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Original Research Article

The evaluation between vitamin D level and pelvic organ prolapse in post-menopausal women

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ABSTRACT

Background: Vitamin D is important for skeletal integrity and optimal muscle function. The high incidence and prevalence of vitamin D deficiency and pelvic organ prolapse have been found in postmenopausal women, raising the question of whether the entities are related. The aim of the study was to evaluation between vitamin D level and pelvic organ prolapse in post-menopausal women.
Methods: This case control study has been designed and conducted in the Department of Obstetrics and Gynecology, BSMMU to investigate the level of vitamin D in patients with and without pelvic organ prolapse to explore the association of vitamin D with pelvic organ prolapse. After taking informed written consent the serum vitamin D level of all participants was measured by CMIA technology with flexible assay protocols at Biochemistry and Molecular Biology department of the same institute. Statistical analysis of the results was obtained by using window-based computer software devised with Statistical Packages for Social Sciences (SPSS-24).
Results: The study population was divided into two groups, a case group (n=74) consisting of patients with pelvic organ prolapse and a control group (n=74) comprising of women without pelvic organ prolapse. A total 148 participants of 52 years or older attending the out or inpatient department were enrolled in the study. Mean±SD level of Vitamin D in the case group was 13.96±5.18 ng/ml and in the control, group was 21.08±5.77 ng/ml respectively. The difference was statistically significant ($p<0.05$). Moreover, the vitamin D levels were inversely proportionate with the severity of pelvic organ prolapse.
Conclusions: Vitamin D deficiency may be an important systemic factor associated with pelvic organ prolapse. Measuring vitamin D levels in postmenopausal women and replenishing deficiencies may also be important for the pelvic floor.

Keywords: Vitamin D, Skeletal integrity, Pelvic organ prolapse, Postmenopausal women

NTRODUCTION

Pelvic organ prolapses (POP) affects millions of women worldwide. It is caused by weakening of the supporting tissues of the pelvic floor, occurs independently or in conjunction with other pelvic floor dysfunction, and carries a lifetime surgical risk of up to 20% and a significant proportion of reoperations due to recurrence.[1] Accompanied by the supporting soft tissue of the pelvic floor is a combination of muscles, fascia, and ligaments that hold the pelvic organs in place to provide support and resist deformation in highly dynamic environments.[2] There is evidence that supporting tissue fragility, either at the systemic or local level, may predispose to POPs, with weaker supporting tissue underlying the pelvic floor. It is composed of components, suggesting that these components are likely to break or stretch and pop.[3] Various factors can impair pelvic floor function. Recognizing the prevalence of vitamin D deficiency, its recently observed potential protective effects on tendons, ligaments and connective tissue, and its known effects on longitudinal and striated muscles, the role of this factor has been investigated in many clinical studies is subject to observation in recent years. It has already produced some promising but contradictory results.[4-6]

The past two decades have seen an epidemiological increase in vitamin D deficiency in the general population. It is estimated that 20-80% of US, Canadian and European elderly men and women are vitamin D deficient.[7] Vitamin D, along with calciotropic hormones, is an important factor in maintaining calcium and phosphorus homeostasis and is involved in bone integrity. Its active form, 1, 25(OH)2D3, exerts its biological effects through the vitamin D receptor (VDR). These receptors are also present in smooth muscle and skeletal muscle.[8] Through them, vitamin D influences the proper functioning of skeletal muscle by regulating calcium homeostasis, affecting muscle contraction, and maintaining the muscle cell environment against inflammation.[9] Deficiency results in fewer type 2 muscle fibers in the muscle, and muscle weakness is evident not only in frank deficiency but also in dysfunction. In POP, fibrosis and disruption of the connective tissue of the vaginal wall predominated, and exacerbation of degenerative connective tissue changes led to its progression.[10] Women with POP have more type III collagen than women without the disease. Type III collagen predominates in tissues that require increased extensibility and elasticity; an increase manifested in vaginal extensibility.[11]

Pelvic floor disorders (PFD) are a major clinical problem in postmenopausal women. This is a spectrum of disorders that includes pelvic organ prolapse (POP), urinary incontinence (UI), and fecal incontinence (FI).[12] These can occur alone or in combination. Associated symptoms are vaginal protrusion or bulging, involuntary leakage of urine, flatus or feces. The overall prevalence of her PFD in nonpregnant women was 24% of her age, nearly doubling as the woman ages, and from age 60 to when she was 36-49 years of age, the prevalence was highest.[13] Various factors that contribute to PFD include multiple births, mode of delivery, mechanical delivery, obesity and collagen deficiency, but menopause is a known risk factor. Many epidemiological studies have shown that age is one of the most important causes of PFD. This may be due to age-related changes in neuromuscular function and changes in connective tissue in older women.[14]

METHODS

It was a case control study, done in the department of obstetrics and gynecology of Bangabandhu Sheikh Mujib Medical University (BSMMU) hospital in co-operation with the department of biochemistry of the same institute from September 2019 to August 2020.

Ethical clearance was taken from the Institutional Review Board of BSMMU before conducting the research. After obtaining a written informed consent a total of 148 participants attending the outpatient and inpatient department were enrolled in the study. The study population was divided into case group (n=74) and a control group (n=74).

Statistical analysis

Statistical analysis of the results was obtained by using window-based computer software devised with Statistical Packages for Social Sciences (SPSS-24).

RESULTS

Group I: women with pelvic organ prolapse, Group II: women without pelvic organ prolapse.

Table 1: Socio demographic characteristics of study population (N=148).

Characteristics	Group I (n=74)		Group II (n=74)		P value
	n	%	n	%	
Age (in years)					
53-60	39	52.7	40	54.1	
61-65	35	47.3	34	45.9	
Mean±SD	59.95	±3.8	59.54	±3.55	[a]0.498[ns]
Range (min-max)	53	-65	53	-65	

Continued.

Characteristics	Group I (n=74)		Group II (n=74)		P value
Educational status					
Illiterate	38	51.4	30	40.5	
Primary	21	28.4	31	41.9	$^{b}0.222^{ns}$
SSC and above	15	20.2	13	17.6	
Occupation					
Housewife	65	87.8	65	87.8	
Service holder	2	2.7	0	0.0	$^{b}0.325^{ns}$
Day labour and others	7	9.5	9	12.2	
Monthly income (Taka)					
<10,000	11	14.9	15	20.3	
(10,000-20,000)	39	52.7	28	37.8	$^{b}0.151^{ns}$
(20,000-40,000)	19	25.7	19	25.7	
>40,000	5	6.7	12	16.2	

s=significant, ns=not significant, a p value reached from Unpaired t-test, bp value reached from Chi-square test

Table 2: Distribution of the study populations by duration of postmenopausal period (N=148).

Duration of menopause	Group I (n=74)		Group II (n=74)		P value
	N	%	N	%	
<5 years	3	4.1	10	13.5	
5-10 years	24	32.4	27	36.5	
11-15 years	19	25.7	14	18.9	
16-20 years or more	28	37.8	23	31.1	
Mean±SD	14.2	±6.18	14.66	±7.62	0.683^{ns}
Range (min-max)	4	-24	4	-25	

ns=not significant, p value reached from unpaired t-test

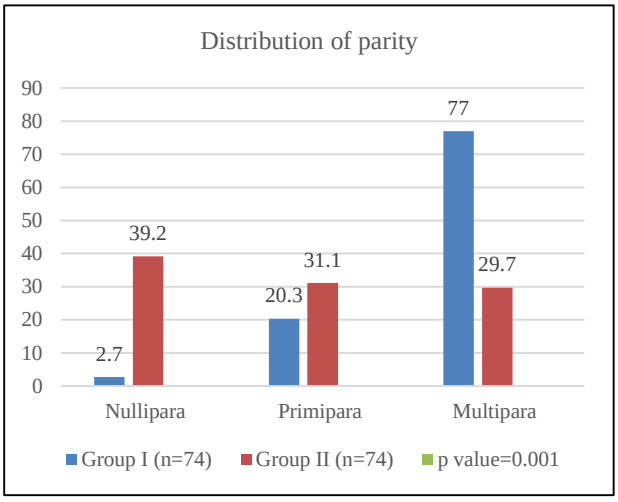

Figure 1: Distribution of the study populations by parity (N=148).

Table 1 shows socio demographic characteristics of study population. It is observed that, there is no significant difference between two groups in terms of age, marital status, educational status, occupation and monthly income.

Figure I shows almost three fourth 57 (77.0%) patients are multipara in group I and 22 (29.7%) in group II and the difference is statistically significant ($p<0.05$) between two groups.

Table 2 shows that more than one third (37.8%) of patients belong to 16-20 years or more in group I and 23(31.1%) in group II. The mean duration of postmenopausal age is 14.2±6.18 years in group I and 14.66±7.62 years in group II. The difference is statistically not significant ($p>0.05$) between two groups.

Table 3 shows the distribution of the study populations by vitamin D. It is observed that majority (97.3%) patients have ≤30 Low vitamin D in group I and 64(86.5%) in group II. The difference is statistically significant ($p<0.05$) between two groups. The risk of developing pelvic organ prolapse 5.63 times higher in women with decreased vitamin D level.

The table shows the multiple logistic regression analysis done to see the effect of independent variables (vitamin D, Parity, age, educational status, occupation, monthly income, duration of postmenopausal age, chronic cough, chronic constipation, BMI) on dependent variable (pelvic organ prolapse). The decrease in serum vitamin D level increases the risk of developing pelvic organ prolapse by 2.70-fold. Other variables were not significantly associated to develop pelvic organ prolapse.

Table 3: Association of vitamin D level with pelvic organ prolapse (N=148).

Vitamin D (ng/ml)	Group I (n=74)		Group II (n=74)		OR (95%CI)	*p* value
	n	%	n	%		
≤30 Low vitamin D	72	97.3	64	86.5	5.63 (1.09-38.7)	[a]0.016[s]
>30 normal	2	2.7	10	13.5		

s= significant, p value reached from Chi-square test

Table 4: Multiple logistic regression tables showing the effect of independent variables on dependent variable.

	β (regression coefficient)	SE	Wald statistic	df	P value	OR	95% CI	
							Lower	Upper
Vitamin D level	0.40	0.06	41.59	1	0.001[s]	2.70	1.32	1.69
Parity	0.99	0.33	9.05	1	0.135[ns]	0.82	0.91	2.16
Age	-0.30	0.32	0.87	1	0.351[ns]	0.74	0.39	1.39
Educational status	0.30	0.27	1.20	1	0.273 [ns]	1.35	0.79	2.32
Occupation	-0.45	0.38	1.45	1	0.228 [ns]	0.63	0.30	1.33
Monthly income (Tk.)	-0.35	0.30	1.41	1	0.236 [ns]	0.70	0.39	1.26
Duration of postmenopausal age	0.08	0.20	0.17	1	0.684 [ns]	1.08	0.74	1.59
Chronic cough	-0.94	1.84	0.26	1	0.607 [ns]	0.39	0.01	14.27
Chronic constipation	-0.82	1.63	0.25	1	0.616 [ns]	0.44	0.02	10.75
BMI (kg/m^2)	-0.10	0.14	0.55	1	0.457 [ns]	0.90	0.69	1.18

s=significant, ns= not significant

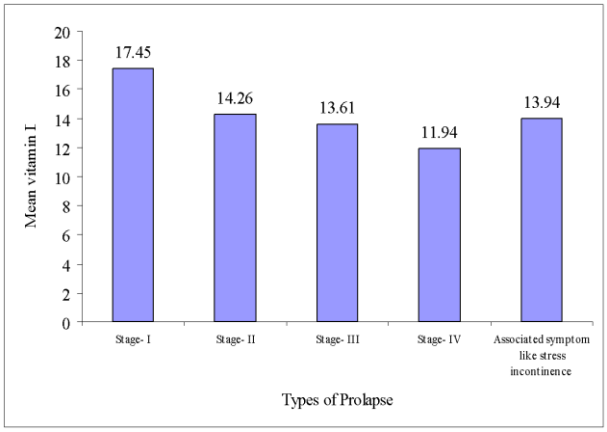

Figure 2: Pelvic organ prolapse with vitamin D level.

DISCUSSION

Vitamin D has been extensively studied, mainly due to its high prevalence and association with bone resorption. Recently, the clinical importance of vitamin D is noted in physiological impact on various systems. Vitamin D is a fat-soluble vitamin. It plays an important role in bone growth and maintenance of bone density. It affects the intestinal absorption of calcium, which affects bone strength.[15] The prevalence of vitamin D deficiency in the postmenopausal women in studies done globally shows a wide range from 1.6% to 86% depending on the regional location and seasonal variation.[7] In a study conducted in South India, the prevalence of vitamin D deficiency in postmenopausal women ranged from 50% to 80%.[16]

The role of vitamin D in muscle strength, neuromuscular function, and postural stability has been evaluated in recent studies. Pelvic floor muscles are also made up of skeletal muscle and can be affected by vitamin D levels. Several retrospective studies have shown an association between vitamin D deficiency and PFD.[17] Vitamin D is involved in the proper functioning of the musculoskeletal system. A proposed mechanism involves the role of vitamin D in calcium absorption, thereby protecting muscle cells from insulin resistance and inflammation. Vitamin D receptors have been identified in skeletal and smooth muscle. Although randomized trials have provided inconclusive evidence, many observational studies support a role for vitamin D in muscle function and effectiveness.[18] Evidence for a role of vitamin D in smooth muscle has not yet been demonstrated, but various studies have demonstrated a role for vitamin D in proper skeletal muscle function. Vitamin D has been shown to promote skeletal muscle growth and contribute to proper function by binding to the muscle vitamin D receptor (VDR).[19] Since pelvic floor muscles are composed of both smooth and skeletal muscle, the physiological effects of the pelvic floor are thought to be regulated by vitamin D levels.

In our study, according to socio demographic characteristics of study population. There is no significant difference between two groups in terms of age, marital status, educational status, occupation and monthly income. And based on study populations by parity, almost three fourth 57 (77.0%) patients are multipara in group I and 22 (29.7%) in group II and the difference is statistically significant ($p<0.05$) between two groups.

Sources of vitamin D include fish oil, egg yolk, liver, and sun exposure of the skin. Hydroxylation of vitamin D to 25-hydroxylate vitamin D3 occurs in the liver, followed by the formation of the active form of vitamin D, 1,25-hydroxylate vitamin D3, in the kidney.[20] Vitamin D increases intestinal absorption of calcium and is taken in combination with calcium. Vitamin D plays an important role in maintaining bone and muscle strength.[21]

In the present study, according to duration of postmenopausal period, more than one third (37.8%) of patients belong to 16-20 years or more in group I and 23 (31.1%) in group II. The mean duration of postmenopausal age is 14.2±6.18 years in group I and 14.66±7.62 years in group II. The difference is statistically not significant ($p>0.05$) between two groups.

In a prospective study by Dallosso et al., the relationship between dietary nutrients and overactive bladder symptoms in 5,816 women showed that women with higher vitamin D intakes had a lower risk of overactive bladder syndrome.[22] Badarian et al. Her survey of 1881 women as part of the National Health and Nutrition Examination Survey (NHANES) showed that vitamin D deficiency was a risk factor for her developing PFD.[23] Increased vitamin D levels reduced the risk of PFD regardless of age.

This study shows, the multiple logistic regression analysis done to see the effect of independent variables (vitamin D, Parity, age, educational status, occupation, monthly income, duration of postmenopausal age, chronic cough, chronic constipation, BMI,) on dependent variable (pelvic organ prolapse). The decrease in serum vitamin D level increases the risk of developing pelvic organ prolapse by 2.70-fold. Other variables were not significantly associated to develop pelvic organ prolapse.

Our finding that vitamin D deficiency was associated with PFD is similar to that of Badalian et al., and Dallosso et al. The overall prevalence of vitamin D deficiency in the postmenopausal women in this study was 77.5%, which is similar to the previous studies done in South India.[24] This study attempted to study the risk factors for clinical PFD, POP and SUI.

Limitations

The present study was conducted in a very short period due to time constraints and funding limitations. The small sample size was also a limitation of the present study.

CONCLUSION

Our study showed a significant association between vitamin D levels and POP in postmenopausal women. Vitamin D deficiency may be an important associated systemic factor for POP in the postmenopausal female population. The anterior vaginal wall appears to be susceptible to vitamin D deficiency. Educating women and professionals about the importance of vitamin D supplementation should be an important part of a conservative approach to preventing and treating POPs.

Recommendations

This study can serve as a pilot to much larger research involving multiple centers that can provide a nationwide picture, validate regression models proposed in this study for future use and emphasize points to ensure better management and adherence.

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The wide range of disciplines involved in the evaluation between vitamin d level and pelvic organ prolapse in post-menopausal women research means that editors need much assistance from referees in the evaluation of papers submitted for publication. I am very grateful to many colleagues for their thorough, helpful and usually prompt responses to requests for their opinion and advice.

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