**ORIGINAL ARTICLE**

# Vitamin D and Uterine Muscule Contraction in Pregnant Women after Delivery

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## ABSTRACT

**Background:** Ineffective uterine muscle contraction after delivery is a major cause of excessive haemorrhage and may necessitate emergency hysterectomy. Published literature has determined the role of vitamin D deficiency in development of various maternal complications but its role in development of uterine atony is still a point to ponder and research.
**Aim:** To determine the correlation of vitamin D with uterine musculature contraction among pregnant women after delivery.
**Study Design:** Case control study.
**Setting:** Department of Obstetrics & Gynaecology, Sheikh Zayed Medical College/Hospital Rahim Yar Khan.
**Duration of Study**: 1st January 2020 to 30th June 2020.
**Methods:** A total of 100 subjects with uterine atony were taken as cases while 100 subjects with normal uterine tone were taken as controls according to selection criteria and taking informed consent. A blood sample of 5 ml was taken by vene-puncture using aseptic techniques after delivery. Blood sample was collected in serum vial and was sent to the laboratory for serum vitamin D levels the same day.
**Results:** In our study most of the women were from 20 to 35 years of age and 29.550± 2.25 years was the mean age in case group while 29.260± 2.46 years in control group and mean vitamin D level was 22.350±9.02 ng/ml in case group while 28.480±10.53 ng/ml in control group. Vitamin D deficiency was seen in 84 (84%) patients in Case group as compare to 57 (57%) patients in Control group (p=0.000, OR = 3.9).
**Conclusion:** In our study we observed that vitamin D is required for uterine musculature contraction and inadequate levels of vitamin D may lead to ineffective contraction of uterus after delivery resulting in postpartum haemorrhage.
**Keywords:** Vitamin D, uterine muscle contraction.

## INTRODUCTION

Postpartum haemorrhage is defined by WHO as "a blood loss of 500 ml or more within 24 hours after birth"[1]. Postpartum haemorrhage is an obstetrical emergency that can happen after birth. It is the single most noteworthy cause of maternal mortality in developing countries[2] .Uterine atony or failure of the uterus to contract following delivery, is the most common cause of postpartum haemorrhage and accounts for 79% of the causes of postpartum haemorrhage[3].
There are many risk factors attributed to uterine atony such as prolonged labour, uterine overdistension due to polyhydramnios, fetal macrosomia and multiple pregnancy, extended use of oxytocin, chorioamnionitis and BMI above 40[4]. It was observed that myometrial contraction after childbirth is the primary mechanism for hemostasis and prevention of postpartum haemorrhage[5]. It is seen that higher calcium levels are found in women undergoing normal vaginal delivery speculating adequate uterine smooth muscles contraction[6].Vitamin D is required for absorption of calcium from intestine thus maintaining blood calcium levels[7].

Many researchers have found association of low levels of vitamin D with undesirable pregnancy outcomes such as pre-eclampsia, preterm birth, gestational diabetes and increased rate of cesarean section[8,9]. But the role of vitamin D deficiency in development of uterine atony is still a point to ponder and research. Only a single study is available so far in our population concering the correlation of vitamin D with uterine musculature contraction after delivery. It was noted that vitamin D levels were found to be low in 87% of women with uterine atony as compared to 68 % in group with no uterine atony[10]. However, no other study is available in this regard to further support the findings.

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## SUBJECTS AND METHODS

Before data collection a letter of approval was taken from ethical committee of Sheikh Zayed Hospital, Rahim Yar Khan. We conducted a prospective case control study in the department of Obstetrics & Gynaecology at Sheikh Zayed Hospital, Rahim Yar Khan, from 1st January 2020 to 30th June 2020. A total of 200 postpartum females between the age group 20-35 years, delivered either through vaginal delivery or cesarean section and fulfilling the selection criteria were recruited for the study after taking informed consent. A total of 100 subjects with uterine atony were taken as cases, while 100 subjects with normal uterine tone were taken as controls. For the cases to be included, uterine atony was defined as the failure of the uterine musculature to contract after delivery of placenta and membranes leading to blood loss in excess of 500ml at normal vaginal delivery and more than 1000 ml at cesarean

section. The selection criteria for controls were similar to cases except that they had normal uterine tone after delivery. Exclusion criteria were chronic renal or liver diseases, preeclampsia, bleeding disorders, vaginal or cervical tears and all those factors that can lead to uterine atony such as grandmultiparity (≥5 children), polyhydramnios, macrosomia, and multiple pregnancy. Patients who were fulfilling the inclusion criteria but not willing to participate in the study were also excluded. Information regarding all the study variables were recorded in a structured proforma. A blood sample of 5 ml was taken after delivery by vene-puncture using aseptic techniques. Blood sample was collected in serum vial and was sent to the laboratory for serum vitamin D levels the same day. Reports were collected by the researcher herself the next day and the results were noted in the Proforma as well. Confidentiality of the data was ensured. Data was entered in SPSS version 23 and analyzed. Quantitative variables i.e. age, gestational age, weight, height, BMI, blood loss and Vitamin D levels were summarized as mean and standard deviation. Qualitative variables i.e., parity, mode of delivery and presence of vitamin D deficiency were presented as frequency tables and percentages. Chi-square test was applied to compare vitamin D deficiency in both groups taken p ≤0.05 as significant. Odd ratio was also calculated. Stratification was done with regard to age, gestational age, parity, mode of delivery, BMI and blood loss to see the effect of these variables on vitamin D deficiency. Post stratification using the chi-square test for both groups was applied, p ≤0.05 was considered statistically significant and Odd ratio was calculated.

## RESULTS

In our study most of the women were from 20 to 35 years of age and 29.550± 2.25 years was the mean age in case group while 29.260± 2.46 years in control group. Mean gestational age was 38.810±1.33 weeks in case group while 38.990±1.21 weeks in control group and mean weight was 63.540±11.41 Kg in case group while 70.300±12.91 Kg in control group, mean height 1.565± 0.10 meters in case group while 1.546± 0.08 meters in control group, mean BMI 26.125±4.94 Kg/$m^2$ in case group while 29.533±5.48 Kg/$m^2$ in control group, mean blood loss 788.500±241.21 ml in case group while 403.100±227.23 ml in control group and mean vitamin D level was 22.350±9.02 ng/ml in case group while 28.480±10.53 ng/ml in control group as shown in Table-I

Table- I: Mean±SD of patients according to age, gestational age, weight, height, BMI, blood loss and Vitamin D level (n=200)

| Demographics | Mean±SD Case group n=100 | Mean±SD Control group n=100 |
|---|---|---|
| Age (years) | 29.550± 2.25 | 29.260± 2.46 |
| Gestational age (weeks) | 38.810±1.33 | 38.990±1.21 |
| Weight (Kg) | 63.540±11.41 | 70.300±12.91 |
| Height (m) | 1.565± 0.10 | 1.546± 0.08 |
| BMI (Kg/$m^2$) | 26.125±4.94 | 29.533±5.48 |
| Blood loss (ml) | 788.500±241.21 | 403.100±227.23 |
| Vitamin D level (ng/ml) | 22.350±9.02 | 28.480±10.53 |

Among the study group 64% of patients had normal vaginal delivery and cesarean section was done in 36% of patients. In control group 80% patients had normal vaginal delivery and rate of cesarean section was 20%. In the case group 97% patients were having parity ≤3, while in control group it was 96%. Parity more than 3 were seen in 3% cases and 4% in control group. Vitamin D deficiency was seen in 84 (84%) patients in Case group as compare to 57 (57%) patients in Control group (p=0.000, OR = 3.9) as shown in Table-II.

Table-II: Comparison of Vitamin D Deficiency in both groups (n=200)

| Vitamin D Deficiency | Case group n=100 | Control group n=100 | P Value Odd ratio |
|---|---|---|---|
| Yes | 84 (84%) | 57 (57%) | 0.0003.9 |
| No | 16 (16%) | 43 (43%) | |
| Total | 100 (100%) | 100 (100%) | |

Among the age group 20-30 years, vitamin D deficiency was noted in 86 % of cases and 57% of controls and normal vitamin D levels were seen in 14% of cases as compared to 43 % in controls. Among the patients with ages more than 30 years, vitamin D deficiency was 81% and 60% in cases and controls respectively and normal vitamin D were noted in 19% of cases and 42% of controls. Stratification of vitamin D deficiency as regard to mode of delivery in both groups is shown in table III.

Table- III: Stratification of Vitamin D Deficiency as regard to mode of delivery in both groups

| For Vaginal delivery | | | |
|---|---|---|---|
| Group | Vitamin D Deficiency | | P value Odd ratio |
| | Yes | No | |
| Case | 50(78.1%) | 14(21.9%) | 0.001 |
| Control | 42(52.5%) | 38(47.5%) | 3.2 |
| **For C-section delivery** | | | |
| Case | 34(94.4%) | 2(5.6%) | 0.035 |
| Control | 15 (75%) | 5(25%) | 5.7 |

Among the patients who had normal vaginal delivery vitamin D deficiency was seen in 63% of subjects, while it was 87.5% among patients who delivered through cesarean section.

## DISCUSSION

In our study we have concluded the correlation of low serum Vitamin D levels with impaired uterine musculature contractility leading to uterine atony. Uterine atony, if not managed promptly may lead to excessive haemorrhage adding a significant burden to maternal morbidity and mortality.

Not only the kidneys are involved in the metabolism of 25 hydroxy vitamin D, but in many other organs evidence of its receptors have found, opening a new gate to research the association of vitamin D deficiency with a number of systemic diseases[11]. Vitamin D receptors has been identified in maternal decidua and the fetal trophoblastic tissue. Thus placenta plays an important part in the metabolism of 25 (OH) D during pregnancy, implicating its role in normal growth of pregnancy and fetus[12]. Calcium influx into uterine musculature plays a major part in uterine muscle excitability and contractility [13]. Since, vitamin D is

essential for effective calcium assimilation from intestine and keeping normal serum calcium levels suggesting vitamin D deficiency with impaired uterine muscle activity [7]. The uterotonic drugs oxytocin, misoprostol, and prostaglandin F2α also initiate uterine contractility through influx of calcium into the myometrial smooth muscles[14].

In our study among the patients who developed uterine atony after delivery, 84% found to have low vitamin D levels as compared to 57% in control group (p= 0.000) that is statistically significant. Similar results were reported by Khan et al who found a noteworthy correlation between low levels of vitamin D and ineffective uterine musculature contraction, showing low vitamin D levels in 87% of patients having uterine atony and 68% in controls with normal uterine tone[10]. Our study and the study conducted by Khan et al were done on similar group of population. But in previous study both case and control groups were of unequal size, i.e 100 cases and 30 controls. Statistical power of the study is affected by unequal sample sizes[15]. Therefore to get accurate local evidence we planned to use equal sample size of 100 in each group. In another study notable association of vitamin D deficiency was seen with uterine atony and postpartum haemorrhage, showing uterine atony in 4.7% of patients with low vitamin D levels as compared to 0.7% in control group with normal level of vitamin D with p value of 0.033 [9].

In our study, 64% of the patients with uterine atony had vaginal delivery and 36% had cesarean delivery as compared to 80% and 20% in the control group with normal uterine tone had vaginal delivery and cesarean section respectively. Out of the 56 patients from both groups who had cesarean section 49 had low vitamin D levels. The association of low vitamin D levels with high rate of primary cesarean section was also demonstrated by H manal et al, who showed cesarean section rate of 40.9% due to various causes of labour dystocia in the vitamin D deficient group as compared to only 12.8% rate of cesarean section in the control group with sufficient vitamin D levels[9].

In our study mean blood loss was more in the study group with uterine atony as compared to the controls. The significant association of postpartum haemorrhage with vitamin D deficiency was also demonstrated in one study showing excessive haemorrhage 5.6% in vitamin D deficient group as compared to 1.3% in control group[9].

In our study, out of total 200 patients enrolled 141(70.5%) had low levels of vitamin D. This shows very high prevalence of vitamin D deficiency in pregnant ladies in Pakistan. A research work done in Nepal showed vitamin D deficiency in 81% of pregnant ladies[16]. Although vitamin D deficiency is prevalent worldwide, but its proportion varies greatly between different regions according to lifestyle and genetics[17].In a systematic review it was seen that when the pregnant ladies were supplemented with vitamin D there were remarkable reduction in antenatal and postnatal maternal complications[18].

In author's view, preponderance of hypovitaminosis D in Asian Population may be correlated with a high rate of adverse perinatal outcomes as compared to developing countries and this field needs further research in Pakistan.

## CONCLUSION

In our study we have concluded the correlation of low serum Vitamin D levels with impaired uterine musculature contractility leading to uterine atony. As our population has high preponderance of vitamin D deficiency, all pregnant women should be supplemented with vitamin D so that risk of uterine atony and resulting excessive hemorrhage can be reduced.

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