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Original Article

Effect of Body Mass Index on the Active Stage of Labour

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ABSTRACT

Objective: To explore the duration of the active phase of the second stage of labour in relation to maternal pre-pregnant body mass index (BMI).

Study Design: Prospective analytical study.

Place and Duration of Study: Department of Gynaecology and Obstetrics, Pak Emirates Military Hospital, Rawalpindi Pakistan from Dec 2023 to Jun 2024.

Methodology: Three hundred and fifty pregnant women (gestational age upto 22 weeks) who gave birth at the hospital were included. The women were categorised into two Groups according on their gestational age: nulliparous women (TGCS-1, 200) and parous women (TGCS-3, 150). Then, they were moved into BMI Groups according to the WHO classification. The average time it took for the second stage of labour active phase to complete was determined.

Results: Out of 200 TGCS Group 1 patients, 10(5.0%) patients were underweight, 122(61.0%) had normal BMI, 44(22.0%) were overweight and 24(12.0%) patients had obesity. In TGCS Group Caucasian (n=20,83.3%), Oxytocin augmentation (n=10,41.7%), Epidural analgesia (15, 62.5%), Intrapartum CS (n=3, 12.5%) more seen in obese Patients. In TGCS Group 3, similar Caucasian (n=26,81.3%) and Oxytocin augmentation (n=5,15.6%) more seen in obesity Patients. The overall median duration of active punching was increased in normal BMI patients Group 1 while in Group 3, Underweight of patients had overall more median duration of active pushing.

Conclusion: Our research showed that the median time for the active second stage of labour decreased with increasing body mass index.

Keywords: Body mass index (BMI), Spontaneous onset of labour, Stages of Labour, WHO Ten-Group Classification System (TGCS).

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INTRODUCTION

Worldwide, obesity rates are on the rise as per recent statistics, 37% of American women, 29% of British women, 21% of French women, and 23% of Norwegian women were obese, according to the World Health Organisation (WHO).[1] Macrosomia, stillbirth, gestational diabetes, preeclampsia, abnormal birth weight, and premature delivery are all complications that might arise from a pregnant woman who is overweight.[2] Due to decreased cardiotocographic monitoring and a higher risk of surgical delivery, obesity significantly complicates foetal safety during delivery.[3] Compared to healthy, nonpregnant women of normal weight who were not at risk for pregnancy difficulties, multiparous women with a body mass index (BMI) more than 35 were less likely to require obstetric intervention or care.[4] Newborn outcomes were also not different between women who had a trial of labour and those who had a planned caesarean cut, according to a recent study. Parity, earlier caesarean section, foetal lie, gestational age, multiple pregnancies, and spontaneous or induced commencement of labour are known to affect labour outcomes.[5] One helpful framework is the Ten-Group Classification System (TGCS), which can be used to get similar Groups for these variables. There is a pre-labor stage, an active phase, and three sub-stages within the active phase of labour. The second stage begins when the cervix has fully effaced and continues until the baby is born. In the second stage, the mother engages in aggressive expulsive effort after a quiescent phase. Research has linked obesity to a number of negative birth outcomes, including a sluggish first stage of labour and a sluggish advancement in the latent period.[6] Previous research on the relationship between body mass index (BMI) and the length of the second stage of labour has yielded contradictory results.[7] Although some research has shown shorter second stages in obese women, other studies have failed to find a statistically significant difference in duration. One study indicated that obese women had lengthier second phases, but that study didn't use

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survival analyses,[8] and the other two studies didn't distinguish between active and inactive second stages. It is not known when exactly a woman reaches complete dilatation; the first step in making a diagnosis is a vaginal examination, which may take place after full dilation has occurred.[9,10]

Thus, we do not know for sure how long the passive second stage is. Because both the effusive efforts and the delivery of the infant are objectively observable occurrences, it is possible to record with confidence when the active second stage begins and when it ends. Given the higher risk of complications for obese women during childbirth, it is important for the birth attendant to be aware of this fact so that their attitude can impact the birth experience and the final product. We think this information could lead to a more optimistic attitude towards delivery on the part of the birth attendant as well as the women themselves, as evidence from clinical trials indicates that the active second stage can be shorter in women who are overweight. We set out to quantify the duration of the active second stage in the three TGCS groups that were defined by body mass index.

METHODOLOGY

The prospective analytical study was conducted at the PEMH, Gynecology and Obstetrics Department, Rawalpindi Pakistan from Dec 2023 to Jun 2024 .The ethical approval was obtained beforehand (A/28/ERC/49/2024).

Inclusion Criteria: The study population consisted of women who exhibited the following characteristics: a single pregnancy, cephalic, spontaneous commencement of labour, gestational age 37 wks or longer, and the absence of a history of caesarean section.

Exclusion Criteria: We did not include caesarean sections or surgical vaginal deliveries that occurred during the active phase. Additionally, women who underwent a C section during the initial stage of labor or who were actively involved in the second stage for 120 minutes or more were not included.

Following the informed consent process, participants were enrolled in the study. This study made use of the non-probability consecutive sampling method.

The women were categorised into two Groups based on their gestational age: nulliparous (TGCS 1) and parous (TGCS 3). Then, they were subjected to a body mass index (BMI) analysis in accordance with the World Health Organization guidelines. The following categories of pre-pregnancy body mass index (BMI) were used: underweight (<18.5), normal weight (185-24.9), overweight (25.0-29.9), obesity class 1(30.0-34.9), obesity class 2(35.0-39.9), and obesity class 3(≥40.0).[11] Median estimated time of active second stage of labour was the primary outcome measure.

Consistent contractions, a 4-centimeter dilatation, and an effaced cervix were the hallmarks of the first stage of labour during the study period. According to the former WHO classification. When the cervix had dilated to its maximum size, the woman was considered to be in the second stage of her pregnancy. The period between the initiation of active expulsive effort and the birth of the baby was called the active second stage. At 1 cm cervical dilation/hour, an alert line was used to monitor the first stage of labour progress, and at 4 hours, an action line was moved, in accordance with the criteria set out by the World Health Organisation. In the first stage, oxytocin augmentation can only begin following amniotomy and the crossing of the action line, per the World Health Organization's standards.[11] During the initial phase of labour, Zhang's guidance was utilised.[12] In the second stage, if the birth attendant felt that the contractions weren't strong enough, they could start oxytocin augmentation. Additionally, according to national recommendations, the second stage should not go longer than three hours, and after sixty minutes of active pushing, women who are either nulliparous or parous should consider having a surgical birth.[13]

As an intravenous infusion of oxytocin was started for the patient at 5 mU/minute and increased by 2.5 mU every 15 minutes up to a maximum of 30 mU/minute, the goal was to induce labour or regular contractions at a rate of 3-5/10 minutes. At first, a low-dose mobile epidural analgesia (bupivacaine or ropivacaine combined with fentanyl) was viewed as the main approach to pain control.

We factored in the median expected time for the second stage of labour. We accounted for the possibility that epidural analgesia and oxytocin augmentation were mediators by comparing the anticipated median duration in women who had these procedures done with and without them. Separate analyses were conducted on TGCS Groups 1 and 3. The reference Group consisted of individuals with a body mass index (BMI) ranging from 18.5-24.9 kg/m^2. We also took mother age into account when doing our analysis. Data analysis was carried out using IBM

Statistical Package for Social Science statistics for Windows v.26.0 (IBM Corp.). Quantitative data were presented as mean ± standard deviation (SD) or median (interquartile range [IQR]), depending on the normality of the data. Qualitative data was represented by using percentage and frequency.

RESULTS

During the study period, 400 women in TGCS 1 and 3 gave birth in the hospitals. We excluded 50 women with missing BMI, leaving 350 women available for analysis, 200 in TGCS Group 1 and 150 in TGCS Group 3. The study population and selections into the analysis are presented as a flow chart (Figure). Median Age was 32.62±4.50 years. Out of 200 TGCS Group 1 patients, 10 (5.0%) patients were underweight, 122 (61.0%) had normal BMI, 44 (22.0%) were overweight and 24(12.0%) patients had obesity. In TGCS Group Caucasian (n=20,83.3%), Oxytocin augmentation (n=10, 41.7%), Epidural analgesia (15, 62.5%), Intrapartum CS (n=3, 12.5%) more seen in obesity Patients while Spontaneous delivery (86,70.5%) and CS active 2nd stage (n=2,1.6%) were more found in normal BMI patients and Instrumental delivery was more found in over weight patients (Table-I). Out of 150 TGCS Group 1 patients, 7(4.7%) patients were underweight, 99(66.0%) had normal BMI, 12(8.0%) were overweight and 32(21.3%) patients had obesity. In TGCS Group 3, similar Caucasian (n=26,81.3%) and Oxytocin augmentation (n=5,15.6%) more seen in obesity Patients while Epidural analgesia (n=3,42.9%), Instrumental delivery (n=1,14.3%), Intrapartum CS (n=2, 28.6%) and CS active 2nd stage (n=1, 14.3%) more found in underweight patients and Spontaneous delivery (n=94, 94.9%) was more in normal patients (Table-II). The overall median duration of active punching was increased in normal BMI patients in TGCS-1 while in TGCS-3, Underweight of patients had overall more median duration of active pushing. Table-III shows the estimated median duration of the active pushing phase in minutes (interquartile range) for TGCS-1, and the Table –IV shows the same data for TGCS Group 3.

DISCUSSION

Subjects in TGCS Groups 1 and 3 had a shorter estimated median length of the active second stage of labour when their body mass index was greater, according to our study. Compared to women of normal weight in Group 3, those in Group 1 who were obese class 3 had an estimated median duration that was fourteen minutes shorter while the comparable difference was 3 minutes in Group 2. Even after separating the women into Groups according to whether they had epidural analgesia or oxytocin augmentation, the correlation between a greater body mass index and the predicted length was consistent.

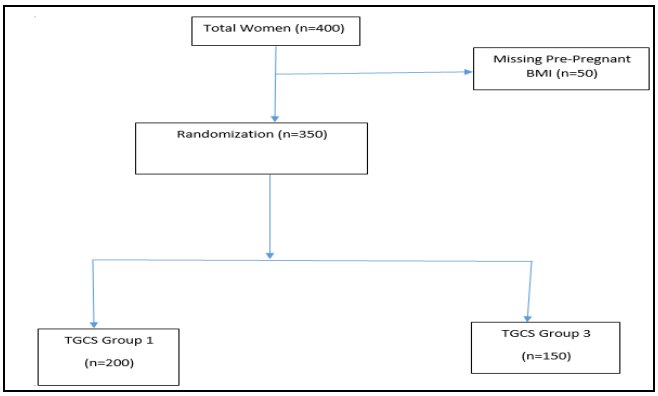

Figure: Flow chart of Study Participants

Obese and overweight women suffer longer early stages of labour and slower cervical dilatation, according to multiple research. Every surgical delivery reduces the duration of labour, hence it is risky to analyse the median or median.[14] The overall duration of active labour was not different among nulliparous women in a Danish cohort studied by Ellekjaer *et al*.[15] But they also discovered that overweight and obese women had caesarean sections performed sooner in the labour process, thus they came to the conclusion that this could have affected their findings. It could be mistakenly concluded that labour is shorter in obese women if correction for surgical interventions is not attempted. As already proposed by Vahratian *et al*.,[16] one way to study labour duration is to use survival approaches that censor surgical deliveries. This manner, the possibility of making this mistake is lessened. Research on the second stage of labour is limited. Although one previous study revealed 8 no correlation between BMI and second stage duration, another indicated that multiparous women, but not nulliparous women, had a longer second stage as their BMI increased. A big, modern-day Swedish cohort was the subject of the study by Carlhäll *et al*.[17] Using survival analyses, they discovered that the estimated duration of the active period of labour rose considerably with rising BMI. Obese women had a median second stage duration that was shorter than normal, which was a secondary result. Our results are consistent with a prior study that indicated that women receiving epidural analgesia had an extended

Table-I: Characteristics of WHO Ten-Group Classification System Group-1 (TGCS-1), (n=200)

Parameters	Underweight (n=10)	Normal (n=122)	Overa Weight(n=44)	Obesity (n=24)
Maternal age (years) Mean±SD	26.3±5.4	27.8±4.6	28.6±5.1	27.3±4.2
Birth weight, g Mean±SD	3329.1±427.0	3540.2±441.5	3476.9±439.2	3583.6±455.6
Caucasian	6 (60.0%)	90 (73.8%)	36 (81.8%)	20 (83.3%)
Oxytocin augmentation	3 (30.0%)	45 (36.9%)	18 (40.9%)	10 (41.7%)
Epidural analgesia	5 (50.0%)	62 (50.8%)	26 (59.1%)	15 (62.5%)
Spontaneous delivery	7 (70.0%)	86 (70.5%)	24 (54.5%)	16 (66.7%)
Instrumental delivery	2 (20.0%)	28 (22.9%)	14 (31.8%)	5 (20.8%)
Intrapartum Caesarean Section	1 (10.0%)	8 (6.6%)	4 (9.1%)	3 (12.5%)
Caesarean Section active 2nd Stage	0 (0.0%)	2 (1.6%)	1 (2.3%)	1 (4.2%)

Table-II: Characteristics of WHO Ten-Group Classification System Group-3 (TGCS- 3), (n=150)

Parameters	Underweight (n=7)	Normal (n=99)	Overa Weight (n=12)	Obesity (n=32)
Maternal age (years) Mean±SD	31.4±5.4	32.8±4.9	31.8±4.9	30.8±5.1
Birthweight, g Mean±SD	3664.8±431.2	3626.5±242.5	3629.5±495.2	7336.2±432.4
Caucasian	5 (71.4%)	79 (79.8%)	9 (75.0%)	26 (81.3%)
Oxytocin augmentation	1 (14.3%)	7 (7.1%)	1 (8.3%)	5 (15.6%)
Epidural analgesia	3 (42.9%)	21 (21.2%)	3 (25.0%)	10 (31.3%)
Spontaneous delivery	6 (85.7%)	94 (94.9%)	11 (91.7%)	29 (90.6%)
Instrumental delivery	1 (14.3%)	4 (4.0%)	1 (8.3%)	1 (3.1%)
Intrapartum Caesarean Section	2 (28.6%)	3 (3.0%)	1 (8.3%)	2 (6.3%)
Caesarean Section active 2nd stage	1 (14.3%)	1 (1.0%)	0 (0.0%)	0 (0.0%)

Table-III: Estimated median duration of Active Pushing Phase in minutes (Interquartile range) in WHO Ten-Group Classification System Group-1 (TGCS-1), (n=200)

Parameters	Overall	Epidural −	Epidural +	Oxytocin −	Oxytocin +
Underweight (n=10)	42.5 (25.3 – 76.1)	38.6 (31.5 – 64.5)	55.8 (32.8 – 85.1)	34.5 (21.5 – 54.6)	76.5 (51.2 – 99.1)
Normal(n=122)	41.2 (24.9 – 72.2)	36.8 (21.2 – 58.9)	55.6 (31.5 – 87.2)	34.0 (20.1 – 56.4)	68.9 (43.8 – 97.8)
Overa Weight (n=44)	40.6 (19.0 – 63.8)	25.2 (17.5 – 54.9)	49.8 (22.5 – 79.5)	30.6 (17.8 – 48.2)	62.5 (36.4 – 96.5)
Obesity (n=24)	28.9 (19.6 – 55.4)	26.7 (18.4 – 49.2)	43.2 (25.9 – 63.8)	21.5 (17.5 – 45.6)	38.9 (18.0 – 75.4)

Table-IV: Estimated Median Duration of Active Pushing Phase in Minutes (interquartile range) in WHO Ten-Group Classification System Group-3 (TGCS- 3), (n=150)

Parameters	Overall	Epidural −	Epidural +	Oxytocin −	Oxytocin +
Underweight (n=7)	11.4 (6.9 – 19.1)	10.5 (7.1 – 17.8)	14.9 (8.9- 29.1	11.5 (6.9 – 18.9)	41.5 (19.8 – 75.1)
Normal (n=99)	10.5 (6.9 – 17.5)	9.5 (6.7 – 14.9)	14.8 (7.9 – 25.6)	10.1 (6.9 – 16.8)	25.8 (13.5 – 55.4)
Over- Weight (n=12)	10.4 (6.9 – 17.0)	9.0 (4.9 – 15.0)	12.5 (8.1 – 21.2)	9.5 (5.1 – 15.9)	16.8 (10.4- 43.5)
Obesity (n=32)	8.0 (5.9 – 13.4)	8.1 (4.2 – 12.5)	9.1 (5.6 – 14.9)	8.5 (5.1 – 14.5)	18.9 (8.2 -51.5)

active second stage. There is a clear causal link between epidural analgesia and oxytocin augmentation.[18] A higher prevalence of epidural analgesia may be linked to a higher body mass index (BMI). Although a sluggish progression indicates oxytocin augmentation, it may also cause the active second stage to be shorter. As a result, we separated the patients into two Groups: those who received epidural analgesia and those who did not; we then observed the same relationships in the two sets of data. There may be room for debate regarding the results' external validity. Similar to other Scandinavian countries, Norway also has a relatively low rate of caesarean sections. But we kept this possible prejudice to a minimum by employing survival techniques. Norway also has a lower median body mass index (BMI) than the United States and the United Kingdom, but it's comparable to that of France, Italy, and Germany.[19]

The exact causes of the reduced duration of the active second stage in women who are overweight or obese are not well understood. There may be a correlation between the shorter active second stage and either an increase in pushing strength or an increase in abdominal pressure with a higher body mass index. A broader bony pelvis in adulthood is associated with an increased risk of foetal evacuation in those who had a history of obesity in their teenage years, according to one study. Another potential explanation is that the pelvic floor muscles lose some of their strength and resistance due to the combination of high abdominal pressure and fat infiltration.[20] A decrease in needless interventions for women who are overweight or obese may arise from the dissemination of this study's findings, since clinicians' decision-making is impacted by patients' perceptions of risk. Finally, we discovered that the projected median time of the active second stage of labour was shorter as BMI increased.

LIMITATIONS OF STUDY

There were little deviations from the analysed population when looking at the total anticipated time of the active second stage in the women without a BMI. A further limitation was that more women in the high body mass index (BMI) Group had caesarean sections before they reached stage two.

CONCLUSION

There was a correlation between a higher body mass index and a shorter predicted median duration of the active second stage of labour.

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Authors Contribution

Following authors have made substantial contributions to the manuscript as under:

SA & SC: Data acquisition, critical review, approval of the final version to be published.

VA & AS: Conception, study design, drafting the manuscript, approval of the final version to be published.

MT & RA: Data analysis, data interpretation, critical review, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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