



## RESEARCH ARTICLE

# Assessment of Pulmonary Capillary Wedge Pressure Using Pulse Wave Doppler in Hemodialysis Patient- Prospective Observational Study

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### Abstract:

**Background:** We aimed to identify the clinical utility of a simple echocardiography approach for estimating the pulmonary capillary wedge pressure (PCWP) on the basis of pulse wave doppler in pre and post hemodialysis patient.

**Method:** A prospective observational study was done in 50 patient's attending their Hemodialysis session at Chettinad Hospital with the age limit <70 years. From the total subjects 30 were males and 20 were females. In this present study we analyzed the pre and post dialysis volume changes using Estimated PCWP and correlate it with other volume markers. To determine that estimated PCWP might be one of the diagnostic accuracy to detect volume load in the patient undergoing Hemodialysis.

**Result:** In this study, it was found that patients who had very low Estimated PCWPs (PCWP-less than 4mmHg) after a dialysis session started to experience wooziness, cramping, etc. The patient's hemodynamic state in the post-dialysis period is significantly impacted by intra-dialytic weight gain. The changes in Pulmonary Capillary wedge pressure in Post Dialysis session is well correlated with the other volumetric markers like Systemic blood pressure, LA Diameter, Creatinine and BUN levels.

**Conclusion:** Echocardiography plays an important role in day-to-day clinical diagnosis. In this study, patients with chronic kidney disease underwent haemodialysis. In Post dialysis period the intra dialytic weight gain play a major impact on the patient hemodynamic status. To overcome this various volume markers were used. At this point, the estimated pulmonary capillary wedge pressure can be used as one of the most specific volume load markers in patients undergoing Hemodialysis and it is well correlated with other volume markers too.

**Keywords:** Pulmonary Capillary Wedge Pressure, Estimated Pulmonary Capillary Wedge Pressure, End Stage Renal Disease, Pulse Wave Doppler, Mean Arterial pressure, Blood Urea Nitrogen.

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**1 | INTRODUCTION**

Invasively recorded pulmonary capillary wedge pressure (PCWP), which is directly related to functional capacity and prognosis in patients with heart failure, has been frequently employed as a substitute for left ventricular (LV) filling pressure(1,2,3). There have been reports of several echocardiography-derived parameters offering non-invasive methods for calculating the PCWP(4). E' is influenced by LV morphology, regional function, and mitral annular structure and can lead to inaccurate PCWP estimate, multiple articles have lately raised doubts regarding the usefulness of E/E', particularly in patients with maintained LV ejection fraction (EF)(5,6).The formula for estimating pulmonary capillary wedge pressure is ePCWP = 1.9 + 1.24 (E/ε)(7). Studies testing this approach on hemodialysis patients' heart function. Due to the precise information regarding ventricular filling pressure that pulse wave doppler provides, it is possible to acquire significant data for the evaluation of volume load in cases of end-stage renal disease (ESRD). In this study, we sought to assess the association between ePCWP estimated with PWD and other volume load-related factors.

**2 | METHODS AND MATERIALS**

The current study was a prospective observational study conducted in the cardiology department of Chettinad Super Speciality Hospital. The institutional ethical committee gave their consent to the study. Subjects are taken based on the Inclusion and Exclusion criteria. Inclusion Criteria: Age limit 20 to 70 years, End stage renal disease patients on Hemodialysis, Diabetes mellitus, Systemic hypertension, Dyslipidaemia, known CAD. Exclusion Criteria: Patients receiving first time for Hemodialysis, Patients with COPD, Valvular Heart Disease, Arrhythmias, Pregnancy, Patients with psychiatric issues. All patients individuals had pulse wave doppler echocardiograms. In the questionnaire, relevant history was documented. All patients underwent investigations such as creatinine, BUN, echocardiography, BP, Mean Arterial Pressure (MAP). The department of cardiology CSSH will use a vivid S5 GE machine and an ESAOTE machine to do conventional echocardiography Pulse Wave Doppler. All patients are imaged while lying in left lateral decubitus position to assess the E/E' using pulse wave doppler as per ASE guidelines. In order to test the clinical hypothesis that high E/A in the context of aberrant LV diastolic function strongly suggests the presence of high

filling pressure, we combined the use of E' ≤8 and high E/A with PCWP estimation to see if this method can more reliably predict raised PCWP than E/E' derived PCWP prediction.

**3 | PULSE WAVE DOPPLER**

The accuracy and precision of the diagnosis procedure utilised to determine whether systolic or diastolic impairment is detected. Tissue doppler imaging shows the early diastolic myocardial velocity E' and E/E' have the relationship with LV comfort and adherence measures, whereas the myocardial systolic speed compared to ejection fraction, S is a more accurate predictor of systolic function.

**4 | RESULTS**

In this study, 50 patients were taken in which 30 patients were male (60%) and 20 patients were female (40%) who attend their Hemodialysis session.

Table 1: Changes in Hemodynamic Parameters:

PARAMETERS	PRE-DIALYSIS	POST DIALYSIS
SYSTOLIC BP (mmHg)	180± 20	140± 15
DIASTOLIC BP(mmHg)	110±15	80±10
MEAN ARTERIAL PRESSURE (mmHg)	130±12	100±9

In table 1 the average changes in Hemodynamic parameters after the dialysis session revealed, a decreasing trend of Systolic blood pressure (from 180 + 20 mmHg to 140 + 15mmHg), Diastolic blood pressure (from 110 + 15mmHg to 80 + 10mmHg), Mean arterial pressure (from 130 + 12mmHg to 100 + 9mmHg).

PARAMETERS	PRE-DIALYSIS	POST DIALYSIS
Creatinine	8.3 ± 3	4.2± 1.4
BUN	28±7	17±6

Table 2 shows a clinical parameters after the dialysis session was noted, which revealed drop in Creatinine level (from 8.3 + 3mg/dl to 4.2 + 1.4mg/dl) and Blood urea nitrogen (from 28 + 7mg/dl to 17 + 6mg/dl) levels.

Table 3: Changes in Echocardiographic Parameters:

PARAMETERS	PRE-DIALYSIS	POST DIALYSIS
E/E'	15.6± 3.1	8.7± 2.5
Estimated PCWP	21±3	13±4

Table 3 shows the Pre and Post Hemodialysis session the changes in patient Pulmonary capillary wedge pressure were observed. In which the Estimated PCWP in Pre - Dialysis ranges between 21 + 3mmHg, and in Post - Dialysis it ranges between 13 + 4mmHg.

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## 5 | DISCUSSION

Regardless of the underlying aetiology, the rise of LV filling pressure is a common characteristic of heart failure(8)and one of the primary treatment objectives is PCWP >18 mmHg (9,10).Consequently, we used a PCWP of 18 mmHg(10,11) not though 12 or 15 mmHg(5,6). Using the current investigation as the threshold value for assessing the diagnostic precision of echocardiography-derived parameters for determining high LV filling pressure.

The focus of the current study is on the many aetiologies of heart disease, particularly in individuals undergoing and recovering from hemodialysis. Even though we were able to prove our main thesis, which demonstrated statistically significant higher diagnostic accuracy and etiological varieties may bring favourable distribution in the mean PCWP, more research in larger populations is required to pinpoint the etiological variations that may affect the diagnostic effectiveness of the evaluation of pulse wave doppler in the prediction of high mean PCWP.

However, septal E' is frequently employed in clinical settings since it is thought to correlate well with LV diastolic performance (12). Although great attention was taken to gather all data in stable cardiac conditions for the study of mitral inflow and the PCWP, right heart catheterization and echocardiography were not measured at the same time. There were no left atrial or LV end-diastolic pressure measurements made directly(13). Finally, other echocardiography-derived parameters that have been shown to be reliable predictors of high LV filling pressures and cardiovascular mortality include the ratio of the systolic and diastolic velocities of the pulmonary venous inflow, the systolic fraction of the pulmonary venous forward flow, and V p (14,15,16).

## 6 | CONCLUSION

Prediction and maintenance of volume overload are important in Post dialysis period to prevent complications. To overcome this various volume markers were used. From this aspect the use of parameters such as Hemodynamic markers like, Systemic Blood pressure, Mean arterial pressure. Clinical markers like Creatinine and BUN. Echocardiographic markers like LA diameter, LV internal dimensions, E/E' and Estimated PCWP were noted. At this point, the estimated pulmonary capillary wedge pressure can be used as one of the most specific volume load markers compared with other parameters in patients undergoing Hemodialysis and it is well correlated with patients hemodynamic status.

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