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Role of hepatic veins doppler parameters for volume status evaluation in hemodialysis patients

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Abstract

Background: Fluid balance is important in hemodialysis patients. ‘‘Dry’’ weight is usually assessed clinically, and also biochemical markers is considered reliable. The use of ultrasound to assessment of volume status received growing attention in clinical research in hemodialysis patients. Ultrasound can evaluate extravascular and intravascular water. So, ultrasound is considered as a useful tool to evaluate the volume status of hemodialysis patients. **Objective**: To assess the role of hepatic vein doppler parameters in assessment of volume status before and after a dialysis session in hemodialysis patients. **Patients and Methods**: This was across-sectional study carried out at Hemodialysis Unit, Al-kasr EL ainy University Hospital, conducted on100 hemodialysis patients. Demographic data and clinical information were recorded. Laboratory data including CBC, urea, creatinine, calcium, phosphate and albumin were evaluated. Radiological examination included ultrasound hepatic veins before and after dialysis session. **Results**: there was statistically significantly difference between cases and control in doppler wave form of (hepatic veins), ($P < 0.001$) There was a statistically significant correlation between hepatic vein wave form change pre and post dialysis, the normal wave form increased from 44 (44%) to 88 (88%) after dialysis, and abnormal wave form decreased from 56 (56 %) to 12 (12%) after dialysis **(P- value < 0.001). Conclusions**: hepatic vein doppler parameters is simple and low- cost technique, and can be easily applied by nephrologists at the bedside to assess of volume status before and after a dialysis session.

Key words: volume status, hepatic vein, doppler parameters.

INTRODUCTION

Chronic kidney disease (CKD) is a progressive loss in renal function over a period of months or years. All individuals with a glomerular filtration rate of less than 15/ml/min/1.73 m2 for 3 months are classified as having end-stage renal disease (ESRD) [Karthikeyan et al., 2016]. The prevalence rates of CKD worldwide are high and have increased in the last few years to about 13– 15%, with an increased prevalence of diabetes and hypertension [Hill et al., 2016]. End-stage renal disease (ESRD) is increasing worldwide. Worldwide, the prevalence of ESRD differs greatly. In the United States, the prevalence was 1811 pmp [Ghonemy et al., 2016]. In Europe, the prevalence has increased from 760 pmp in 2004 to 889 pmp in 2008 [Stel et al., 2011]. In Egypt, there are no recent data about the prevalence of ESRD; however, the last statistics was performed in 2004, with a prevalence of 483 pmp. [El-Arbagy et al., 2016] In the El-Minia governorate, one of the Upper Egypt governorates, the prevalence was 308 pmp [El Minshawy, 2011]. In patients with ESRD on intermittent hemodialysis, it is vital to maintain fluid status within an optimal range to avoid circulatory complications. Dialysis solutes removal adequacy is determined by measuring the patient's dry weight [Canaud et al., 2019]. Dry weight is determined by clinical examination and usually reflects the lowest post-dialysis weight that can be tolerated by the patient without developing hypotension, intradialytic symptoms, or excess fluid. Clinical examination of dry weight does not include nutritional status change or fat-free body mass, so it is difficult to determine whether the patient is hyper- or hypo-volumic and may cause an increase in morbidity and mortality [Sebastian et al., 2016]. However, if a patient's dry weight has not been achieved, the patient will experience the complications of inadequate dialysis. Physical examination is used as the main modality for hemodialysis patients because the availability of other diagnostic tools is limited. Yet, a diagnostic test including physical examination and chest ultrasound and inferior vena cava diameter to assess volume status and detect lung congestion in hemodialysis patients is needed [Bucharles et al., 2019].

The present work aimed to assess the role of hepatic vein doppler parameters in assessment of volume status before and after a dialysis session in hemodialysis patients

Patients and Methods

This cross-sectional study included 100 hemodialysis patients at Nephrology Unit, al kasr alainy University Hospital,.the procedures followed cairo University Ethical Committee Regulation.. We excluded patients with morbid obesity, with chronic lung diasease and chronic liver diasease.

Hepatic vein assessment:

Hepatic Vein The hepatic vein can be examined using a curved probe of wireless handheld US (UX-8C GOCCLK033). The middle hepatic vein is identified from a mid-subcostal or lateral view. Hepatic venous waveforms are obtained via applying PWD in about 2-4 cm from its junction to the IVC.

Results:

The present study included 100 Egyptian patient from dialysis units in Kasr Alainy hospital who meet inclusion and exclusion criteria and 30 Egyptian subjects as control. Females' patient represents 48% and males 52% while in control females were 46.7% and males 53.3% with no statistically significant difference between cases and control

Table (1): Show difference in doppler wave form of (, hepatic vein) between cases and control

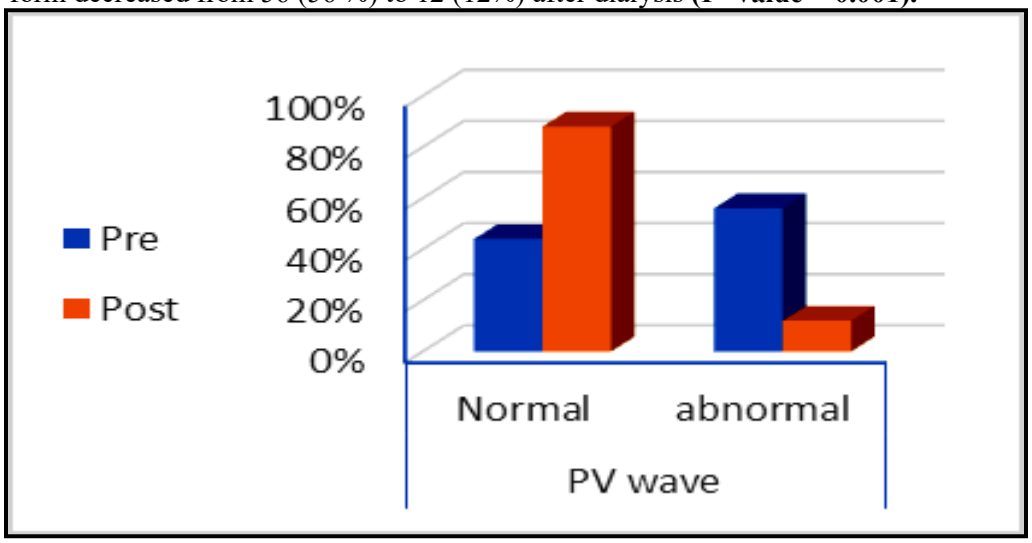
		Cases		Controls		P value
		Count	%	Count	%	
HV wave- pre	Normal	44	44.0%	30	100.0%	< 0.001
	abnormal	56	56.0%	0	0.0%	

- Regarding doppler wave form of (hepatic veins), there was statistically significantly difference between cases and control (P < 0.001)

Table (2): Comparison between wave form of (HV) pre and post in cases

Cases		Pre		Post		P value
		Count	%	Count	%	
HV wave	Normal	44	44.0%	88	88.0%	< 0.001
	abnormal	56	56.0%	12	12.0%	

- There was a statistically significant correlation between hepatic vein wave form change pre and post dialysis, the normal wave form increased from 44 (44%) to 88 (88%) after dialysis, and abnormal wave form decreased from 56 (56 %) to 12 (12%) after dialysis **(P- value < 0.001).**



Discussion:

Assessment of fluid and hemodynamic status is a critical skill for nephrologists, central to almost every consult from hypertension and electrolyte disorders to management of AKI and ESKD. Fluid status assessment has a stored tradition in which physical exam signs of jugular venous distention, third heart sounds, rales, and peripheral edema have been learned and reproduced by generations of physicians. These signs are helpful in extreme cases, but are insensitive for the detection of volume overload (**Torino et al., 2016).**

Our study was is observational cross-sectional study that was conducted on 100 Egyptian patient from dialysis unit in Kasr Alainy hospital who meet inclusion and exclusion criteria and 30 Egyptian subjects as control. Female patients represent 48 % and males 52% while in control females were 46.7% and males 53.3% with no statistically significant difference between cases and control

The study revealed improvement of IVC doppler parameters post hemodialysis , the normal wave form increased from 44 (44%) to 88 (88%) after dialysis, and abnormal wave form decreased from 56 (56 %) to 12 (12%) after dialysis **(P- value < 0.001).**

There was similar to **Andrei et al., (2023),** this prospective, observational study included adult patients within 24 h of ICU admission. VExUS (Venous excess ultrasound score) which depend on assessment of IVC, portal vein, hepatic vein and intrarenal blood flow Doppler parameters) and hemodynamic parameters were measured four times during the ICU stay: within 24 h of ICU admission, after day 1 (between 24 and 48h), after day 2 (between 48 and 72h), and last day of ICU stay. The prevalence of AKI during the first week in ICU and 28-day mortality were assessed.

The 145 patients included, the percentage of patients with a VExUS score of 2 (moderate congestion) and 3 (severe congestion) was 16% and 6%, respectively. The prevalence did not change over the study period. There was no significant association between admission .VExUS scores and AKI ($p = 0.136$) or 28-day mortality ($p = 0.594$). Admission VExUS ≥ 2 was not associated with AKI (OR 0.499, $CI_{95\%}$ 0.21–1.17, $p = 0.109$) nor 28-day mortality (OR 0.75, $CI_{95\%}$ 0.2–2.8, $p = 0.669$). The results were similar for VExUS scores measured at day 1 and day 2. They conclude that in general ICU cohort the prevalence of moderate to severe venous congestion was low.
Early assessment of systemic venous congestion using VExUS scores (which depend on assessment of IVC, portal vein, hepatic vein and intrarenal blood flow doppler parameters) was not associated with the development of AKI or with 28-day mortality.

Conclusion

Hepatic vein doppler parameters is simple and low cost technique, and can be easily applied at the bedside to assess of volume status before and after a dialysis session, , and may help in justify dry weight which still a challenge for the nephrologists and therefore represents the ultimate goal of our study.

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