



Characterization of The Spleen in Long Standing Hemodialysis Patients Using Ultrasound

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ABSTRACT:- This study had been done in the Renal Dialysis Center in Sudanese kidney Transplanted Association (Association Specialized Hospital) in Khartoum state during the period from September 2016 to January 2017. The main goal of this study is to evaluate the spleen of long standing hemodialysis patients by using ultrasound apparatus, with a probe of 3.5 MHz frequency. The study was done on 100 cases under regular hemodialysis for 3 years or more. The study showed that there was an increasing in spleen length, width and thickness comparing with normal range. Therefore the volume of spleen increased comparing with normal range. The measurement of the splenic parameters (length, thickness and volume) reported that they were increasing when age increased. Also it was showed that when the all measurements of the spleen increased, its echogenecity decreasing and echotexture changing from homogenecity to heterogenecity.

Keywords:- Hemodialysis, Echogenecity, Transplanted, Spleen, Ultrasound.

I. INTRODUCTION

Chronic kidney disease is a progressive loss in renal function over a period of months or years. The symptoms are non-specific, and might include feeling generally unwell and weight loss with poor appétit. Chronic kidney disease is identified by blood test for creatinine. Higher levels of creatinine indicate a lower glomerular filtration rate and as a result a decreased capability of the kidney to excrete waste products. The most causes of chronic kidney disease in Sudan are hypertension, diabetes, chronic glomerulonephritis and urinary calculi.^{(1),(2)}

There is no specific treatment unequivocally shown to slow the worsening of chronic kidney disease. If there is an underlying cause to CKD, this may be treated directly to slow the damage. In more advanced stages, treatments may be required for anemia and bone disease. Severe CKD requires renal replacement therapy, which may involve a form of dialysis. There are many complications of hemodialysis like anemia which affect the spleen, neuropathy, blood coagulopathy and amyloidosis. In stage 5 CKD, renal replacement therapy is usually required, in the form of either dialysis or transplant. While renal replacement therapies can maintain patients indefinitely and prolong life, the quality of life is severely affected.⁽³⁾

Medical ultrasonography is an ultrasound-based diagnostic medical imaging technique used to visualize muscles, tendons, and many internal organs, to capture their size, structure and any pathological lesions with real time images. The technology is relatively inexpensive and portable, especially when compared with other techniques, such as magnetic resonance imaging (MRI) and computed tomography (CT). According to the latest WHO data published in May 2004 kidney disease deaths in Sudan reached 1.64% of total death. The hemodialysis nowadays is becoming light guide in the darkness of end stage renal disease (ESRD) to whom cannot undergo renal transplantation. This study tries to show the effect of long term hemodailysis on spleen by using ultrasound.⁽⁸⁾

II. MATERIALS AND METHODS

This is a descriptive cross sectional study where the data collected prospectively. The study conducted at Sudanese kidney transplanted association (Association specialized hospital) in Khartoum state, Sudan. From September 2016 to January 2017. Hundred of patients on hemodialysis for more than 3 years came to hospital

for hemodialysis and ultrasound examination for check up were included in the study. Patient less than fifteen years old and with duration of less than three years were excluded. The variables were; Spleen length; width; thickness; echogenicity; homogeneity; volume and duration of dialysis. Patients were randomly selected. The patient should be supine initially and later on the right side. Apply coupling agent liberally over the left lower chest, the upper abdomen and left Flank. The patient should take a deep breath and hold it in when a specific area is being scanned. Start by placing the transducer centrally at the top of the abdomen (the xiphoid angle), scan the patient in supine and oblique position. Multiple scans may be necessary. Scanning from below the costal margin, angling the beam toward the diaphragm. Then from the ninth intercostal space downward. Also longitudinal scan from anterior to posterior axillary line and transverse upper abdominal scan were performed. A highly designated ultrasound machine was used (Mindary 3300 v 100-240) with a convex probe (3.5) MHz frequency. Ethical clearance had obtained from the authorities of the Faculty of Graduate Studies, and Scientific Researches, The National Ribat University. No individual patient details mentioned throughout this study.

III. STATISTICAL METHODS

Descriptive statistics was used to describe the study variables, using the Statistical Package software for Social Science (SPSS), version 20 to analyze these variables and presented into tables, figures.

IV. STUDY SAMPLE CHARACTERISTICS

Data collected from September 2016 to January 2017 at the Sudanese kidney transplanted association (Association specialized hospital) in Khartoum state, Sudan, where the patients fulfilling the criteria were randomly selected.

V. RESULTS

According to the age of the total number of subject who underwent the study they divided into 4 groups, 25 (25%) of them had age ranged between (15-30) years, 30 (30%) between (31-45) years, 32 (32%) of between (46-60) years, 13 (13%) between (60-70) years. The minimum age was (18) and the maximum +(70) with the mean of (43.81) and SD (14.28), as shown in fig (1).

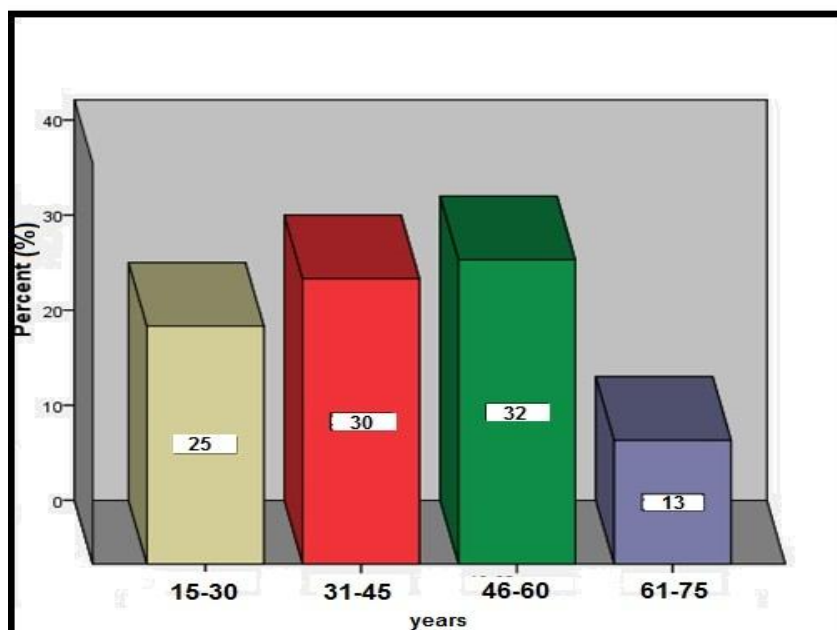


Fig (1): Shows frequency distribution of age group

Out of the total number of patients 58 (58%) were males, and the rest 42 (42%) were female, as shown in table (1).

Table (1): Frequency distribution of gender

Regarding the frequency of dialysis 67 (67%) of the patient had duration of the dialysis between (3-5) years, follows by 21 (21%) with duration between (6-8) years and 12 (12%) with duration between (9-13) years. The minimum duration was 3 years and the maximum 13 years with the mean of (5.27) and SD (2.31), as shown in fig (2).

Gender	Frequency	Percent	Valid Percent	Cumulative Percent
Male	58	58.0	58.0	58.0
Female	42	42.0	42.0	100.0
Total	100	100.0	100.0	

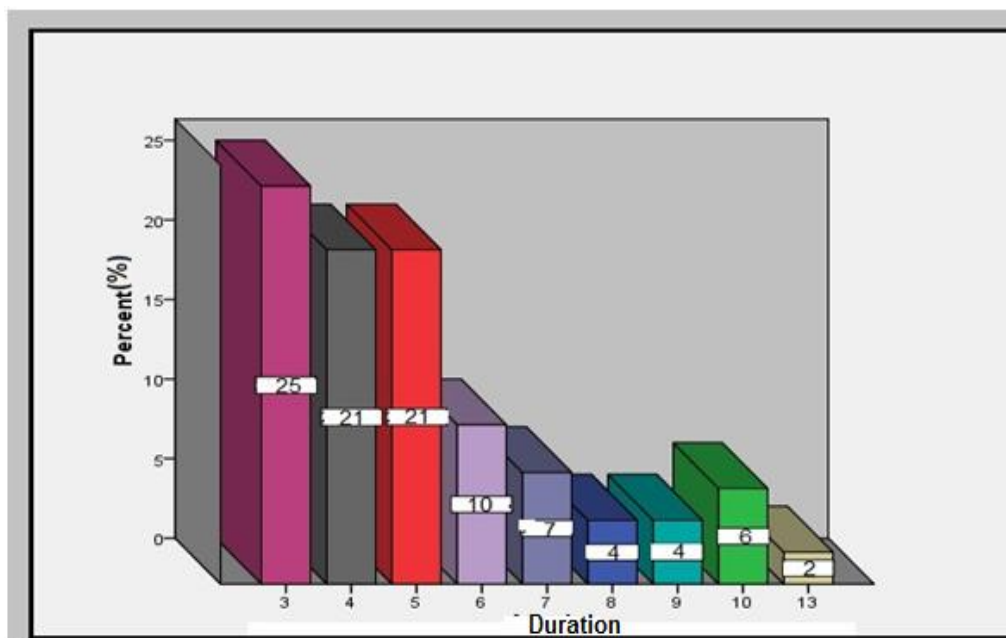


Fig (2): Shows frequency distribution of dialysis duration

The minimum length of the spleen was (6.97) cm and maximum (17.00) with the mean of (11.7726) cm and SD (2.04965). The minimum width was (5.01) cm, and the maximum (15.20) cm with the mean of (8.9825) and SD of (2.16541). The minimum thickness was (4.00) cm and maximum (8.87) cm with the mean of (6.0096) and SD (1.10571). The minimum Volume was (103.19) cm³ and maximum (972.17) cm³ with the mean of (353.952) and SD (175.346). Considering the echogenicity of spleen out of the total number of subjects underwent the study their US revealed that in 60(60%) of them their spleen were isoechoic, in 12 (12%) hyperechoic and in 28 (28%) were hypoechoic, as shown in table (2).

Table (2): The echogenicity of spleen:

Echogenicity	Frequency	Percent	Valid Percent	Cumulative Percent
Isoechoic	60	60.0	60.0	60.0
Hyperechoic	12	12.0	12.0	72.0
Hypoechoic	28	28.0	28.0	100.0
Total	100	100.0	100.0	

In 68 (68%) of patients the echotexture of their spleen was homogeneous and 32 (32%) was heterogeneous, as shown in table (3).

Table (3): The echotexture of spleen:

Echotexture	Frequency	Percent	Valid Percent	Cumulative Percent
Homogeneous	68	68.0	68.0	68.0
Heterogeneous	32	32.0	32.0	100.0
Total	100	100.0	100.0	

When comparing the volume of spleen with the age of patient in dialysis, it was found that the spleen volume increased by 5.476 cm³ for each year of age as shown in scatter plot of fig (3).

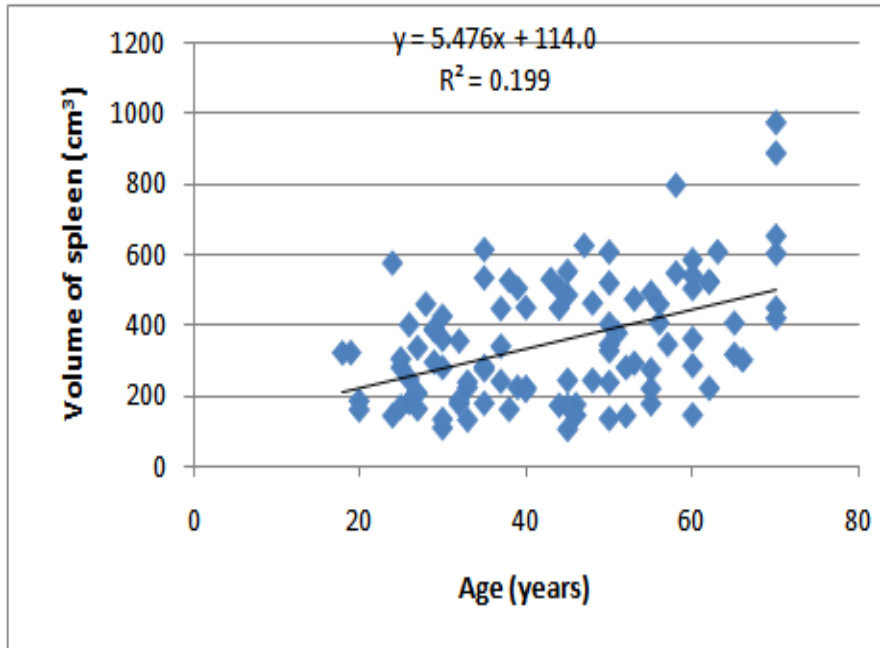


Fig (3): Scatter plot shows the relationship between age of patient under dialysis and volume of spleen

When comparing the volume of spleen with the duration of dialysis, it was found that the splenic volume increased by 56.6 cm^3 for each year of dialysis, as shown in scatter plot of fig (4).

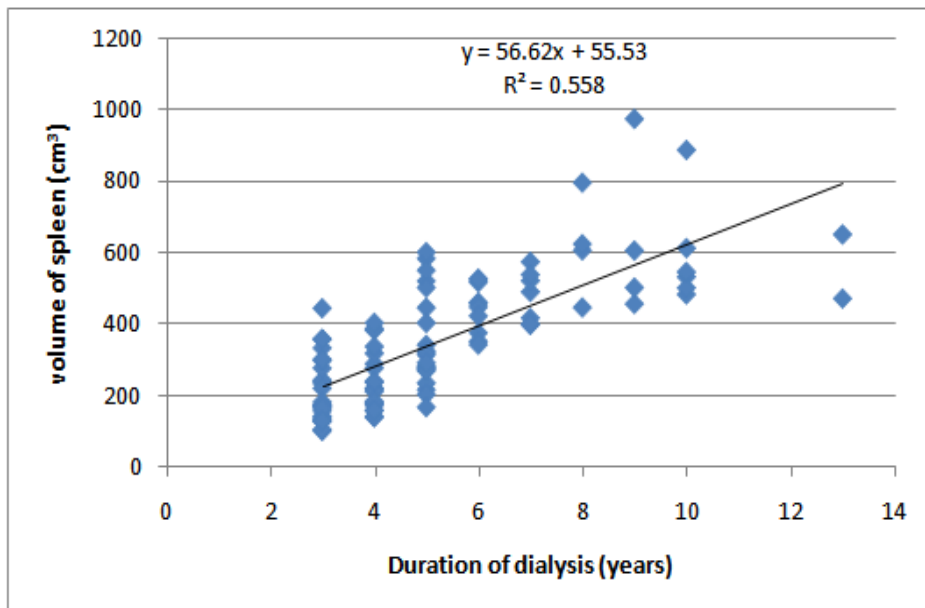


Fig (4): Scatter plot shows the relationship between duration of dialysis and volume of spleen (volume increased by 56.6 cm^3)

When comparing the parameters of spleen with the duration of dialysis, it was found that the length of the spleen increased by 0.663 cm , splenic width increased by 0.5 cm , the thickness of spleen increased by 0.249 cm for each year of dialysis. Also when comparing the parameters of the spleen with its volume in dialytic patient, it was found that the volume increased by 74 cm^3 for each increasing cm in the length, 66.84 cm^3 for each increasing cm in thickness, and 125 cm^3 for each increasing cm in splenic width. Fig (5).

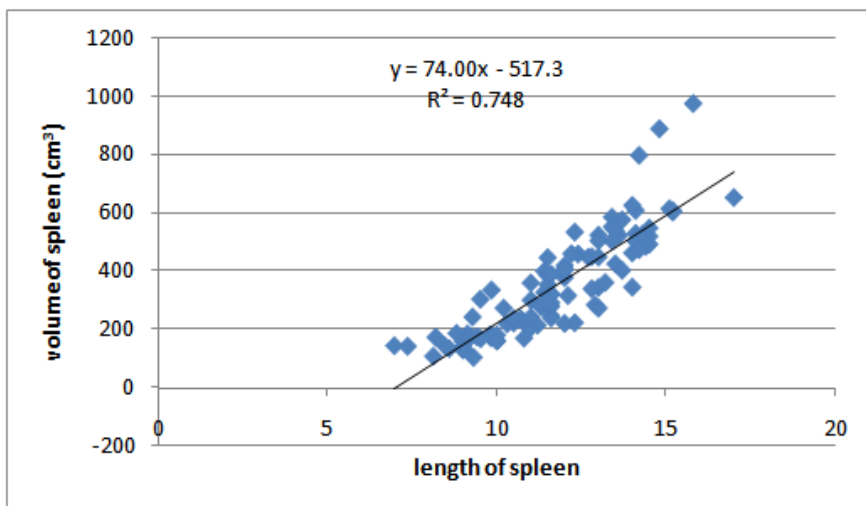


Fig (5): Scatter plot shows the relationship between lengths and volume of spleen in dialytic patient

Considering the relationship between the duration of dialysis and echogenicity of spleen it was found that in 49(49%) of patients, who experienced dialysis for (3-5) years their spleen were isoechoic, 10 (10%) hyperechoic and 8(8%) hypoechoic, in 10 (10%) of patients, who experienced dialysis for (6-8) years their spleen were isoechoic, 1(1%) hyperechoic and 10 (10%) hypoechoic, in 1 (1%) of patients, who experienced dialysis for (9-13) years their spleen were isoechoic, 1(1%) hyperechoic and 10 (10%) hypoechoic, as shows in table (4) and fig (6).

Table (4): Crosstabulation between duration of dialysis and echogenicity of spleen

Duration (years)	Echogenicity			Total
	Isoechoic	Hyperechoic	Hypoechoic	
3	16	7	2	25
4	16	1	4	21
5	17	2	2	21
6	5	0	5	10
7	3	0	4	7
8	2	1	1	4
9	0	0	4	4
10	1	1	4	6
13	0	0	2	2
Total	60	12	28	100

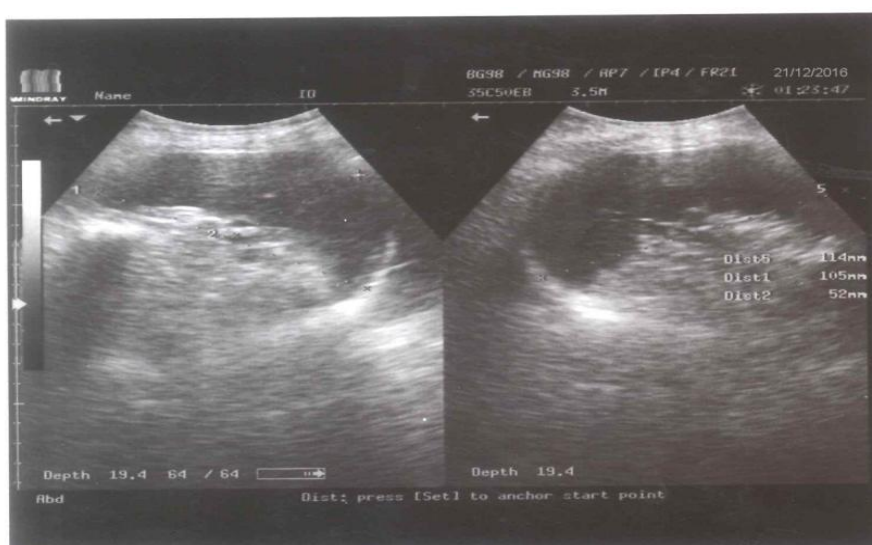


Fig (6): US images of a patient with dialysis for 5 years show hyperechoic splenic texture

VI. DISCUSSION

This study has been conducted in Sudanese Kidney Transplanted Association (Association Specialized Hospital) in Khartoum state. A total of 100 patients on hemodialysis for 3 years or more, 58 (58%) of them were male and 42 (42%) were females, categorized into 4 age groups. Most of the patient 32 (32%) were within the age group (46 to 60) years and the last group from (61-75) years which represented by 13 (13%). The study showed that 60 (60%) of the patients had isoechoic splenic texture, 12 (12%) patients had hyperechoic splenic texture and 28(28%) patients with hypoechoic spleen. The majority of the patients 68 (68%) had homogeneous spleen while 32 (32%) patient had heterogeneous spleen. This study proved that the mean & SD of age for data were 43.81years (± 14.28 SD), the mean of splenic parameters; length, width, thickness and volume were 11.77cm (± 2.04 SD), 8.98cm (± 2.16 SD), 6.009cm (± 1.10 SD), 353.9 mls (± 175.34 SD) respectively. The present study showed that the spleen volume, length, width, and thickness were increasing when the duration of hemodialysis and age were increased, which agree with study done by M M Platts et al, stated that the mean of splenic volume was increased in the patient who were receiving hemodialysis. also the present study revealed that the hemodialysis decreased the echogenicity of spleen and changed its homogeneity into heterogeneity depending on the duration of dialysis that which agree with study done by M M Platts et al, showed that the hemodialysis decreases the echogenicity of spleen depending on the duration of dialysis.

VII. CONCLUSION AND RECOMMENDATIONS

This study was done for 100 patients on hemodialysis for 3 years or more to evaluate the spleen volume, length, width, thickness and even echogenicity and heterogeneity. The result of the study concluded that when the parameters of the spleen (length, width and thickness) were increased, the volume was increasing comparing with normal range. Also the measurements of the spleen (length-thickness-width-volume) were increasing when the age of patient and duration of dialysis were increased. The echogenicity of spleen decreased when there was an increasing in all measurements of spleen; the homogeneity was decreased and changed into heterogeneity. Further study in evaluation of characterization of spleen in long standing hemodialytic patients with large sample of Sudanese population for more accurate results is needed. Ultrasound department should be found in any renal center for dialysis. Further study should be run to study the changes that may occur due to hemodialysis in other organs in the body.

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REFERENCES

- [1]. Levey As, coresh J, Balk E, et al. Guidelines for chronic kidney disease. *Annlutern Med.* 2003 ; 139(12): 137-47
- [2]. Osman EM, et al. Chronic renal failure in Khartoum, Sudan. *UPS J Med sci,* 1987; 92 (1); 65-73
- [3]. De Francisco AL, Pinerac. Challenges and future of renal replacement therapy *Hemodial Int.* 2006 ; (10) 19-23
- [4]. BD chaurasia. *Human anatomy.* 4th Ed, NewDelhi: CBS publishers; 2004; P: 279-283
- [5]. Sameh Doss. *Abdomen anatomy; EygptCario :* 1991 ; p 70
- [6]. Richard S Snell. In: Betty Sun. *Clinical anatomy.* 4th Ed, Maryland. USA, 2004; p 57
- [7]. Harold Eillis. *Clinical anatomy.* 11th Ed. Australia. Black Well publishing; 2006; p 104
- [8]. Aldrich, J E. *Basic physics of ultrasound imaging.* *Crit Care Med;* 35 LippinCott William and Wilkins. (2007).
- [9]. Arther C Guyten, Johan E Hall. *Textbook of medical physiology.* 11th Ed. Philadelphia: Saunders; 2006; p 404-426
- [10]. Harsh Mohan. In: Ivandamjanov(editor). *Textbook of pathology.* 6th Ed. India: Jaypee Brothers Medical Publishers 2010.
- [11]. Anthony J. Bowdler, *The Complete Spleen: Structure, Function, and Clinical Disorders* 2 Ed. Springer Science Busiess Media New York.(2000)
- [12]. Sandra L. Hagen-Ansert. *Diagnostic sonography.* 7th ED, California. Elsevier Inc; 2012; P 438-439
- [13]. HADA, R. End stage renal disease and renal replacement therapy – challenges and future prospective in Nepal. *J NMA J Nepal Med Assoc,* (2009)(48) 344-8.
- [14]. By Jessie szalay, live science contributor, spleen function , location and problems, at olawleogunarti. Com. January 29.2015.
- [15]. Ashwinpai. Thomas R Gest. Blood supply and structure of spleen. *Atemedicine. Med scape .com* Jan 13 2014.
- [16]. Sudan kidney disease. WHO May 2014 at www.Worldlifeexpectancy.com/sudan-kidney-disease.
- [17]. Platts M M , Anastarsidei E, et al. *B Med j* 1984 nov. At www.Vesalius.com.
- [18]. Loftus et al. *Nigerian medical journal, journal of the Nigeria Medical Association.* Med know publication, at www.ncbi.nlm.n...
- [19]. Okoye et al. *Sonographic splenic size in normal adult African population,* article: April 2006.
- [20]. Pietri et al. *J ultrasound Med* 1984 Jan Boscainim. At www.Ncib.nlm.n

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