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Original Research Article

Maternal and neonatal outcomes in pregnancies complicated by maternal obesity

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ABSTRACT

Background: Maternal obesity imparts elevated maternal and neo natal adverse outcomes. Aim of the study was to evaluate and analyse the maternal and neonatal outcomes in obese mothers.
Methods: This was a prospective case control study in a tertiary care high risk referral center. Antenatal women with first trimester Body mass index (BMI) of more than 30 Kg/m^2 constituted the cases and those antenatal women with BMI <25 Kg/m^2 formed the controls.
Results: Mean age was slightly more (28.6±4.3 years vs 26.3±3.6 years: P<0.0001) in the obese group. Obese women were significantly more likely to have of gestational diabetes (OR 5.2, 95% CI 3.2-8.7 P<0.00001), gestational hypertension (Or 3.5, 95% CI 2.1-5.9 P<0.0001) , induction of labour (OR 2.5, 95% CI 1.8-3.6 P<0.0001), failed induction of labour (OR 2.4, 95% CI 1.3-4.2 P=0.003), Preeclampsia (OR 2.8, 95% CI 1.6-4.9 P=0.0002), Caesarian section (Or 4.0, 95% CI 2.9-5.9 P<0.0001) and Postpartum hemorrhage (OR 4.0,95% CI 1.1-14.3 P=0.034), prolonged hospital stay (OR 12.8, 95% CI 7.7-21.1 P<0.0001) and adverse neonatal outcomes such as low(<7) Apgar (OR 3.2, 95% CI 1.1-10.0 P=0.03), Large for gestational age babies (OR 3.1, 95% Cl 2.1-4.5 P<0.0001) and transfer to new born nursery (OR 3.4, 95% CI 2.3 -5.2 P<0.0001).
Conclusions: Maternal obesity in pregnancy is high risk and has many adverse maternal and neonatal outcomes warranting specialized antenatal, intranatal and post-natal care.

Keywords: Gestational diabetes, Gestational hypertension, Large for gestation age babies, Maternal Obesity

INTRODUCTION

There is worldwide increase in the prevalence of obesity including women of childbearing age.[1] Maternal obesity is associated with a wide array of adverse maternal pregnancy outcomes and increased risks in the offspring.[2] Nearly one third of the women of childbearing age group are overweight or obese.[3] Overall maternal obesity is associated with increased risk of miscarriage, recurrent abortions and other congenital anomalies and intrauterine death. Maternal complications include increased prevalence of gestational diabetes mellitus, gestational hypertension, pre-eclamptic toxaemia, increased rate of operative delivery, post-operative infections and deep vein thrombosis.[4-6] Neo natal complications includes Large for gestational age babies and low Apgar scores at birth and increased shoulder dystocia in new born.[4,6] Remote complications include childhood obesity, type 2 diabetes mellitus and metabolic syndrome. Thus, obesity in pregnancy is of special concern and needs special care. Most of the available literature on impact of obesity in pregnancy is from western world and only sparse data exist in India especially in Kerala, where the prevalence of obesity in childbearing age group is increasing. It is in this background this study was conceptualized and was designed to analyse the maternal and foetal outcomes in

obese mothers in order to evolve specialized health care policy for these high risk obese pregnant women.

METHODS

A prospective case control study was conducted at the department of obstetrics and gynecology in Government Medical College at Trivandrum in Kerala, South India under Kerala University of Health Sciences. The department is a tertiary care referral university hospital center where all types of high-risk pregenancies receive antenatal, perinatal and post-natal services. Prospective ante natal women with single ton pregnancies were included in the study.

Inclusion criteria

- All with BMI (Body Mass Index) ≥30kg/m^2 preregistration or self-reported body weight or the at the time first antenatal registration at first trimester were included as study population and those antenatal women with BMI <25kg/m^2 on preregistration or self-reported body weight or at the first antenatal registration in first trimester formed the control population.

Exclusion criteria

- Multiple pregnancies
- Preexistent chronic hypertension
- Preexistent diabetes mellitus
- Preexistent renal/cardiac/liver disease
- Patients unwilling to consent.

Data was collected from all patients during personal interview at antenatal visit and the maternal demographic characteristics, medical and obstetric history and pregnancy outcomes were collected and entered using standardized proforma.

All antenatal women were advised to have regular antenatal check-ups and abdominal ultrasonic evaluation of the foetus to assess fetomaternal morbidities in addition to the regular standardized antenatal investigations. Vigilant antenatal surveillance was implemented in all high-risk pregnancies. Antenatal complication if any, were treated as per the standard protocols and guidelines relevant to the case. Mode of delivery was decided as per the obstetrical indication. Informed consent was obtained from all the participants after explaining the purpose and method of study. Maternal characteristics including age, parity, gestational weight gain, gestational age at termination and pregnancy outcome were compared between obese and normal women. Maternal outcome characteristics included Gestational hypertension (GHTN), pre eclamptic toxaemia (PET), Gestational Diabetes mellitus (GDM), and Caesarian Section (CS) rate. Gestational age was based on early Ultra sonogram (USG), and last menstrual period (LMP). Large for gestational age (LGA) defined as birth weight more than 90th percentile adjusted for gestational age and gender.

Small for Gestational Age (SGA) defined as new born with weight less than 10th percentile for gestational age gestational hypertension was defined as blood pressure of more than or equal to 140mmHg systolic or more than or equal to 90mmHg diastolic measured on 2 occasions 6hours apart in a previously normotensive women after 20 weeks of gestation. Preeclampsia was diagnosed when GHTN was associated with proteinuria (>300mg protein in 24-hour urine sample). Oral glucose tolerance test (OGTT) was done at 24 to 28 weeks of gestation and a diagnosis of GDM was made when 2-hour sugar level >140mg%. Failed induction diagnosed when pharmacological methods did not generate contractions and leading to vaginal delivery. Dystocia defined as failure to progress either due to uterine dysfunction or pelvic contraction or cephalo pelvic disproportion.

Statistical analysis

Data were analyzed using statistical package for social sciences (SPSS version 17, SPSS Inc. Chicago IL USA). Descriptive statistics were expressed as arithmetic mean and standard deviation. Pearson's Chi Square test ($\chi 2$) and Fisher's exact test were used for comparison of categorical variables where ever applicable. P value less than 0.05 considered statistically significant. Odds ratio (OR) and 95% confidence intervals (95% CI) were calculated.

RESULTS

In this study 415 parturient with obesity (BMI ≥30 kg/m^2) were recruited in the study arm and 405 antenatal women with normal body weight (BMI <25 Kg /m^2) recruited in the control arm. Maternal characteristics are presented in Table 1.

Table 1: Maternal Characteristics.

Characteristics	Obese women (N = 415)	Normal weight women (N=405)	P
Mean age (years)	28.6±4.3	26.3±3.6	<0.0001
Parity status N (%)			
Nulliparous	128 (30.8)	149 (36.8)	0.07
Multiparous	287 (69.2)	256 (63.2)	χ^2=3.24
Education status N (%)			
Below 10th standard	317 (76.4)	341 (84.2)	0.005
Above 10th standard	98 (23.6)	64 (15.8)	χ^2=7.8904
Weight gain during pregnancy (mean±SD, kg)	10.5±5.2	9.3±6.6	0.0039
BMI (Mean±SD, kg/m^2)	32.2±5.69	23.8±4.78	<0.0001

Mean parity was higher in obese mothers 2.5±0.64 compared to 2.1±0.71 in mothers with normal weight (p<0.0001).

Prior treatment for infertility was also more frequent in obese mothers 70(16.9%) than in normal weight mothers 14(3.4%) (p<0.001). Maternal weight gain ranged from 4.6 to 16.2 kg in obese mothers versus 2.7 to 14.6 kg in normal women.

The gestational age at termination was also slightly earlier (37.11±2.34 weeks) in obese mothers than normal weight parturient (37.87±2.28 weeks) which was significant p <0.0001 (Figure 1).

Obese parturients have more likely hood of developing gestational diabetes mellitus, induced labour, failed induction and dystocia than in normal BMI mothers (Table 2).

Gestational hypertension is 3.5 times higher in obese mothers than normal weight mothers and PET and eclampsia are also were higher (2.8 and 4.5 times respectively) in obese mothers than normal BMI mothers (Table 2).

However, HELLP (haemolysis, elevated liver enzymes, low platelet count) syndrome was not significantly different between the groups.

Intra and peripartum complications are summarized in Table 3. There was nearly 12 times higher risk of prolonged hospital stay in obese mothers than normal BMI mothers.

Similarly, the incidence of postpartum haemorrhage in obese mother was nearly 3.5 times compared to normal. The need for emergency caesarean section was also high in obese mothers (Table 3).

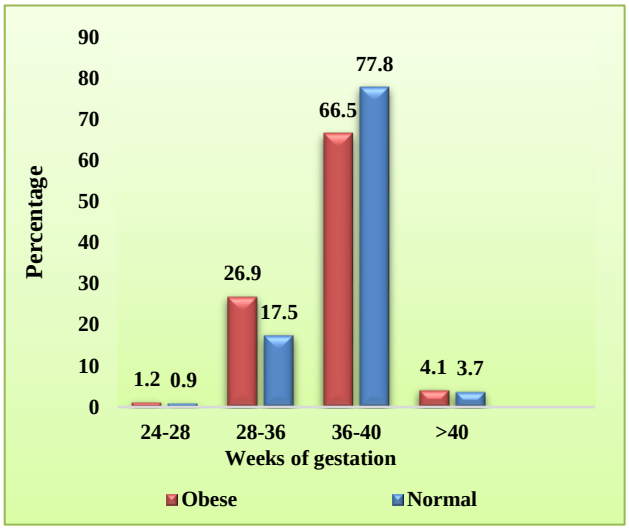

Figure 1: Gestational age at termination.

Table 2: Maternal outcomes.

Outcome	Obese N (%) 415	Normal N (%) 405	OR (95% CI)	P
Gestational diabetes mellitus	102 (24.6)	24 (5.9)	5.2 (3.2-8.3)	<0.00001
Induced labour	136 (32.8)	64 (15.8)	2.5 (1.8-3.6)	<0.0001
Failed Induction	41(9.8)	18 (4.4)	2.4 (1.3-4.2)	0.0026
Abruption	24 (5.8)	16 (3.9)	1.5 (0.8-2.9)	0.2920
Dystocia	68 (16.4)	34 (8.4)	2.1 (1.4-3.3)	0.0005
Preterm labour	43 (10.3)	30 (7.4)	1.4 (0.9-2.4)	0.14
Gestational hypertension	64 (15.4)	20 (4.9)	3.5 (2.1-5.9)	<0.0001
Pre-eclampsia	48 (11.5)	18 (4.4)	2.8 (1.6-4.9)	0.0002
Eclampsia	22 (5.3)	5 (1.2)	4.5 (1.7-11.9)	0.001
HELLP*	6 (1.4)	2 (0.4)	3.0 (0.6- 14.7)	0.28
Mode of delivery				
Caesarian section/instrumental	208 (51.1)	82 (20.2)	4 (2.9-5.4)	<0.0001
Normal vaginal	207 (49.9)	323 (79.8)		

*Haemolysis, Elevated Live enzymes and Low platelets.

Table 3: Peripartum complications.

Outcome	Obese N (%) 415	Normal N (%) 405	OR (95% CI)	P
Perineal tear	14 (3.3)	12 (2.9)	1.1 (0.5-2.5)	0.74
PPH* mild	14 (3.4)	4 (1)	3.5 (1.1-10.7)	0.029
PPH*-moderate /severe	12 (2.9)	3 (0.7)	4.0 (1.1-14.3)	0.034
Emergency caesarian section	160 (38.5)	80 (19.7)	2.6 (1.9-3.5)	<0.0001
Prolonged hospital stays	160 (38.5)	19 (4.7)	12.8(7.7-21.1)	<0.0001

*Post-partum hemorrhage

Table 4: Neonatal outcomes.

Outcome	Obese N (%) 415	Normal N (%) 405	OR (95% CI)	*P*
APGAR@ score ≤ 7 at 5 minutes	13 (3.1)	4 (1)	3.2 (1.1-10.0)	0.03
Preterm birth	45 (11.1)	50 (12.3)	0.9 (0.6-1.3)	0.50
Still birth	9 (2.2)	5 (1.2)	1.8 (0.6-5.3)	0.30
Small for GA*	10 (2.4)	15 (3.7)	0.6 (0.3-1.4)	0.28
Large for GA*	115 (27.7)	45 (11.1)	3.1 (2.1- 4.5)	0.000036
Admission to new born nursery	102 (24.6)	36 (8.9)	3.4 (2.3-5.2)	< 0.0001

@ Activity, Pulse, Grimace, Appearance, and Respiration, *Gestational age.

Table 4 summarizes the neo natal outcomes. Low Apgar score (≤7 at 5 minutes) was three times higher in new-borns of obese mothers than normal BMI mothers. But the preterm birth, still birth, small for gestational age babies were not significantly different between the two groups. Large for gestational age babies and need for admission to new born nursery were significantly higher (more than three times) in babies of obese mothers than normal weight mothers.

DISCUSSION

The mean age of antenatal women with obesity was higher than that of the normal with BMI <25 kg/m^2 (28.6±4.3 years vs 26.3±3.6 years; p <0.0001). Mean age in this study population lower than previously reported such as mean age was above 30 years in obesity compared to 29.7±6 years in non-obese normal mothers.[7] Similar higher age has been reported in other western studies as well where the mean age of obese mothers were above 30 years.[8,9] This may be due to early age of marriage in girls in this country and the obesity prevalence increases with age. The parity status was also higher in the study population 2.5±0.6 compared to 2.1±0.7 in the normal weight mothers. Similar observations were made in prior studies and may be due to the post-delivery traditional health care delivery of highly calorigenic protein rich diet ("prasavaraksha") combined with sedentariness of postpartum period which results in increased weight gain during inter pregnancy period.[8,10] Obese pregnant women have been shown to have very high likelihood, two to eleven-fold, of developing gestational diabetes mellitus (GDM).[6,11,12] GDM was 24.6% in Obese mothers versus 5.9% in normal weight mothers (p<0.0001) and there was 5.5 fold increased likelihood of developing diabetes in obese mothers than normal weight mothers in this study. This is similar to the observations in a previous large epidemiological data.[7] Tissue insulin resistance, decreased glucose uptake in skeletal muscle and adipose tissue and increased hepatic gluconeogenesis are seen with obesity. Adipose tissue is also a source of inflammatory cytokines and other metabolically active chemical mediators and obesity may be considered as a state of low-grade inflammation.[1] Obese pregnant women also have elevated C-reactive protein and increased levels of fasting and post prandial insulin concentrations. Gestational diabetes mellitus (GDM) may be the result of insufficient insulin secretion to compensate for increase insulin resistance during pregnancy in obese women.[1] Gestational hypertension, pre-eclampsia and eclampsia have been shown to occur with increasing frequency in obese mothers than normal body weight mothers. [1,7,8,10-13] Gestational hypertension, preeclamptic toxemia (PET), eclampsia were 3.5 times, 2.8 times and 4.5 times higher respectively than normal weight mothers in this study. This is similar to previous reports. In a large study in UK by Scott-Pillai et al, between 2004-2011reported odds ratio of 1.9 for gestational hypertension in overweight mothers,3.5 in obese group and 5 in very obese group and 6.6 in severely obese group.[7] In another recent study from Saudi Arabia reported 3 times and 7 times higher occurrence of PET and eclampsia in obese mothers in comparison with normal weight mothers.[10] Swedish workers reported very high occurrence of gestational hypertension (OR =8.59 95%CI 5.23-14.14) and PET (OR = 2.06, 95% CI 1.14- 3.73). HELLP syndrome was higher in obese group in this study but did not reach statistical significance. Gestational age at termination was marginally earlier in the study group compared to the controls 37.11±2.34 vs 37.87±2.28: p<0. 0001). There were more preterm deliveries also in the obese mothers. Similar increased risk of preterm deliveries was reported in previous study by Leddy et al.[14] Obesity in pregnancy leads to increased need for induced labour as well as increased occurrence of failed induction. Sebire et al, reported similar higher rates of induction in overweight (OR 2.14 95% CI 1.85- 2.47) and obese mothers (OR 1.70 95% CI 1.64-1.76).[15] Higher induction rates in obese mothers have been also reported by previous workers.[7,8] The higher early induction rates may be due to the co morbid conditions that are associated with obesity such as gestational hypertension, PET and eclampsia. Failed induction was more than two-fold in obese mothers but is much less frequent than reported in recent study by Ramonienė et al.[8] Dystocia was also 2.4-fold higher in the obese mothers and is similar tom the previous observations.[8,13] Cesarean delivery was 4 times more frequent in obese mothers than non-obese mothers and is likely multifactorial with increased dystocia, macro somia and other maternal complication such as eclampsia or PET and diabetes mellitus. Similarly, higher occurrence of need for caesarian section had been reported in previous reports ranging from 1.2 to 2.8 times

more in obesity than normal weight mothers.[7,8,10,15] Higher maternal comorbidities such as PET, eclampsia and diabetes mellitus may be the reasons for increase in CS seen in this study. Maternal obesity was associated with increased occurrence (3.5 to 4 times) of postpartum hemorrhage than normal weight mothers. Increased maternal morbidity resulted in prolonged hospital stay in obese mothers than normal weight mothers in this study. This is similar to the previous reports of long hospital stay in in obese mothers included more frequent occurrence obese mothers by Scott-Pillai et al, Sebrie et al.[7,15] Low APGAR score was more frequent in new borns of obese mothers than the babies of normal weight mothers. Crane et al, Ramonienė et al and Sebrie et al reported similar low Apgar score in the new borns of obese mothers.[4,8,15] Obese mothers had larger for gestational age babies (LGA) and more admissions to the new born nursery. This is consistently reported in most of the prior studies. Increase in new born nursery admissions could be due to neonatal asphyxia and due to the high-risk pregnancies with several comorbid conditions in obese mothers.

CONCLUSION

Obesity during pregnancy carries high maternal and foetal risks. There are increased risks of gestational hypertension, preeclampsia, gestational diabetes, dystocia, induction of labor, failed induction of labor and cesarean delivery as well as higher likelihood of PPH. Maternal obesity adds to neonatal complications such as increased birth asphyxia as well as macrosomia (large for gestational age babies) and more frequent admissions to new born nursery. Thus, pregnancy in obese mothers should be considered as a high risk one and warrant high level specialized antenatal, natal and post-natal care.

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