blood Urea Levels Within and Between Groups.



Graph 3 - Intra group comparison of mean pre-op and post-op e-GFR levels among the cases studied.

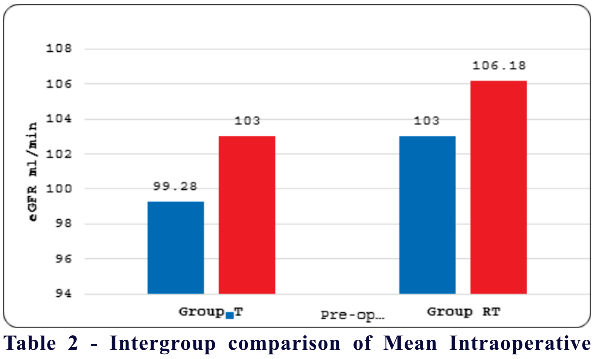


Table 2 - Intergroup comparison of Mean Intraoperative Intraabdominal pressure (IAP).

IAP (mmHg)	Group T (n=40)		Group RT (n=40)		P-value
	Mean	SD	Mean	SD	
At Baseline	12.45	1.22	12.47	1.50	0.935NS
30 mins from Insufflation	12.92	1.56	13.07	1.52	0.665NS
60-min from Insufflation	13.10	1.66	13.47	1.45	0.285NS
Before Desufflation	13.25	1.67	13.27	1.34	0.941NS

Graph 4 - Intergroup comparison of Mean Intraoperative Pneumoperitoneum time.

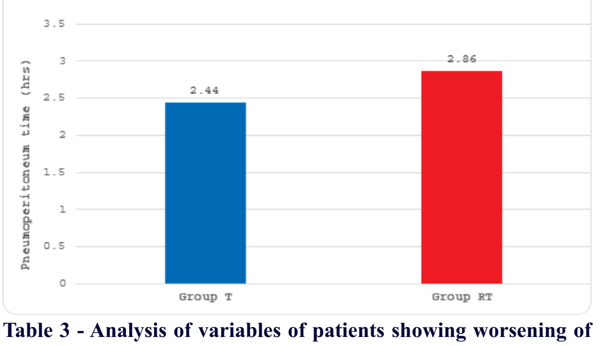


Table 3 - Analysis of variables of patients showing worsening of renal function parameters in Group T.

Parameter		Not showing worsening	Showing worsening	P-value
Age (years) Mean ± SD		43.07 ± 17.22	51.33 ± 12.86	0.145 NS
Diabetes Mellitus, n (%)		1 (3.6%)	2 (16.7%)	0.209 NS
Hypertension		3 (10.7%)	3 (25.0%)	0.341 NS
Hypothyroidism		2 (7.1%)	0	0.999 NS
Duration of surgery (Hrs) Mean ± SD		2.72 ± 0.56	3.33 ± 0.67	0.006 **
Pneumoperitoneum time (hr) Mean ± SD		2.39 ± 0.42	2.54 ± 0.73	0.404 NS
IAP (mmHg) Mean ± SD	At Baseline	12.46 ± 1.17	12.42 ± 1.38	0.912 NS
	30-min after Insufflation	13.04 ± 1.62	12.67 ± 1.43	0.500 NS
	60-min after Insufflation	13.32 ± 1.61	12.58 ± 1.73	0.202 NS
	Before Desufflation	13.39 ± 1.84	12.92 ± 1.24	0.417 NS
Peak airway pressure (PAP) Mean ± SD	At Baseline	19.54 ± 2.92	18.17 ± 2.17	0.154 NS
	30-min after Insufflation	19.63 ± 3.42	19.33 ± 3.02	0.798 NS
	60-min after Insufflation	19.82 ± 3.66	19.75 ± 3.57	0.955 NS
	Before Desufflation	19.75 ± 3.03	19.75 ± 3.08	0.999 NS
Serum creatinine (mg/dl) Mean ± SD	Pre-op	0.74 ± 0.11	0.85 ± 0.23	0.055 NS
	Post-op	0.69 ± 0.12	0.86 ± 0.22	0.003 **
	Difference (Pre-Post)	0.047 ± 0.051	-0.017 ± 0.14	0.036 *
Serum blood urea Mean ± SD	Pre-op	22.75 ± 8.32	23.16 ± 10.54	0.898 NS
	Post-op	20.61 ± 8.52	22.75 ± 9.67	0.488 NS
	Difference (Pre-Post)	2.14 ± 4.17	-0.74 ± 2.59	0.040 *
e-GFR Mean ± SD	Pre-op	101.64 ± 37.79	93.75 ± 35.16	0.541 NS
	Post-op	108.00 ± 42.76	91.33 ± 33.95	0.239 NS
	Difference (Pre-Post)	-6.36 ± 9.71	2.42 ± 9.39	0.012 *

Table 4 - Analysis of variables of patients showing worsening of renal function parameters in Group RT.

Parameter		Not showing worsening	Showing worsening	P-value
Age (years) Mean ± SD		42.80 ± 16.39	53.25 ± 14.63	0.040*
IAP (mmHg) Mean ± SD	At Baseline	12.55 ± 1.54	12.40 ± 1.50	0.757NS
	30-min after Insufflation	12.90 ± 1.55	13.25 ± 1.52	0.475NS
	60-min after Insufflation	13.05 ± 1.43	13.90 ± 1.37	0.063NS
	Before Desufflation	13.30 ± 1.08	13.25 ± 1.58	0.908NS
Peak airway pressure (PAP) Mean ± SD	At Baseline	18.15 ± 1.69	17.85 ± 2.39	0.650NS
	30-min after Insufflation	18.40 ± 2.60	18.65 ± 3.09	0.784NS
	60-min after Insufflation	19.25 ± 3.38	20.25 ± 2.71	0.309NS
	Before Desufflation	20.05 ± 3.59	20.50 ± 2.78	0.660NS
Serum creatinine (mg/dl) Mean ± SD	Pre-op	0.74 ± 0.19	0.68 ± 0.23	0.402NS
	Post-op	0.66 ± 0.15	0.70 ± 0.21	0.563NS
	Difference (Pre-Post)	0.075 ± 0.13	-0.016 ± 0.06	0.007**
Serum blood urea Mean ± SD	Pre-op	17.40 ± 4.13	19.65 ± 7.28	0.237NS
	Post-op	16.95 ± 6.68	19.10 ± 7.07	0.329NS
	Difference (Pre-Post)	0.45 ± 5.68	0.55 ± 3.80	0.948NS
e-GFR Mean ± SD	Pre-op	109.25 ± 30.81	101.80 ± 33.53	0.469NS
	Post-op	114.50 ± 24.21	97.85 ± 28.12	0.052NS
	Difference (Pre-Post)	-5.25 ± 18.11	3.95 ± 8.74	0.048*

Table 5- Correlation Analysis Between Duration Of Surgery, Pneumoperitoneum Time, Intra-op Intra-abdominal Pressure With Renal Function Tests.

		Group T (n=40)		Group RT (n=40)	
Correlation between		r-value	P-value	r-value	P-value
Duration of surgery (Hr)	Serum creatinine (mg/dl)	0.230	0.159NS	0.199	0.291NS
	Serum blood urea	0.212	0.196NS	0.424	0.006**
	Urinary pH	0.177	0.280NS	0.258	0.118NS
	Urinary Specific gravity	0.251	0.123NS	0.004	0.983NS
Pneumo-peritoneum time (Hr)	Serum creatinine (mg/dl)	0.171	0.291NS	0.171	0.291NS
	Serum blood urea	0.332	0.036*	0.464	0.003**
	Urinary pH	0.205	0.204NS	0.053	0.750NS
	Urinary Specific gravity	0.093	0.569NS	0.065	0.700NS
Intra-op IAP (mmHg)	Serum creatinine (mg/dl)	-0.208	0.198NS	0.133	0.412NS
	Serum blood urea	-0.202	0.211NS	0.631	0.001***
	Urinary pH	-0.076	0.640NS	0.253	0.126NS

DISCUSSION

Laparoscopic surgery has transformed the surgical world by providing significant advantages over open procedures. Although routine CO2 pneumoperitoneum generation improves access to the surgical site, it also causes a number of pathophysiological alterations. These changes may significantly impact the elderly and those with pre-existing comorbidities. This study explores the effects of laparoscopic surgery on renal function, paying particular attention to important markers such as creatinine, urea, and estimated eGFR.

Intra group comparison of mean Age between patients showing worsening of renal function parameters with patients not showing worsening in Group RT was done there was significantly higher range of age more than one decade in patients showing worsening of renal function parameters (P value 0.040*) (Table 4). According to Amjad Shalabi et al. post-surgery AKI incidence is higher in patients who are older and have worse baseline renal function because they are more susceptible to the negative effects of pneumoperitoneum. They also observed that AKI occurred in 40% of patients who had pneumoperitoneum as opposed to just 12% of those who had open surgery. [6]

Intragroup analysis revealed that the Average Duration of surgery significantly (P-value 0.006*) influenced the results in patients in Group RT who had worsening metrics to those who did not (Table 5). In their analysis of 519 patients, Cho A et al. found that eGFR and age were predictors of post-nephrectomy AKI. They also found that patients who suffered postoperative AKI had a statistically significant P-value of less than 0.001 and a 4.24-fold increased risk of developing new onset chronic kidney disease (CKD). [7]

When blood urea and surgical duration were correlated (Table 5), the r value (0.424) and (P value-0.006*) demonstrated statistical significance. Hunter et al. showed that elevated IAP caused significant decreases in renal blood flow and glomerular filtration rate (GFR). Elevated IAP was observed to produce a rise in BUN levels, indicating compromised renal function. [8] The idea of IAH and its connection to renal impairment were investigated by Malbrain et al. He discovered relationship between raised IAP and indicators of renal disease, such as elevated blood urea levels. [9]

We observed that Group RT had a significantly longer mean Pneumoperitoneum time (2.86 hours) compared to Group T (2.44 hours) (Graph 4) consistent with literature on the technical complexity of the RT position. Both groups showed a strong positive correlation between pneumoperitoneum time and blood urea (Table 5) (Group T: (r - 0.332), (p - 0.036); group RT: (r - 0.464), (P - 0.003)), which is consistent with the findings that higher IAP lowers kidney perfusion and eGFR. According to Scbastian Demyttenaere et al. 17 out of 20 studies and 20 out of 25 studies, respectively, reported a decline in renal function and renal blood flow during pneumoperitoneum. Fluid hydration reduces these pressure-dependent alterations, which are more noticeable when the head is elevated. These results are independent of the type of gas used. Although there have been well-documented brief drops that end when the pneumoperitoneum is released, the clinical importance for healthy patients is still unknown, but it might be significant for patients with impaired renal function. At-risk patients require extra care when undergoing laparoscopic procedures. [10] Pneumoperitoneum raises IAP during laparoscopic procedures, which has a major effect on renal function. Renal blood flow and GFR are decreased when the renal vasculature is compressed by elevated IAP. Renal perfusion is further reduced by hormonal reactions, including the production of renin, angiotensin, and aldosterone. Furthermore, venous pressure rises when the renal veins are directly compressed, which reduces urine production (oliguria). Renal tissue ischemia may result from decreased renal blood flow and elevated metabolic demands. Optimizing IAP and keeping an eye on renal function metrics can help lessen these negative consequences. [11]

We observed the effect of IAP on Renal function in patients posted for Laparoscopic Surgery in T and RT positions (Table 2). There were no statistically significant differences in IAP between T and RT at any of the time points that were measured, and the results showed no significant differences in IAP between or within the groups when comparing patients who had worsening renal function parameters to those who did not. Additionally, IAP as a single factor does not significantly affect postoperative renal function, since individuals with changes in renal function parameters had similar IAP values to those without changes within both groups. The hypothesis that IAP alone, within modest ranges, is not a major factor for renal dysfunction in laparoscopic procedures was supported by Neudecker et al.'s demonstration that regulated rises in IAP during laparoscopic surgery did not result in significant renal impairment. [12] In their research on animals, Wever et al. also observed that elevated IAP can have a major effect on renal perfusion and function. The findings of this study indicated that whether patients are in the T or RT positions, there is no discernible difference in renal function within the mild IAP ranges often utilized during laparoscopic surgery (up to about 13 mmHg). This observation is clinically relevant because it demonstrates that certain surgical positions can be used safely without raising unnecessary concerns about IAP-induced renal function impairment. [13]

The Trendelenburg group (Group T) in our study, however, showed a significant improvement in renal function overall, as evidenced by significant decreases in postoperative blood urea levels (P-value = 0.044) and serum creatinine (P-value = 0.050) (Graph 1, 2 & 3), as well as a significant rise in eGFR (P-value = 0.028). Serum creatinine levels in 15 patients increased from baseline, ranging from 0.01 to 0.22 mg/dl, despite overall improvements. AKI is defined as a change of >0.3 mg/dl from baseline, and one patient's difference was 0.22 mg/dl. Eight patients with creatinine rise also had urea rise, and eGFR estimations were impacted by patient weight and did not correlate well with creatinine rise. Creatinine levels increased in a smaller proportion of patients (26.66%), but the greatest rise (0.22 mg/dl) was noticeably greater than in the reverse Trendelenburg group. According to Shuo Xue et al.'s research, renal impairment may result from elevated IAP and impaired renal blood flow. [14][15]

In-depth results for Group RT revealed elevated blood urea, creatinine, and eGFR. Individual patient weight had an impact on eGFR estimations, which did not correlate well with an increase in creatinine. Creatinine levels increased in 55% of patients, with a maximum increase of 0.12 mg/dl. C. According to a study by Michael Dunham et al. the Reverse Trendelenburg position, in which the head is raised above the feet, lowers intra-abdominal pressure and may improve renal perfusion and function. This position maintains consistent blood creatinine, urea levels, and eGFR, which suggests less stress on the kidneys and a lower risk of AKI, according to research and the results of our study. These measures showed no appreciable postoperative alterations in the RT Group, confirming its role in preserving renal function. [16]

Despite having shorter lengths of operation and pneumoperitoneum, patients in group T showed a greater change in creatinine. This finding implies that renal function results during laparoscopic procedure is significantly influenced by variables other than duration, such as the degree of intra-abdominal pressure and individual patient factors. Significant postoperative changes in urine pH were seen in patients exhibiting worsening renal function measures, together with changes in serum creatinine and eGFR in the group RT.

CONCLUSION

Laparoscopic surgery Patients operated in Trendelenburg position showed higher rise in creatinine values (maximum 0.22mg/dl) than patients in Reverse Trendelenburg Position despite shorter Duration of surgery and Pneumoperitoneum time.

Limitations

1. Due to the early discharge of participants within 3 days, prolonged follow-up was not feasible. Extended monitoring post-discharge could offer valuable data on long-term outcomes and the progression of complications.
2. Urine output monitoring possibility of accurate measurement cannot be ruled out.

RECOMMENDATIONS

Future studies should focus on integrating novel biomarkers such as Neutrophil Gelatinase-Associated Lipocalin (NGAL), Kidney Injury Molecule-1 (KIM-1), and Cystatin C in the prediction and early diagnosis of Acute Kidney Injury (AKI) in patients undergoing laparoscopic surgery. These biomarkers could potentially offer more sensitive and specific early detection of renal impairment compared to traditional markers like serum creatinine and blood urea nitrogen (BUN).

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