

## PREDICTION OF UTERINE ATONICITY OCCURRENCE IN HYPOCALCEMIC PREGNANT

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### ABSTRACT

**Background:** uterine atony is one of the leading causes of maternal morbidity and mortality. It is also still an unpredictable emergency in the majority of causes although many risk factors for atonicity have been identified. Moreover, the rate of atonicity is increasing worldwide. Optimum levels of calcium are very important for contraction of uterine muscle. Low levels of serum calcium result in a reduced contraction.

**Aim:** to correlate the serum calcium levels and uterine atonicity. **Materials and methods:** this was a prospective comparative observational study including 100 pregnant women admitted for vaginal delivery at Tishreen University Hospital, Lattakia, Syria, between April 2022 and April 2023. Participants were divided into two groups, **Group 1 (50 subjects):** with serum calcium less than **8.5 mg/dl**. **Group 2 (50 subjects):** with serum calcium between **8.5 -10.5 mg/dl**. The participants were monitored for the following 24 hours for evidence of atonicity. **Results:** Both groups were comparable with regard to the age, parity, and gestational age. In women with serum calcium less than **8.5 mg/dl**, 13 patients developed uterine atonicity. In women with serum calcium between **8.5 -10,5mg/dl**, only one client developed uterine atonicity. That means uterine atony is more when serum calcium is less than **8.5mg/dl**. Moreover, we noticed an increase in the incidence of atonicity and an increase in the severity of bleeding when the degree of calcium deficiency was more severe. **Conclusion:** This study has shown that low calcium level is strongly associated with uterine atony, hence is a risk factor for uterine atony.

**KEYWORDS:** Serum calcium, uterine atony, Postpartum Haemorrhage (PPH).

### INTRODUCTION

As long the mother is the greatest thing in existence, therefor it was incumbent upon us in our specific competence to give her along with her fetus, all means of survival and wellness. As known postpartum haemorrhage is one of the most common causes of her loss of life. Moreover, every second of bleeding equals an entire life, consequently we have long ago studied all details related to the bleeding, mainly to prevent it.

PPH is a major cause of maternal morbidity and one of the 5 major causes of maternal mortality in both high and low per capita income countries.<sup>[1]</sup> The most common definition of primary postpartum haemorrhage is estimated blood loss > 500 ml after vaginal birth or >1000ml after caesarean delivery.

Uterine atony is the main cause of postpartum haemorrhage. Atonicity occurs when the uterus doesn't

contract optimally after the delivery of the placenta. It is diagnosed with the presence of a soft - bodied uterus by palpation and extending to the borders of the navel with vaginal bleeding, and pressure on the uterus leads to the flow of large blood clots.

Bleeding is classified according to its severity, Minor: **500 -1000 ml**.

Major: divided into: moderate: **1000 - 2000 ml**. Severe: **> 2000 ml**.

Recent reports indicate an increasing incidence of atonicity around the world.<sup>[2]</sup> It is still an unpredictable emergency in the majority of causes although many risk factors for atonicity have been identified.<sup>[3]</sup> Despite the progress of medicine and the identification of many risk factors for atonicity, part of them is still unknown to us, and we still see women developing atonicity without having a risk factor.

Perfect uterine contraction after delivery is dependent on an effective muscular contraction of which optimum physiological levels of serum calcium in the parturient women is believed to play a major role.

Optimum levels of calcium are very important for the effective uterine contraction.<sup>[4]</sup> Calcium exerts its effect by activating the muscle proteins and causing effective uterine contraction. The oxytocic drugs increase uterine tone by increasing intracellular calcium.<sup>[5,6]</sup>

In an in vitro study, normal calcium was associated with superior oxytocin induced contractility compared with contraction produced by oxytocin in uterine tissue with abnormal calcium.<sup>[7]</sup>

**METHODS**

This is a prospective comparative observational study conducted in the department of obstetrics and

**Inclusion Criteria**

• Vaginal deliveries	• Spontaneous onset of labour
• Age between 20-35 years	• Term pregnancies
• Primigravida and multiparity (1-2 only)	

**Exclusion Criteria**

- Multiparity (3 or above).
- Factors which interfere with the ability of the uterus to contract: (placenta previa - Abruptio placenta - Retained placenta - Big baby - Anemia - Hydraminos - Abnormal labour, precipitate labour, induced labour, prolonged labour, obstructive labour).
- Medical disorders (Arterial hypertension - Gestational diabetes - bleeding and coagulation disorders - previous PPH -Obvious fibroids).

The data obtained was processed and analyzed using the statistical package for social sciences (SPSS) version 20. Descriptive statistics: Quantitative variables with measures of central tendency and measures of dispersion. Qualitative variables with frequencies and percentages. The following tests were used to study the relationship between the two independent groups: Independent T Student test to compare the mean of two independent groups. Chi-square or Fisher exact test to study the relationship between qualitative variables. The results are statistically significant with a **P-value < 0.05**. Adopting

gynecology, at Tishreen University Hospital, Lattakia, Syria between April 2022 and April 2023. A total of 100 subjects were included in the study. The study subjects were divided into two groups: group 1 with serum calcium less than 8.5 mg/dl (50 subjects) and group 2 with serum calcium between 8.5 -10.5 mg/dl (50 subjects). The blood sample was collected for serum calcium in 1st and 2nd stage of labour. Following the delivery of the baby, third stage of labour was actively managed with 10 I.U of intramuscular oxytocin given within 1 minute of the delivery, in addition to 20 I.U intravenous infusion within 1000 ml of LRS. The participants were monitored for the following 24 hours for evidence of atonicity.

the program (IBM SPSS Statistics version 20) to calculate statistical coefficients and analyze results.

**RESULTS**

The research sample included **100** pregnant women admitted for vaginal delivery in the department of obstetrics and gynecology, at Tishreen University Hospital, Lattakia, Syria.

The ages of the women ranged between 20-35 years with an average age of **25.81±2.5 years**. The gestational age of women ranged between **37- 41 weeks**, with an average of **38.87±1.1weeks**. Normal serum calcium values ranged between **8.5-10.5 mg/dl** with an average of **9.1±0.5 mg/dl**. The values of serum calcium deficiency ranged between **7.2-8.4 mg/dl** with an average of **7.9±0.2 mg/dl**. Our study included only ten women who had one or two previous abortions (before the 20th week of pregnancy), **7** of whom had a normal serum calcium value, and **3** of whom had a calcium deficient value. No atonicity was observed in any of these ten women.

**Table (1): comparison of mean maternal age in the two research groups.**

Age (year)	Normal Calcium	Low Calcium	P-value
Min – Max	20 - 30	21 - 33	0.07
Mean ± SD	25.18 ± 2.1	26.44 ± 2.7	

We note from the table 1: there are no statistically significant differences between the two research groups according to the maternal age.

**Table (2): Comparing the gestational age of the two research groups.**

Gestational age (week)	Normal Calcium	Low Calcium	P-value
Min – Max	37 - 41	37 - 41	0.4
Mean ± SD	38.78±1.1	38.96±1.1	

As noticed from the previous table 2 that, there are no statistically significant differences between the two groups according to the gestational age.

**Table (3): The distribution of the two research groups according to parity.**

Obstetric status	Normal Calcium	Low Calcium	P-value
Primigravida	23(46%)	24 (48%)	0.8
multiparous	27(54%)	26 (52%)	

It can be seen from the table 3 that there are no statistically significant differences between the two research groups according to the obstetric status.

**Table (4): Comparing the incidence of uterine atony bleeding in the two research groups.**

Uterine atony bleeding	Normal Calcium	Low Calcium	P-value
found	1(2%)	13(26%)	0.001
Non found	49(98%)	37(74%)	

Table 4 shows that, there are statistically significant differences between the two research groups according to the occurrence of uterine atony.

**Table (5): Serum calcium level and severity of bleeding.**

Severity of bleeding	Normal Calcium	Low Calcium	P-value
minor(1000 – 500 ml)	1(100%)	7(53.8%)	0.04
major(> 1000 ml)	0(0%)	6(46.2%)	

**Table (6): The relationship between the severity of calcium deficiency and the incidence of uterine atony in the group of hypocalcemic pregnant.**

Severity of calcium deficiency	Incidence of uterine atony Bleeding	Non-Incidence of uterine atony Bleeding	P-value
7.2 – 7.9	8 (61.5%)	13(35.1%)	0.03
8 – 8.4	5 (38.5%)	24(64.9%)	

**Table (7): The relationship between the severity of calcium deficiency and the severity of bleeding in the group of hypocalcemic pregnant women who bled.**

severity of calcium deficiency	Minor Bleeding	Major Bleeding	P-value
7.2 – 7.9	3(42.9%)	5(83.3%)	0.001
8 – 8.4	4(57.1%)	1(16.7%)	

**Table (8): The distribution of hypocalcemic patients who bled from uterine atony according to: maternal age-gestational age-obstetric condition.**

Basical Properties	Incidence of uterine atony Bleeding	Non-Incidence of uterine atony Bleeding	P-value
Age (year)	25.61±3.1	26.72±2.6	0.2
gestational age (week)	38.76±1.3	39.02±1.1	0.5
Obstetric Primigravid Status	5(38.5%)	19(51.4%)	0.4
multiparous	8(61.5%)	18(48.6%)	

## DISCUSSION OF THE RESULTS

Our present study was conducted to investigate whether hypocalcemia causes uterine atonicity, which is a life threatening condition that may lead to emergency hysterectomy. It was quite clear from the results of our study that an ideal serum calcium level is essential for effective uterine contractions, and that a low level may cause uterine atonicity. As we found in table (4): among 50 pregnant women with a normal serum calcium value, only one patient developed uterine atonicity (2%), while in the other group containing 50 pregnant women with low serum calcium, it occurred atonicity in 13 of them (26%), and this is a statistically significant difference between the two groups ( $P=0.001$ ). There were no significant statistical differences between the two research groups due to the mother's age, gestational age, or obstetric condition, we show this in tables 1, 2 and 3. The amount of bleeding resulting from atonicity ranged from 800 to 2000 ml, with an average of  $1330.67 \pm 515.4$  ml. In the low calcium group, there were 13 cases of bleeding, including 6 cases of major bleeding ( $>1000$  ml), where the amount of bleeding ranged from (1500 - 2000 ml) and 7 cases of minor bleeding (500-1000 ml), while in the normal calcium group, we didn't find any A case of major bleeding, but there was only one case of minor bleeding, the amount of which was 800 ml, this constitutes a statistically significant difference between the two groups ( $P=0.04$ ), where this result was reached and explained in table (5). We have noticed that the more severe the degree of calcium deficiency, the greater the possibility of uterine atonicity. Of the 50 patients with hypocalcemia, 21 had a range calcium value of 7.2-7.9mg/dl and 8 of them eventually bled (61%) compared to (1.35%) of them didn't bleed, while there were 29 patients with calcium deficient between 8-8.4 mg/dl, and 5 patients (5.38%) bled at the end, compared to (9.64%) who didn't bleed, this is a statistically significant difference between the two groups ( $P=0.03$ ), this was indicated in the results table (6).

In addition, we have noticed in table (7) that there is an inverse relationship between the value of serum calcium and the severity of bleeding, in patients with a calcium deficient value range between 7.2-7.9 mg/dl, there were 5 cases of major bleeding, and 3 cases of minor bleeding, while in patients with a calcium deficiency range of 8-8.4 mg/dl, we found only one case of major bleeding, and 4 cases minor bleeding. In other words, 83.3% of patients with major bleeding were within the calcium deficient range (7.2 -7.9mg/dl) versus (16.7%) within the range (8-8.4 mg/dl), this is considered a statistically significant difference ( $P=0.001$ ). Looking at the group of hypocalcemic patients who developed atonicity haemorrhage, we didn't find a statistically significant difference between them and the hypocalcemic patients who didn't bleed, according to maternal age, gestational age, and obstetric condition. The 14 study samples who developed uterine atony bleeding were treated with oxytocic drugs (Oxytocin – Metherin - prostaglandines), but 4 of them didn't respond to these drugs and were

given intravenous calcium gluconate (10 ml in 500 ml LRS), where a good response occurred and the bleeding stopped. The importance of optimal calcium level in the prevention of primary postpartum haemorrhage has been elucidated from a study whereby patients with postpartum haemorrhage from atonic uteri that hadn't responded to usual oxytocics had been observed to have a marked contraction of the uterus and lessing of the haemorrhage immediately after receiving intravenous calcium gluconate.<sup>[8]</sup>

In a study done by Admina et al (2019),<sup>[9]</sup> the average value of calcium in women with atonicity was lower than that in women without atony, with a statistically significant difference ( $P=0.026$ ), the study concluded that calcium deficiency is associated with atonicity and postpartum haemorrhage, this is consistent with the main finding of our study.

Danny Epstein et al,<sup>[10]</sup> focused in his research on the association between the value of calcium and the severity of postpartum haemorrhage, and the study found that calcium deficiency was more present in the group of patients with severe bleeding compared to light bleeding, this result intersects with our related result.

## CONCLUSION

This study has shown that hypocalcemia in pregnant women is strongly associated with the occurrence of uterine atonicity, so hypocalcemia is a risk factor. Our study also concludes that the more severe the degree of calcium deficiency, the greater the probability of uterine atonicity and the severity of bleeding. This relationship between serum calcium and uterine atonicity could be explored in the development of predictive, preventive and therapeutic strategies for atony and postpartum haemorrhage.

## RECOMMENDATION

We recommend maintaining an ideal serum calcium level for pregnant women. Our study suggests that all subjects admitted in labour should be tested for serum calcium levels. if serum calcium is less than **8.5 mg/dl**, atonicity should be anticipated, and then it can be managed by giving intravenous calcium gluconate before delivery to avoid bleeding or aggressive procedures such as hysterectomy, and to reduce maternal morbidity and mortality. We propose detailed studies regarding the use of intravenous calcium gluconate in the treatment and prevention of uterine atonicity.

## REFERENCES

1. Belfort M.A, Lock wood C.J, Barss V.A., Overview of postpartum hemorrhage. Uptodate, Oct, 2017.
2. Callaghan Wn, Kuklina EV, Berg CJ, Trends in Post partum hemorrhage: United States, 1994-2006. Am J Obstet Gynecol, 2010; 202: 353-356.
3. Henriquez DDCA, Bloemenkamp KWM, van der Bom JG. Management of postpartum hemorrhage:

- how to improve maternal outcomes? *J Thromb Haemost*, 2018; 16: 1523e34.
4. Lockwood CJ, Krikun G, Schatz F. The decidua regulates hemostasis in human endometrium. *Semin Reprod Endocrinol*, 1999; 17: 45-51.
  5. Khan SM, Saeed M, Mustafa G, Durrani HD. Uterine atony; association of low serum vitamin D. *professional med J.*, 2014; 21(6): 1117-21.
  6. Balki M, Talati C, Carvalho J. Investigating the effect of extracellular calcium on oxytocin -induced human myometrial contractility in vitro. *Clinical trials*. Gov. Identifier NCT02274454, Samuel Lunenfeld Research Institute, Mount Sinai Hospital.
  7. Talati C, Ramachandran N, Carvalho J.C.A. Kingdom J, Balki M., The Effect of extracellular calcium on oxytocin-Induced contractility in naive and oxytocin-pretreated human myometrium in vitro. *Anesth Analg*. 2016; 122: 1498-1507.
  8. Al-Eknaah MM, Homeida AM, Dafalla EA, Galil AKA, Al-Tahir AY. Uterine activity after induction of hypocalcaemia in the ovariectomized camel (*camelus dromedarius*). *Veterinary Research Communications*, 1997; 21(1): 45-50.
  9. Joseph Ifeanyi Adinma, Serum Calcium in Primary Postpartum Hemorrhage, October *European Journal of Pharmaceutical and Medical Research*, 2019; 6(10): 53-58.
  10. Epstein D, Solomon N, Korytny A, Marcusohn E, Freund Y, Avrahami R, Neuberger A, Raz A, Miller A., Association between ionised calcium and severity of postpartum hemorrhage: a retrospective cohort study, *The National Center for Biotechnology Information advances science and health by providing access to biomedical and genomic information.*,  
<https://doi.org/10.1016/j.bja.2020.11.020>.