

Prevalence of Pericardial Effusion in Patients on Maintenance Hemodialysis in The Iraqi Dialysis Center

Ali Jasim M. AL-Sultani,

Department of Medicine, College of medicine , Babylon University

Alialsultany81@yahoo.com

Abstract

Background: Patients with end stage renal disease (ESRD) on regular hemodialysis (HD) are presented in significant percentage with pericardial effusion that was associated with significant morbidity and little mortality.

Aim: This study concern to estimate the prevalence of uremic pericardial effusion (UPE) among patients on regular hemodialysis and its possible associated factors. **Patients and Methods :** In this cross section study, the data was conducted at the Iraqi Dialysis Center of Baghdad Teaching Hospital in Medical City, mainly assessed by echocardiography to 100 patients on regular hemodialysis included in this study attending our hospital for hemodialysis as part of thier long term treatment. **Results:** The prevalence of UPE was 23% among HD patients and the result was significant with $P < 0.001$, mainly associated with aging, those with hypertention (HTN), diabetes mellitus (DM), ischaemic heart disease (IHD), hypoalbuminaemia, anaemia and inadequate HD, but the prevalence interstingly was low in patients with heptitis C virus infection.

Conclusion: the prevalence of UPE was higher than previous study that show dialysis-associated pericardial effusion account to 8-12% of patients on hemodialysis.

Key words: ESRD, HD, UPE, IHD, HCV.

الخلاصة

الخلفية

ان مرضى عجز الكلى المزمن كثيرا ما يعانون من انصباب التامور الذي كثيرا ما يعرضهم الى درجة ملحوظة من المرض وبعض الاحيان يهدد حياتهم.

الهدف

دراستنا تركز على تخمين مدى الانتشار بالانصباب التاموري لدى مرضى الفشل الكلوي الذين يجرون غسيل الكلى الدموي ومعرفة الاسباب المرتبطة بالاصابة.

الطرائق

في هذه الدراسة تم جمع البيانات في المركز العراقي لغسل الكلى في مستشفى بغداد التعليمي في مدينة الطب ل 100 مريض ياتون للمستشفى لاجراء الغسل الكلوي الروتيني لهم وتم التشخيص عن طريق اجراء فحص الايكو.

النتائج

اظهرت الدراسة ان معدل الانتشار بانصباب التامور كانت 23 % بين مرضى الغسل الكلوي الدموي حيث كان نسبة الاصابة عالية مع التقدم بالعمر، الاصابة بارتفاع ضغط الدم او السكري، انخفاض نسبة الالبومين بالدم، فقر الدم، امراض تصلب الشرايين والمرضى الذين لا يخضعون لجلسات غسل كافية (مرتان اسبوعيا)، بينما ينخفض المعدل بالنسبة للمرضى المصابين بالتهاب الكبد الفايروسي نوع سي.

الاستنتاج

تم الاستنتاج من هذه الدراسة انها اثبتت تاثير بعض العوامل في حدوث الاصابة بانصباب التامور لدى المرضى الذين يعانون من الفشل الكلوي المزمن وبالاخص تقدم عمر المرضى، الاصابة بارتفاع ضغط الدم او السكري، انخفاض نسبة الالبومين بالدم، فقر الدم، امراض تصلب الشرايين والمرضى الذين لا يخضعون لجلسات غسل كافية (مرتان اسبوعيا)، بينما ينخفض المعدل بالنسبة للمرضى المصابين بالتهاب الكبد الفايروسي نوع سي.

الكلمات المفتاحية: عجز الكلى المزمن، الغسل الكلوي، الانصباب التاموري، تصلب الشرايين، التهاب الكبد الفايروسي نوع C.

1. Introduction

The most common cardiovascular manifestations of chronic kidney disease (CKD) in patients on hemodialysis are ischaemic heart disease (IHD), cerebrovascular disease (like stroke), peripheral vascular disease (PVD), pericardial disease, valvular calcification, endocarditis and sudden cardiac death (Floege *et al.*, 2014).

One of the most common cardiovascular manifestations in uraemic patients are pericardial diseases including pericardial effusion. Pericarditis from untreated uremia is rare today. The more common dialysis-associated pericarditis may be related to intercurrent illnesses (including viral infections), fistula recirculation (by inducing inefficient HD and hemodynamic disturbance), or underlying diseases such as systemic lupus erythematosus, but the exact pathogenesis remains uncertain. (Alpert & Ravenscraft, 2003).

An effusion causing significant hemodynamic compromise like (pericardial tamponade) or large pericardial effusions judged unlikely to resolve with conservative measures require echocardiographically or computed tomography (CT)-guided pericardiocentesis or surgical drainage. (Alpert & Ravenscraft, 2003)

Two forms of pericardial effusion in renal failure have been described. (Alpert & Ravenscraft, 2003; Maisch *et al.*, 2004).

Firstly, uremic pericardial effusion results from inflammation of the visceral and parietal membranes of the pericardial sac. There is a correlation with the degree of azotemia (the BUN is usually >60 mg/dL [22 mmol/L]), although the pathogenesis is poorly understood. Except in the case of systemic immune diseases (such as lupus erythematosus or scleroderma), there is no relationship with the underlying cause of renal failure. (Rutsky & Rostand, 1987).

Secondly, pericardial effusion is occasionally seen in patients on maintenance hemodialysis or peritoneal dialysis. At least two factors may contribute to this problem: inadequate dialysis (ie, the patient has uremic pericarditis) and/or fluid overload. (Lundin, 1990).

The clinical features of pericardial effusion in renal failure are similar to those observed with other causes including chest pain and shortness of breath. (Alpert & Ravenscraft, 2003).

Signs of cardiac tamponade may be seen, particularly in patients with rapid pericardial fluid accumulation. However, the high prevalence of autonomic impairment in this patient population may hinder the normally observed rise in heart rate. (Gunukula & Spodick, 2001).

Echocardiographic examination may reveal a pericardial effusion in at least 50 percent of cases. A concomitant pleural effusion, which is commonly exudative, may be observed, findings consistent with generalized volume overload. (Bakirci *et al.*, 2007).

Either hemodialysis or peritoneal dialysis can be used, but each technique has certain disadvantages. Since anticoagulation can increase hemorrhage into the pericardial space, systemic anticoagulation should be avoided when hemodialysis is the chosen option (Daugirdas *et al.*, 2015). In addition, acute fluid removal with hemodialysis can lead to cardiovascular collapse in patients with tamponade or pretamponade. Peritoneal dialysis, on the other hand, can compromise respiratory function due to large intraperitoneal fluid accumulation. (Daugirdas *et al.*, 2015).

The form of dialysis therapy is usually determined by local availability and the long term plans for the patient with end-stage renal disease. (Daugirdas *et al.*, 2015).

2. Aims of the study

1. To determine the prevalence of pericardial effusion in ESRD patients on regular hemodialysis at the Iraqi dialysis center in medical city.

2. To assess the possible etiological factors for the occurrence of pericardial effusion including: age and sex of the patients, duration and frequency of hemodialysis, hypertension, diabetes mellitus, ischaemic heart disease, virological status, hemoglobine level and serum albumin.

3. Patients and Methods

Selection of study samples

The study was conducted at Iraqi Dialysis Center of Baghdad Teaching Hospital, the dialysis unit of our hospital has a capacity to do hemodialysis for up to 36 patients daily into two to three divided sessions starting at 7:00 am for a maximum 4 hours for each session. The participants are 100 patients with ESRD on regular HD (age ranged 17-79 years old and the mean age; 51.12 ± 15.97) that are divided according to the age into four groups as follow (<19, 20-39, 40-59, >60) years.

Study Design:

This was a cross sectional study which conducted to determine the prevalence of pericardial effusion among patients on hemodialysis and to find the association between pericardial effusion and study variables including (socio-demographic characteristics, frequency of hemodialysis, investigation results and history of chronic diseases). Socio-demographic characteristics include (age and gender), investigations include (chest x-ray, haemoglobin level, fasting or random blood sugar and serum albumin), history of chronic diseases include (hypertension, diabetes mellitus, ischemic heart diseases, viral hepatitis B and viral hepatitis C). The study duration was continued from December 2013 to May 2014.

Data Analysis:

Statistical analysis was carried out using SPSS version 17. Categorical variables were presented as frequencies and percentages. Continuous variables were presented as (Means $\pm$ SD). Pearson's chi square (X^2) test and Fisher exact test were used to find the association between the categorical variables. Independent sample t-test was used to compare means between two groups. A p -value of ≤ 0.05 was considered as significant.

Diagnostic procedures:

Two dimensional echocardiography was performed in each case using an Envisor HDI 5000 machine (Philips, Germany) with 2-4 MHz probe, each patient was examined in left decubitus position.

Uremic pericardial effusion was defined as a collection of fluid in the pericardial space with simultaneous recording of echoes from posterior left ventricular pericardium, epicardium, endocardium, interventricular septum and anterior heart wall. It was classified as mild <100 ml, moderate 100-300 ml and severe >300 ml. (Kumar & Clark, 2012)

When a large volume collects in this space, ventricular filling is compromised leading to embarrassment of the circulation. This is known as cardiac tamponade. (Jameson & Loscol, 2013).

Anaemia was diagnosed when serum haemoglobin level below 13g/dL for male and below 12g/dL for female, while hypoalbuminaemia was diagnosed when serum albumin fall below 35g/L. (Douglas & Murali, 2015).

Diabetes mellitus define by history of DM or a state of hyperglycemia in which fasting blood sugar >126 mg/dL or random blood sugar > 200 mg/dL, need one value for symptomatic and two values for asymptomatic patient.((Kumar & Clark, 2012)

Hypertension is defined by a history of HTN or depend on method of blood pressure reading ; more than 140/90 mm Hg (at clinic); > 135/85 mm Hg(at home) and >130/ 80 mm Hg (ambulatory)(James *et al.*, 2014).

4. Results

Table I shows most of patients (61%) presented between the age of (40-59) years old and (64%) of them were male.

Table I: Distribution of patients according to socio-demographic characteristics

Socio-demographic characteristics	Frequency (%)
Age (years) /	
<19	3 (3.0%)
(20-39)	29 (29.0%)
(40-59)	61 (61.0%)
≥ 60	7 (7.0%)
Total	100 (100.0%)
Gender /	
Male	64 (64.0%)
Female	36 (36.0%)
Total	100 (100.0%)

Majority (55%) of the patients underwent hemodialysis twice session per week as shown in table II.

Table II: Distribution of patients according to frequency of hemodialysis

Table III shows the prevalence of pericardial effusion as diagnosed by echocardiography was (23%) with P-value <0.001 (statistically significant),

Frequency of hemodialysis	Number (%)
Twice per week	55 (55%)
Three times per week	44 (44%)
Four times per week	1 (1%)
Total	100 (100.0%)

while the severity of pericardial effusion are classified as mild, moderate and severe.

Table III shows the prevalence and severity of pericardial effusion among patients on haemodialysis.

Pericardial effusion	Frequency	(%)
Present		
Mild	12	
Moderate	7	
Severe	4	
Total	23	23%
Absent	77	77%
Total	100	100%

There was significant association between pericardial effusion and age of patients, while there was no significant association between pericardial effusion and gender as in table IV.

Table IV Association between pericardial effusion and socio-demographic characteristics

Characteristic	Pericardial effusion		χ^2	P-value
	Present (%)	Absent(%)		
Age Groups				
<19years	0 (0.0)	3 (3.9)		<0.001**^a
(20-39)years	0 (0.0)	29 (37.7)		
(40-59) years	22 (95.7)	39 (50.6)		
≥ 60 years	1 (4.3)	6 (7.8)		
Gender				
Male	15 (65.2)	49 (63.6)	0.019	0.890
Female	8 (34.8)	28 (36.4)		

*p value ≤ 0.05 was significant, **p value ≤ 0.01 was significant and ^a : Fisher – exact test

There was significant association between pericardial effusion and frequency of haemodialysis as in table V.

Table V Association between pericardial effusion and frequency of hemodialysis session

Study variables	Pericardial effusion		χ^2	P-value
	Present (%)	Absent (%)		
Frequency of haemodialysis				
Twice per week	21 (91.3)	34 (44.2)	15.907	<0.001**
Three or four times per week	2 (8.7)	43 (55.8)		

*p value ≤ 0.05 was significant, **p value ≤ 0.01 was significant and a : Fisher – exact test

Table VI shows the association between pericardial effusion and history of chronic diseases including (hypertension, diabetes mellitus, ischemic heart diseases, hepatitis B virus and hepatitis C virus). There was significant association between pericardial effusion and history of hypertension, diabetes mellitus, ischemic heart diseases and inversely with hepatitis C positive patients, while there was no significant association between pericardial effusion and history of hepatitis B virus infection.

Table VI Association between pericardial effusion and history of chronic diseases

Chronic diseases	Pericardial effusion		χ^2	P-value
	Present (%)	Absent (%)		
Hypertension				
Present	22 (95.7)	43 (55.8)	12.336	<0.001**
Absent	1 (4.3)	34 (44.2)		
DM				
Present	12 (52.2)	17 (22.1)	7.791	0.005**
Absent	11 (47.8)	60 (77.9)		
Ischemic heart diseases				
Present	15 (65.2)	10 (13.0)	25.767	<0.001**
Absent	8(34.8)	67 (87.0)		
Viral hepatitis B				
Present	2 (8.7)	0 (0.0)		0.051 ^a

Absent	21 (91.3)	77 (100.0)		
Viral hepatitis C				
Present	4 (17.4)	50 (64.9)	16.116	<0.001**
Absent	19 (82.6)	27 (35.1)		

*p value ≤ 0.05 was significant

**p value ≤ 0.01 was significant

a : Fisher – exact test .

Table VII shows mean differences of hemoglobin and serum albumin by presence of pericardial effusion. There were significant differences between means of hemoglobin and serum albumin for both study groups.

Table VII: The mean differences of hemoglobin, serum albumin and total serum protein by presence of pericardial effusion

Variable	Pericardial effusion	N	Mean $\pm$ S.D	t-test	P value
Hb (g/dl)	Present	23	9.17 $\pm$ 0.90	-5.349	<0.001**
	Absent	77	10.28 $\pm$ 0.86		
Serum albumin (g/l)	Present	23	28.47 $\pm$ 4.94	-7.837	<0.001**
	Absent	77	36.98 $\pm$ 2.98		

*p value ≤ 0.05 was significant

**p value ≤ 0.01 was significant

5. Discussion

This study shows the prevalence of UPE reached (23%) ; most of patients (95.7%) presented between the age of 40-59 years old with (P-value< 0.001) and (64%) of them were male, and majority of patients with UPE (91%) underwent twice HD sessions per week, and the medical history of HTN (95%), DM (52%) and IHD (65%) are represent the major relevant comorbidities in patients with UPE.

Past studies of clinically evident uraemic pericarditis have indicated a prevalence of between 16 and 41 percent among patients in chronic dialysis programs. Many patients have developed pericarditis 3 months or longer after starting dialysis,

in spite of technically adequate and frequent dialysis.(Bailey *et al.*, 1968; Baldwin & Edwards, 1976; Beaudry *et al.*, 1966; Comty *et al.*, 1971).

The echocardiographic results of our study show the prevalence of UPE was 23% which higher than previous studies (Rostand and Rutsky, 1990; Rutsky and Rostand, 1989) that show dialysis-associated pericardial effusion account to 8-12% of patients after the onset of dialysis(Rostand & Rutsky, 1990; Rutsky & Rostand, 1989), this high value may be explained by most of our patients associated significantly with several comorbidities including HTN (95%) , IHD (65%) and DM (52%) , almost all of our patients (100%) are anaemic with hypoalbuminaemia and the majority of patients (91%) recieved HD twice weekly , this will make HD ineffiecient and with difficulty to reach dry weight .

As with other study(Dilek & Siren, 2009), there was no significant difference in the occurrence of UPE among both sexes.

Inconsistence with previous studies (Mazzaferro *et al.*, 1993), most of patients with UPE (95.7%) in our study are in middle age group (statistically significant with P value < 0.001) and these are significantly differ from these previous studies in whome there was a significant correlation between old age group and frequency of occurrence of UPE and this may be explained as most of patients (61%) participate in our study are in middle age group.

In our study, there was a significant reverse relationship between the frequency (twice/week) of HD session like our study (91%) of patients with UPE (twice session / week) with occurrence of UPE that comperable with results of previous studies.(Cornty *et al.*, 1971).

In some studies (Fasial & Meryem 2006), there is a significant correlation between presence of positive medical history of IHD (65%) , HTN (95%) and DM (52%) with the development of UPE; like the results of our study .

This suggest that good glycemic and blood pressure control may prevent the development of UPE.(U.S Renal Data System, 1997).

In contrast to so some studies (Nasir *et al.*, 1979) , in our study ; there was a significant correlation between the prevalence of UPE and hypoalbuminaemia and anaemia .

There is a reverse correlation between HCV positivity status of our patients and the prevalence of UPE ; these results are unexplained .

Also it is found in this study, there are non of our patients develop temponade that disagree to other study (Luft, Kleit, Smith, et al.,1974) in which developes temponade in 3% (Luft *et al.*, 1974), this will be explained by the cases of tamponade may appeare later on during course of disease, majority of patients with UPE not complain from volume overload or we choose low anticoaglant dose that will make bleeding complication are less.

6. Conclusion

1. There is a high prevalence of UPE (one quarter) amoung pateints on maintenance HD .
2. Increasing age , hypoalbuminaemia, anaemia , inadequate HD, IHD, HTN and DM are associated with development of UPE .
3. There is unexplained reverse association of HCV positive patients with development of UPE .

7. Recommendation

1. The findings of this study suggest that echocardiography should be arranged for all ESRD patients at the initiation of HD due to high prevalence of UPE especially among elderly , those with hypoalbuminaemia, positive past medical history and those with suspected UPE by history and physical examination .
2. Early identification and treatment of reversible risk factors that might be related to development of UPE in dialyzed patients may prevent or retard the progression of cardiovascular events .
3. Compliance of patients on regular HD associated with decrease the prevalence of UPE .

8. References

- Alpert MA, Ravenscraft MD. Pericardial involvement in end-stagerenal disease. *Am J Med Sci.* 2003;325:228-236.
- Bailey, G. L., Hampers, C. L., Hager, E. B., and Merrill, J. P. Uremic pericarditis: clinical features and management. *Circulation* (1968); 38, 582-591.
- Bakirci T, Sasak G, Ozturk S, et al. Pleural effusion in long-term hemodialysis patients. *Transplant Proc* 2007; 39:889.
- Baldwin, J. J., and Edwards, J. E.. Uremic pericarditis as a cause of cardiac tamponade. *Circulation* (1976), 53, 896-901.
- Beaudry, C., Nakamoto, S., and Kioff, W. J. Uremic pericarditis and cardiac tamponade in chronic renal failure.*Annals of Internal Medicine*, . (1966) 64, 990-995.
- Comty, C., Cohen, S., and Shapiro, F. L. Pericarditisin chronic uremia and its sequels. *Annals of Internal Medicine*, (1971). 75, 173-38.
- Cornty CM, Simon L, Fred L.S. Pericarditis in chronic uremia and its sequele *Ann Intern. Med.*,1971; 75: 173 - 183.
- Daugirdas J, Blake PJ and Ing TS. handbook of dialysis. 5th edition. Wolter Kluwer health USA. (2015); Pp:75-225.
- Dilek Torun, Siren Sezer, Association of Cardiac Valve calcification and Inflammation in Patients on Hemodialysis; *Renal failure*, , 2009; 27;2, 221-226.
- Douglas L. Mann, Murali Chakinala. Heart failure: pathophysiology and diagnosis : *Harrison principle of internal medicine* ,Mc Graw Hill education.19E (2015); Pp: 1501.
- Fasial Tarrass , Meryem Benjelloun; pericardial effusion in patient with ESRD; *Analyses for risk factors; nephrology* 2006; 11 494-496.
- Floege J, Johnson R and Feehally J. comprehensive clinical nephrology. Elsevier Saunders, 4th edition; (2014); Pp: 907-1019.
- Gunukula SR, Spodick DH. Pericardial disease in renal patients. *Semin Nephrol* 2001; 21:52.
- James PA, Oparil S, Carter BL, et al. 2014 Evidence-based guideline for the management of high blood pressure in adults: Report from the panel members appointed to the Eighth Joint National Committee (JNC 8). *JAMA*.2014; 311:507-520.
- Jameson JL. and Loscol 20 J.. *Harrisons nephrology and acid-base disorders* .2nd ed. McGraw Hill. USA. 8th ed. (2013); Pp:125-320.
- Kumar P. and Clark M. Cardiovascular disease; In *Kumar and Clark clinical medicine*. Sanuders Elsevier UK. 8th ed.,(2012) ; PP:696-789.

- Luft FC, Kleit SA, Smith RN, et al.: Management of uremic
Lundin, AP. Recurrent uremic pericarditis: A marker of inadequate dialysis. *Semin Dial* 1990; 3:5.
- Maisch B, Seferov PM, Risti AD, et al. Guidelines on the diagnosis and management of pericardial diseases executive summary; The Task force on the diagnosis and management of pericardial diseases of the European society of cardiology. *Eur Heart J* 2004; 25:587.
- Mazzaferro, S; Coen, G.; Bandini, S; Role of aging, chronic renal failure and dialysis in the calcification of mitral annulus. *Nephrol. Dial. Transplant.* 1993, 8(4), 335-340.
- Nasir, H. ; H. Kumar, R. Hussain, B. Jamil ,S.A.J. Naqvi (The Kidney Centre. 197/9. Rafiqui Shaheed Road. Karachi.).
pericarditis with tamponade. *Arch Intern Med*,1974; 134: 488.
- Rostand SG, Rutsky EA. Pericarditis in end-stage renal disease. *Cardiol Clin.*1990; 8(4):701-7.
- Rutsky EA, Rostand SG. Pericarditis in end-stage renal disease. Clinical characteristics and management. *Semin Dial.* 1989; 2: 25-30.
- Rutsky EA, Rostand SG. Treatment of uremic pericarditis and pericardial effusion. *Am J Kidney Dis* 1987; 10:2.
- U.S. Renal Data System ,In annual Data Report; National Institutes of Diabetes and Digestive and Kidney Disease, U,S, Dept. of Health and Hummen Services ; Rockvill, MD, 1997.