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Research Article

Vitamin D deficiency as risk factor for Multiple myeloma and Renal dysfunction among Sudanese patients

Muntasir Abbas Medani[1,2*], Altaf S. Mosad[3], Sara Osman Yousif[3,4], Soad Fadlalla Ali[5], Mariam Abbas Ibrahim[3]

[1*]Laboratory Department, Medical Services, Qatar Armed Forces, Doha, Qatar
[2*]Department of Clinical Chemistry, Faculty of Medical Laboratory Sciences, University of Gezira, Wad Medani, Sudan.
[3]Clinical Chemistry Department, College of Medical Laboratory Science, Sudan University of Science and Technology, Khartoum, Sudan.
[4]Department of Clinical Laboratory Sciences, Jouf University, Qurayyat.
[5] Department of pathology, Faculty of medicine, University of Gazira, Wad Madani, Sudan

*Corresponding author: Muntasir Abbas Medani
*Email: muntasirmedani20@gmail.com)

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ABSTRACT

Background: The incidence of multiple myeloma (MM), a malignancy that affects plasma cells,
is increasing in developed countries. Vitamin D (VD) status is a modifiable factor that may lower the risk of cancer by modulating cell proliferation, apoptosis, invasion, and metastasis by attaching to a particular receptor, the vitamin D receptor (VDR).
The study aims: to assess serum Vitamin D levels, urea, creatinine, calcium, phosphorus, uric acid and hemoglobin, among Sudanese individuals diagnosed with MM.
Methods: This is a case control study, where 50 patients and 50 healthy age matched controls were enrolled after informed consent. Blood (serum) samples were analyzed for Vitamin D level and renal profile using a fully automated cobas 6000 & e 601 (Roch Germany). Hemoglobin levels in whole blood were determined by the Sysmex KX21 autoanalyzer.
Results: vitamin D deficiency was common in multiple myeloma patients. There was a significant difference between the two groups p-value= 0.043. A ten-fold increase to have MM was found among the first quartile vitamin D level ≤11.45 **IU/L (**OR= 10.7**).** Urea, creatinine, calcium, phosphorus, uric acid and hemoglobin revealed a significant difference between patient and control. No statistically significant differences in the means of renal disorder markers across the four quartiles among MM cases. Creatinine, phosphate, and calcium levels showed a significant association with vitamin D deficiency.
Conclusion: A significant association between vitamin D deficiency and the risk of MM. Individuals with lowest vitamin D levels exhibited a ten-fold increase to have MM.

Key word: vitamin D, Multiple myeloma, renal disorder, Sudan

Introduction

Multiple myeloma (MM) is a type of cancer that affects plasma cells, and its occurrence is increasing in developed countries [(1)]. The primary organ damage associated with MM is commonly summarized by the acronym "CRAB," which stands for hypercalcemia, renal impairment, anemia, and bone lesions [(2)]. The buildup of monoclonal antibodies, specifically Bence–Jones proteins, can occur in urine, leading to kidney injury, typically manifesting as type 2 renal tubular acidosis, and this is observed in approximately two-thirds of MM patients. Additionally, multiple myeloma stimulates the activity of osteoclasts through the nuclear factor kappa-B ligand (RANKL), leading to bone destruction through lytic lesions, which can cause pain, fractures, reduced mobility, and calcinosis [(3)]. The most recent statistics from the Global Cancer Observatory (GLOBOCAN) indicate that in 2018, there were approximately 160,000 cases of multiple myeloma (MM) worldwide, which represented 0.9% of all cancer diagnoses [(4)]. Among these cases, around 90,000 were males and 70,000 were females, resulting in age-standardized incidence rates of 2.1 per 100,000 for men and 1.4 per

100,000 for women. The lifetime risk of developing MM before the age of 75 is estimated at 0.24% for men and 0.17% for women, suggesting that men are about 1.5 times more likely to be diagnosed with the disease [5]. Vitamin D is crucial for bone mineralization, as it enhances the absorption of calcium and phosphate in the intestine, and its deficiency can adversely affect bone mineralization [6]. Increasingly, vitamin D is acknowledged in oncology for its anti-inflammatory, pro-apoptotic, and anti-angiogenic effects mediated by the activation of the vitamin D receptor (VDR) [7]. Despite this, routine measurement and supplementation of vitamin D are not standard practices for patients with MM, even though risk factors for vitamin D deficiency—such as advanced age and inadequate sunlight exposure—are prevalent in this population. Research indicates that insufficient vitamin D levels are common among MM
patients [8]. Among hematological malignancies, MM shows a significant correlation with calcium metabolism and skeletal-related events (SREs) due to osteoclast activation and osteoblast dysfunction resulting from the interplay between myeloma cells and the bone microenvironment. [9]Vitamin D influences numerous biological functions, including bone metabolism, the innate immune response, and the regulation of cell proliferation and differentiation through its binding to the VDR. Genetic polymorphisms in the VDR gene have been linked to various cancers, including MM [10,11], no data exist for MM among Sudanese. This is the first study aiming to determine the relationship between Vit D and the MM. The results founded from this study, will certainly have an impact in clinical practice.

Materials and Methods

Study design and participants: This study is a hospital base-case control study was conducted in Radio and Isotope Center (RICK) in Khartoum state, Sudan during the period from 2021 -2022. One hundred Sudanese individuals, 50 diagnosed with MM as case group and 50 apparently healthy as controls were enrolled in this study. Age and gender were matched. After obtaining ethical clearance from the Research Ethical Committee of the Ministry of Health (ID No 44), all participants received written informed consent forms after being informed of the study's purpose. A questionnaire was specifically designed to obtain information which helps in either including (patients of MM) or excluding (patients of MM which had taken any vitamin D supplements) certain individuals in or from study respectively.
Ethical consideration: The study was approved by the research committee of the college of Medical Laboratory Science of the Gazira university and ethical approval for the study was obtained from Federal Ministry of Health in Sudan. An informed consent was then obtained from each participant.
Data collection and Clinical Examination: Clinical data was collected from records recorded by authorized clinician who carried out the clinical examination in RICK. The demographic data was collected through structured questionnaire.
Sampling: A 5 mL of venous blood were drawn from each participant and divided into two containers: a whole blood container (EDTA) for Heamoglobin and a plain container for serum VitD & renal profile.
Vitamin D assay: For quantification of 25-VD in serum ECL methods cobas e 601(roche, Germany) was used.
Renal profile: Renal profile including urea, creatinine, Na, K, calcium, phosphorus and uric acid were measured by fully automated analyzer cobas 6000 (Roche, Germany).
Heamoglobin assay: Heamoglobin was measured using a Sysmex KX21 autoanalyzer that uses aperture-impedance technology. Heamoglobin was performed within 1 hour of collection to minimize variations due to sample aging by exactly following manufacturer instructions. (Sysmex KX-21 Operator's Manual Koba, Japan. January 1998).

Statistical analysis

Data were entered into a computer using the SPSS program (ver. 23.0). Results were tabulated and an independent t-test was used for comparison between hematological and biochemical parameters in both the test and control groups, with a probability value of $P<0.05$ considered statistically significant.

Result

A total of 100 individuals were enrolled in this study, 50 patients and 50 controls, with mean ages of 47.66±16.2 and 46.02±16.3 years old, respectively (**Table 1).** Table 1 also shows Vitamin D levels among cases and controls. There was a statistically significant lower mean of Vitamin D levels among cases compared to controls.

Table 1: Vitamin D levels among cases compared to controls

Variables	MM (no=50)	Control (no=50)	P-value
Age (Year)	47.66±16.2	46.02±16.3	0.616
Vit D	16.61±7.38	19.48±6.64	0.043*

Table 2 summarizes cases based on their VD levels, dividing them into four quartiles. A ten-fold increase to have MM was found among the first quartile (≤11.45 IU/L).

Table 2: Vitamin D quartiles among cases and their logistic regression analysis

Variables	VitD (IU/L)	P-value	OR (95%CI)
Q1	≤11.45	0.003*	10.757 (2.210 – 52.360)
Q2	11.45< ≤13.1	0.777	1.515 (0.086 – 26.726)
Q3	13.1< ≤14.5	0.324	1.787 .564 – 5.663)
Q4	>14.5	Reference	-

OR: odd ratio, CI: confidence interval. Logistic regression was used for analysis. P-value ≤ 0.05 was considered statistically significant.

The hemoglobin level and renal profile among cases and controls are summarized in table 3. Significantly higher means of urea, creatinine, phosphorus, Ca++ and UA levels were found in cases compared to controls. In addition, slightly lower means of Na + and K+ were also observed among cases. While the mean levels of Hb were lower among cases compared to controls.

Table 3: Hemoglobin level and renal profile among cases and controls

Variables	MM (no=50)	Control (no=50)	P-value
Hb	10.79±3.19	13.96±1.26	0.000*
Urea	216.08±87.7	31.58±8.92	0.000*
Cr	4.15±1.88	0.53±0.50	0.000*
Na+	137.58±5.66	139.60±3.55	0.036*
K+	3.98±0.55	4.19±0.46	0.042*
P	4.22±0.77	3.01±0.91	0.000*
Ca++	12.00±1.39	8.78±0.57	0.000*
UA	7.69±1.17	6.48±0.85	0.000*

Data were presented as mean± SD. An Independent t-test was used. A two-tailed P-value ≤ 0.05 was considered statistically significant.

Renal profile among cases in relation to Vitamin D quartiles revealed no statistically significant differences in the means of renal disorder markers across the four quartiles among MM **cases (Table 4).**

Table 4: Comparison between Vit D quartiles (Q1, Q2, Q3, and Q4) and renal disorder markers in MM patients

Renal disorder marker	Urea (mg/dL)	Cr (mmol/L)	Na+ (mmol/L)	K+ (mmol/L)	P (mg/dL)	Ca++ (mg/dl)	UA (mg/dL)	Hb (g/dL)
Q1&Q2	214.1±79.3	4.57±1.7	136 ±6.5	4.05±0.61	4.31±0.72	11.46±0.88	7.98±1.26	10.64±2.9
Q3	224.8±97.1	3.37±1.2	141 ±3.5	4.01±0.71	4.56±1.04	12.02±1.56	7.65±0.75	12.54±2.3
Q4	214.5±92.3	4.15±2.0	138 ±5.4	3.93±0.48	4.08±0.69	12.30±1.52	7.54±1.23	10.37±3.4
P-value	0.955	0.360	0.185	0.798	0.263	0.175	0.523	0.240

Data are presented as mean value ± SD. The one-way ANOVA test was used. A two-tailed P-value ≤ 0.05 was considered statistically significant.

Table 5 summarizes the results of a logistic regression analysis that shows the association between certain renal disorder parameters and vitamin D deficiency as a complication of multiple myeloma. Creatinine, phosphate, and calcium levels showed a significant association with vitamin D deficiency. While no significant associations were found with Potassium, uric acid and vitamin D deficiency.

Table 5: Logistic regression analysis of the influence of Vitamin D deficiency on renal disorder markers.

Variables	*P-value*	*OR (95%CI)*
Cr	0.032*	0.150	3.552 (1.117 – 11.295)
K+		0.012*	4.433 (0.585 – 33.614)
P		0.011*	1.978 (0.361 – 10.828)
Ca++		0.431	0.155 (0.037 – 0.655)
UA			6.451 (1.507 – 27.619)

Discussion

This study has shown that Sudanese with MM have a lower Vitamin D level than the control group.
A ten-fold increased risk of having MM was found among the first quartile vitamin D level (≤11.45 **IU/L,** OR= 10.7**).** This agrees with a previous finding done by Natth et al. that reported a high prevalence of vitamin D deficiency in patients with MM and lower 25(OH) D levels (<10 ng/mL) were associated with a higher number of plasma cells in the bone marrow [12]. Similarly, Lauter et al. also noted that a high incidence of vitamin D deficiency and insufficiency in MM patients [13].and Clement similar reported a very low level of vitamin D among myeloma patient [14]. Furthermore, the study found a significant increase in renal profile among MM patients compared to controls. These included higher levels of urea, creatinine, phosphorus, Ca++ and UA. In addition, slightly lower means of Na + and K+ were also observed among cases. While the mean levels of Hb were lower among cases compared to controls. This comes in line with Ştefan G, Cinca S et al. that reported high creatine and calcium levels in patients with MM [15]. Bladé, Fernández et al. noted, Renal failure was present in almost one fourth of patients with MM [16]. Vitamin D quartiles (Q1, Q2, Q3, and Q4) and renal profile in individuals with MM did not differ significantly. A logistic regression analysis showed an association between vitamin D insufficiency and certain renal disorder markers as a side effect of multiple myeloma. Calcium, phosphate, and creatinine levels were significantly associated with vitamin D insufficiency.

Reference

1- Jurczyszyn, A.; Suska, A. Multiple Myeloma. Encycl. Biomed. Gerontol. 2019, 2, 461–478.
2- Michels, T.C.; Petersen, K.E. Multiple Myeloma: Diagnosis and Treatment. Am. Fam. Physician 2017, 95, 373–383.
3- Colmone, A.; Amorim, M.; Pontier, A.L.; Wang, S.; Jablonski, E.; Sipkins, D.A. Leukemic Cells Create Bone Marrow Niches That Disrupt the Behavior of Normal Hematopoietic Progenitor Cells. Science 2008, 322, 1861–1865.
4- Global Cancer Observatory: Cancer Today. Lyon, France: International Agency for Research on Cancer. A
5- Bray, F.; Ferlay, J.; Soerjomataram, I.; Siegel, R.L.; Torre, L.A.; Jemal, A. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA A Cancer J. Clin. 2018, 68, 394–424.
6- Goltzman DJH, biology c. Functions of vitamin D in bone. 2018;149(4):305-12.
7- Oortgiesen BE, Dekens M, Stapel R, Alheraky A, Dannenberg PK, Siemes C, et al. Effectiveness of a vitamin D regimen in deficient multiple myeloma patients and its effect on peripheral neuropathy. Supportive care in cancer : official journal of the Multinational Association of Supportive Care in Cancer. 2023;31(2):138.
8- Terpos E, Efstathiou E, Christoulas D, Roussou M, Katodritou E, Dimopoulos M-AJEoobt. RANKL inhibition: clinical implications for the management of patients with multiple myeloma and solid tumors with bone metastases. 2009;9(4):465-79. Starska-Kowarska K. Role of vitamin D in head and neck
9- cancer—immune function, anti-tumour effect, and its impact on patient prognosis. Nutrients. 2023 Jan;15(11):2592.
10- Köstner KI, Denzer N, Mueller CS, Klein R, Tilgen W, Reichrath J. The relevance of vitamin D receptor (VDR) gene polymorphisms for cancer: a review of the literature. Anticancer research. 2009 Sep 1;29(9):3511-3536.
11- Randerson-Moor JA, Taylor JC, Elliott F, Chang YM, Beswick S, Kukalizch K, Affleck P, Leake S, Haynes S, Karpavicius B, Marsden J. Vitamin D receptor gene polymorphisms, serum 25-hydroxyvitamin D levels, and melanoma: UK case–control comparisons and a meta-analysis of published VDR data. European journal of cancer. 2009 Dec 1;45(18):3271-3281.

12- Nath, K., Ganeshalingam, V., Ewart, B., Heyer, E., Watt, K., Birchley, A., Casey, J., Lai, H.C., Morris, E. and Hodges, G., 2020. A retrospective analysis of the prevalence and clinical outcomes of vitamin D deficiency in myeloma patients in tropical Australia. Supportive Care in Cancer, 28, pp.1249-1254.
13- Lauter B, Schmidt-Wolf IG. Prevalence, supplementation, and impact of vitamin D deficiency in multiple myeloma patients. Cancer investigation. 2015 Nov 26;33(10):505-9.
14- Clement Z, Ashford M, Sivakumaran S. Vitamin D deficiency in a man with multiple myeloma. North American Journal of Medical Sciences. 2011 Oct;3(10):469.
15- Ștefan G, Cinca S, Chiriac C, Zugravu A, Stancu S. Multiple Myeloma and Kidney Impairment at Diagnosis: A Nephrological Perspective from an Eastern European Country. Medicina (Kaunas). 2023 Jul 18;59(7):1326. doi: 10.3390/medicina59071326. PMID: 37512137; PMCID: PMC10384718.
16- Bladé J, Fernández-Llama P, Bosch F, . Renal failure in multiple myeloma: Presenting features and predictors of outcome in 94 patients from a single institution. Arch Intern Med. 1998;28(158):1889–1893.