Section: Anesthesiology

Original Research Article

RIGHT VENTRICULAR SYSTOLIC PRESSURE AS AN INDICATOR OF ELECTIVE VENTILATION IN RENAL TRANSPLANTATION – A RETROSPECTIVE STUDY

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Abstract

Background: Renal transplant is the best treatment for end-stage renal disease (ESRD) patients. Pulmonary hypertension is common among patients with ESRD, while data concerning the effect of right ventricular failure on post-operative outcomes remain inadequate. Thus, this study aimed to evaluate the utility of the Right ventricular systolic pressure (RVSP) as an indicator for Elective ventilation in Renal transplantation. **Materials and Methods:** It was a retrospective analysis of the medical records of 12 patients who had undergone renal transplants from January 2022 to May 2022. Twelve renal transplantation recipient cases were observed with haemoglobin, ejection fraction, right ventricular systolic pressure, post-operative urine outcome, and oxygen saturation (spo2). **Result:** We observed that out of twelve cases, three cases with pulmonary hypertension with right ventricular systolic pressure of more than 40mmhg with the help of elective ventilation support improved overall outcome, and the patient recovered. Further, we have seen a significant association between right ventricular systolic pressure (RVSP) and Spo2 (p-0.003) and between left ventricular ejection fraction (LVEF) and Spo2 (p-0.004). However, there was no significant association between RVSP and LVEF (p-0.1016) and between Hb levels and LVEF (p-0.3707), and between Hb levels and RVSP (p-1.00). **Conclusion:** Pulmonary hypertension greatly influences renal transplant outcomes. Elective ventilator support helps improve cardiopulmonary function and urine output in severe pulmonary hypertension. In addition, elective ventilation in patients with right ventricular systolic pressure greater than or equal to 40mmhg may improve overall outcomes.

INTRODUCTION

Renal transplant is the best treatment for end-stage renal disease (ESRD) patients. The end-stage renal disease involves multisystem complications. ESRD, by itself, has also been proposed to cause pulmonary vascular remodelling and hypertension. Therefore, Hemodynamics and oxygenations are key issues in the perioperative management of renal transplantation. The factors influencing them are anaemia, pulmonary hypertension, and ejection fraction.[1,2]

Clinical findings on X-ray chest and right ventricular systolic pressure (RVSP) by echocardiogram contribute to pulmonary pressures. Possible mechanisms that have been suggested include endothelial dysfunction due to increased oxidative stress from uremic toxins, chronic inflammation resulting from blood exposure to dialysis membrane, vascular calcification, and increased flow from arterio-venous fistula. We observed that patients with high pulmonary pressures need post-operative ventilator support and elective ventilation helps improved outcomes. Pulmonary hypertension is common among patients with ESRD, while data concerning the effect of right ventricular failure on post-operative outcomes remain inadequate.[1-3] Thus, this study aimed to evaluate the utility of the RVSP as an indicator for Elective ventilation in Renal transplantation

MATERIALS AND METHODS

It was a retrospective analysis of medical records of patients who had undergone renal transplants over 5 Months from January to May 2022. Twelve renal

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transplantation recipients over five months were retrospectively analysed for haemoglobin, x-ray chest, ECG, and right ventricular systolic pressure (RVSP) by echocardiogram. In addition, the patient's data and outcomes were tabulated. All patients were assessed with complete routine investigations, including complete blood counts, coagulation profiles, liver function tests, Renal function tests, electrocardiography, chest radiogram, and echocardiography. Based on metabolic and fluid abnormalities, pre-operative heparin-free dialysis was done within 24 hours before surgery to reduce the risk of Hypervolemia and Hyperkalemia. Recipients involving cadaveric donor organs are often scheduled as urgent or emergency procedures. However, a well-preserved kidney provides enough time to prepare the recipient and, if necessary, dialyze to normalize electrolyte and volume imbalance. Pre-operative demographic characteristics (age, sex, duration of CKD, duration of HD/peritoneal dialysis, presence of AV fistula, live/cadaveric donor, etc.) and co-morbidities and relevant investigations with two-dimensional echocardiography were collected from pre-anaesthetic check-up sheets.

Statistical analysis:

Categorical variables are expressed as percentages. The difference between the categorical variables was compared using the Chi-square test/Fisher's exact test. The p values reported are 2-sided and considered significant at $p < 0.05$

RESULTS

Demographic Characteristics of Participants

The study participants were subdivided according to age as 21-30, 31-45, and >45 years old. We have seen that 30% of male and 10% of female participants were aged between 21-30 years old, while 20% of male and 10% of female participants were between 31-45 years old. However, 40% of male and 10% of female participants were aged > 45 years old [Figure 1].

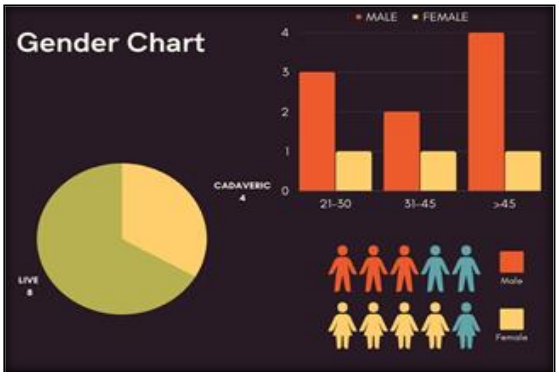

Figure 1: Demographic Characteristics of participants

Twelve renal transplantation recipient cases were observed with haemoglobin, ejection fraction, right ventricular systolic pressure, post-operative urine outcome, and oxygen saturation (spo2). We observed that out of twelve cases, 1% of male and 1% of the female participant had normal Hb levels, 5% of male and 1% of the female participant had mild Hb levels, 2% of males and 1% of the female participant had moderate Hb level. In contrast, 1% of male participants had severe low Hb levels [Figure 2].

Figure 2: Hb levels in study participants

We observed that out of twelve cases, three cases with pulmonary hypertension with right ventricular systolic pressure of more than 40mmHg with the help of elective ventilation support patient improved the overall outcome, and the patient recovered [Figure 3].

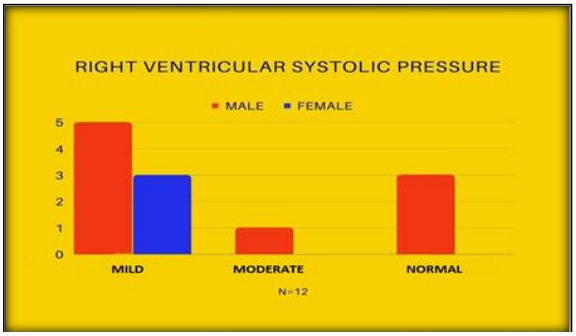

Figure 3: Right ventricular systolic pressure in study participants

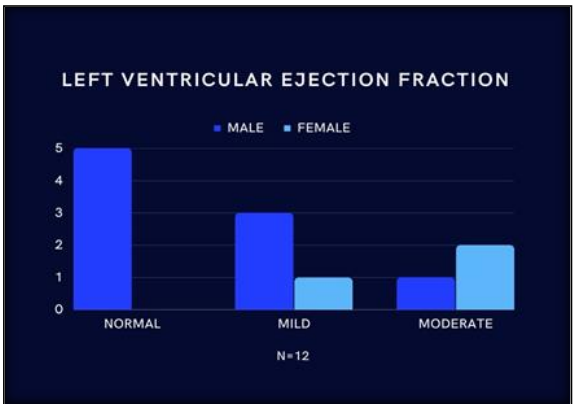

Figure 4: Left ventricular ejection fraction in study participants

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The data on left ventricular ejection fraction indicated that 5% of male participants had normal left ventricular ejection fraction, 3% of male and 1% of female participants had mild left ventricular ejection fraction, whereas 1% of male and 2% of female participants had moderate left ventricular ejection fraction (Figure 4).

Additionally, we have performed a chi-square test which indicated a significant association between RVSP and Spo2 (p-0.003) and between left ventricular ejection fraction (LVEF) and Spo2 (p-0.004) among the study participants. However, there was no significant association between RVSP and LVEF (p-0.1016) and between Hb levels and LVEF (p-0.3707), and between Hb levels and RVSP (p-1.00)

DISCUSSION

Numerous echocardiographic studies have shown that patients with ESRD frequently have pulmonary hypertension (PH).[4-6] For example, chronic volume overload has driven by insufficient ultrafiltration, excessive cardiac output in the presence of an AV fistula and chronic anaemia, and sleep apnea are all plausible explanations for the elevated occurrence in this population.[7] Abdelwhab and Elshinnawy5 found that the prevalence of PH (defined as an estimated RVSP of >35 mm Hg) was high in a study of 76 patients with ESRD regardless of whether the patients were managed with hemodialysis (44.4%) or had not yet started dialysis and were managed with medications alone (32.3%).

Numerous studies have demonstrated that PH is a strong prognostic predictor in ESRD and posttransplant populations. In a retrospective analysis of 739 patients assessed for renal transplantation, Stallworthy et al.[8] reported that PH and RV dysfunction was substantially linked with all-cause death (hazard ratio 1.91, p = 0.001). RVSP 35 mm Hg was related to early graft failure in deceased donor recipients, according to research by Zlotnick et al.[9] (43% of patients with increased RVSP compared to 6% of patients with normal RVSP, p = 0.002). According to Issa et al.[10] a considerably increased RVSP of >50 mm Hg was linked to decreased post-transplant survival (p = 0.06). RVSP, however, could not be measured in a significant portion of the patients (109/324 [33.6%] for Issa et al.[10] and 36/94 [38.3%] for Zlotnick et al.9). Finally, Caughey et al.[11] speculated that results in PH patients undergoing kidney transplantation might be influenced by left atrial pressure. In the absence of raised left atrial pressure, they discovered that 5-year mortality was higher in PH patients, indicating that those with substantial pulmonary vascular disease are more at risk.[11]

In our study, out of twelve patients posted for renal transplantation, one patient went for pulmonary edema, frothy pink sputum was noted, and the patient became hypoxic spo2 around 86-88%, so the patient was intubated and maintained in mechanical ventilation. PEEP was kept around 10 cmH20, saturation improved 93-95%, vitals were monitored throughout the case, and PEEP was adjusted accordingly. Hypoxia is probably due to pulmonary hypertension as the kidney becomes perfused well. The patient echo report showed Right ventricular systolic pressure (RVSP)-42mmhg, indicating moderate pulmonary hypertension. Therefore, we have decided to put the patient in elective ventilation overnight postoperatively. Patient saturation improved, vitals were stable, urine output was good and successfully extubated the next day morning. Based on this above case, we decided to put overnight elective ventilation for a transplant patient with right ventricular systolic pressure above 40mmHg.

We have pre-operatively assessed two cases with right ventricular systolic pressure 45mmHg. Pre-oxygenated and intubated vitals were monitored throughout the procedure. Vitals were stable. Given the increased right ventricular systolic pressure, which indicates pulmonary hypertension, we decided to put the patient in elective ventilation overnight. Again, the patient vitals were monitored. Vitals were stable, urine output was good, and the patient was extubated the next morning.

In patients with ESRD, there are various potential reasons for RV dysfunction, but in the population of our investigation, the precise causes of RV dysfunction were unknown. Additionally, shorter times to all-cause graft failure and shorter times to death were linked to RV dilation. Vein congestion and poor cardiac output are two ways that RV dilatation and dysfunction may cause transplant failure. According to a retrospective analysis of renal transplant recipients who had graft failure, 4.6% of allograft dysfunction was attributable to cardiorenal syndrome, indicating that venous congestion is a significant contributor to allograft dysfunction.[12] When the RV is dilated and dysfunctional, functional tricuspid regurgitation might raise venous pressure and impact renal perfusion pressure.

Additionally, arterial calcification decreased cardiac output, and hypotension brought on by autonomic dysfunction may be causing transplant failure. It will take further research to understand these mechanisms fully. Nevertheless, our research suggests that RV assessment could be very helpful in identifying individuals who need additional cardiovascular optimization and work-up, including diagnostic tests and adjusting ultrafiltration objectives, before receiving a kidney transplant.

Limitations

A retrospective analysis of a relatively limited patient cohort was performed in this single-centre study. Due to the volume dependence of RV dimensions and function, the timing of each echocardiography concerning hemodialysis may have affected the outcomes.

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CONCLUSION

Pulmonary hypertension greatly influences the renal transplant outcome. Elective ventilator support helps improve cardiopulmonary function and urine output in severe pulmonary hypertension. In addition, elective ventilation in patients with right ventricular systolic pressure greater than or equal to 40mmhg may improve overall outcomes.

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