Original Research Article

Study of characteristics and maternal risk factors of small for gestational age fetuses in a tertiary care center

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Abstract

Background: Small for gestational age (SGA) fetuses or newborns are those smaller in size than normal for their gestational age, most commonly defined as a weight below the 10th percentile for the gestational age. Present study was aimed to study characteristics and maternal risk factors of small for gestational age fetuses in a tertiary care center. **Material and Methods:** Present study was hospital based, prospective, observational study, conducted in pregnant women, age > 18 years, booked, singleton pregnancy, with gestational age > 28 weeks, having estimated fetal weight < 10th percentile were diagnosed to have SGA fetus, taken as cases. Remaining pregnant women with average gestational age were taken as controls for comparison. **Results:** Pregnant women were divided as SGA group (n = 43) and non-SGA group (n = 657). Maternal age and parity was comparable among both groups and difference was not significant statistically. In SGA group mean gestational age was less and a greater number of pregnant women with undernourished status were noted as compared to non-SGA group and difference was significant statistically. recurrent miscarriages (≥ 2), ART conception, maternal medical history, chronic medical disease, abnormality of amniotic fluid, abnormality of umbilical cord, abnormality of placenta, abnormal labor, abruption, hypertensive disorders of pregnancy and advanced paternal age (>40 years) were common in SGA as compared to non-SGA group and difference was significant statistically. In SGA group, preterm delivery, LSCS, male gender and lower mean birth weight was noted as compared to non-SGA group and difference was significant statistically. SGA group neonates required resuscitation, NICU admission more than non-SGA group and difference was significant statistically. **Conclusion:** Assessment of risk factors for SGA fetus at booking, improving detection of fetal growth restriction helps to provide the earliest effective intervention for prevention of SGA.
Keywords: risk factors, SGA fetus, fetal growth restriction, hypoglycemia

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INTRODUCTION

Small for gestational age (SGA) fetuses or newborns are those smaller in size than normal for their gestational age, most commonly defined as a weight below the 10th percentile for the gestational age.[1] Small for gestational age may be due to a constitutionally small fetus or nonplacental mediated growth restriction like a structural or chromosomal anomaly, metabolic disorders, and fetal infection or placental mediated growth restriction. Maternal factors like low pre-pregnancy weight, undernutrition, substance abuse, and preexisting medical conditions like severe anemia, preeclampsia, autoimmune disease, thrombophilia's, renal disease, diabetes, and essential hypertension can affect placental implantation, vasculature and hence the transfer of nutrients.[2] SGA can arise from a genetic predisposition to small size or could be due to factors such as low maternal height, malnutrition, and/or infection during pregnancy. The genetic and

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constitutional contributions to SGA are generally felt to be small relative to these other factors, particularly in low- and middle-income contexts.[3] Premature infants, term infants and post term infants may develop SGA. The causes are complex Present study was aimed to study characteristics and maternal risk factors of small for gestational age fetuses in a tertiary care center.

MATERIAL AND METHODS

Present study was hospital based, prospective, observational study, conducted in department of Obstetrics and Gynecology, at BKL Walawalkar Medical College, Sawarde, Ratnagiri, India. Study duration was of 2 years (January 2020 to December 2021). Study approval was taken from institutional ethical committee.

Inclusion criteria: Pregnant women, age > 18 years, booked, singleton pregnancy, with gestational age > 28 weeks, willing to participate

Exclusion criteria: Twin or multiple gestation pregnancies, Fetuses diagnosed with congenital anomalies, Pregnant women referred from other hospitals were excluded.

Study was explained to participants and written informed consent was taken for participation. All antenatal mothers enrolled in the study were screened by ultrasonogram as per protocol. Antenatal mothers having estimated fetal weight less than the 10th percentile for their gestational age (reference for estimated fetal weight) were diagnosed to have SGA fetus, taken as cases. Remaining pregnant women with average gestational age were taken as controls for comparison. General details of pregnant women such as age, obstetric history, medical and socioeconomic history were noted. Anthropometry and complete examination was performed. Biochemical tests hemoglobin, TSH, glucose challenge test and CRP were performed. AFI levels and placental insufficiency indices in USG; PAPP-A and β hCG levels (when available) were recorded. All pregnant women were followed till labour. Maternal outcomes in terms of mode of delivery, gestational age at delivery, fetal weight, fetal gender were recorded. Immediate neonatal outcomes in terms of APGAR score, admission in NICU and duration of hospital stay were recorded. Data was collected and compiled using Microsoft Excel, analysed using SPSS 23.0 version. Frequency, percentage, means and standard deviations (SD) was calculated for the continuous variables, while ratios and proportions were calculated for the categorical variables. Difference of proportions between qualitative variables were tested using chi- square test or Fisher exact test as applicable. P value less than 0.5 was considered as statistically significant.

RESULTS

In present study, we divided pregnant women in two groups as SGA group (n = 43) and Non-SGA group (n = 657). Maternal age and parity was comparable among both groups and difference was not significant statistically. In SGA group mean gestational age was less and a greater number of pregnant women with undernourished status were noted as compared to non SGA group and difference was significant statistically.

Table 1: General characteristics

Characteristic	SGA group (n = 43)	Non-SGA group (n = 657)	P value
Age group			0.67
19-25	12 (27.91 %)	249 (37.90 %)	
26-30	20 (46.51 %)	259 (39.42 %)	
31-35	8 (18.60 %)	135 (20.55 %)	
>35	3 (6.98 %)	14 (2.13 %)	
Mean age (years)	25.13 ± 2.78	26.17 ± 3.06	0.93
Parity			0.39
Primiparous	19 (44.19 %)	248 (37.75 %)	
02- 03	15 (34.88 %)	361 (54.95 %)	
>3	9 (20.93 %)	48 (7.31 %)	
Mean Gestational age	36.18 ± 2.03	38.91 ± 1.93	0.048
Maternal BMI (in first trimester)			0.042
Under weight (<18.5(kg /m)^2	13 (30.23 %)	49 (7.46 %)	
Normal (18.5-22.9 (kg /m)^2	25 (58.14 %)	572 (87.06 %)	
Overweight (23-27.5 (kg /m)^2	4 (9.30 %)	30 (4.57 %)	
Obese (>27.5 (kg /m)^2	1 (2.33 %)	6 (0.91%)	

In present study, maternal risk factors such as previous recurrent miscarriages (≥ 2), ART conception, maternal medical history, chronic medical disease, abnormality of amniotic fluid, abnormality of umbilical cord, abnormality of placenta, abnormal labor, abruption, hypertensive disorders of pregnancy and advanced paternal age (>40 years) were common in SGA as compared to non SGA group and difference was significant statistically.

Table 2: Maternal risk factors

Maternal risk factors	SGA group (n = 43)	Non-SGA group (n = 657)	P value
Previous recurrent miscarriages (≥ 2)	7 (16.28 %)	20 (3.04 %)	< 0.001
ART conception	2 (4.65 %)	12 (1.83 %)	< 0.001
Maternal medical history			
Chronic medical disease	5 (11.63 %)	23 (3.5 %)	<0.001
Autoimmune	2 (4.65 %)	7 (1.07 %)	0.073
Thrombophilia	1 (2.33 %)	6 (0.91 %)	0.07
Present pregnancy factors			
Premature rupture of membrane	14 (32.56 %)	178 (27.09 %)	0.61
Abnormality of amniotic fluid	16 (37.21 %)	98 (14.92 %)	<0.001
Abnormality of umbilical cord	8 (18.6 %)	63 (9.59 %)	<0.001
Abnormality of placenta	7 (16.28 %)	51 (7.76 %)	<0.001
Abnormal labor	12 (27.91 %)	72 (10.96 %)	<0.001
Abruption			
Hypertensive disorders of pregnancy	18 (41.86 %)	87 (13.24 %)	<0.001
Gestational hypertension	5 (11.63 %)	59 (8.98 %)	
Non-severe pre-eclampsia	8 (18.60 %)	17 (2.59 %)	
Severe per-eclampsia	5 (11.63 %)	9 (1.37 %)	
Eclampsia	1 (2.33 %)	2 (0.3 %)	
Intrahepatic cholestasis of pregnancy	1 (2.33 %)	4 (0.61 %)	0.1I
Severe Anemia (Hb<7 gm%)	5 (11.63 %)	79 (12.02 %)	0.71
Smoking or Passive Smoking	4 (9.30%)	41 (6.24 %)	0.19
Advanced paternal age (>40 years)	5 (11.63 %)	39 (5.94 %)	< 0.001

In SGA group, preterm delivery, LSCS, male gender and lower mean birth weight was noted as compared to non SGA group and difference was significant statistically.

Table 3: Delivery outcome

Pregnancy outcome	SGA group (n = 43)	Non-SGA group (n = 657)	P value
Preterm delivery (<37 weeks)	12 (27.91 %)	72 (10.96 %)	< 0.001
Mode of delivery			< 0.001
Vaginal	27 (62.79 %)	496 (75.49 %)	
LSCS	16 (37.21 %)	158 (24.05 %)	
Instrumental	0	3 (0.46 %)	
Neonatal gender			< 0.001
Male	28 (65.12 %)	345 (52.51 %)	
Female	15 (34.88 %)	312 (47.49 %)	
Mean Birth weight (gms)	2191.18 ± 290.03	2801.91 ± 400.93	< 0.001

In present study, SGA group neonates required resuscitation, NICU admission more than non SGA group and difference was significant statistically. Also perinatal complications such as hyperbilirubinemia, hypoglycemia, asphyxia, neonatal respiratory distress syndrome, pneumonia and sepsis were common in SGA as compared to non SGA group and difference was significant statistically.

Table 4: Neonatal outcome

Neonatal outcome	SGA group (n = 43)	Non-SGA group (n = 657)	P value
Required resuscitation	8 (18.6 %)	39 (5.94 %)	< 0.001
NICU admission	16 (37.21 %)	30 (4.57 %)	< 0.001
Perinatal complication			
Hyperbilirubinemia,	14 (32.56 %)	98 (14.92 %)	< 0.001
Hypoglycemia,	8 (18.6 %)	63 (9.59 %)	< 0.001
Asphyxia,	7 (16.28 %)	20 (3.04 %)	< 0.001
Neonatal respiratory distress syndrome,	4 (9.30%)	17 (2.59 %)	< 0.001
Pneumonia,	4 (9.30%)	20 (3.04 %)	< 0.001
Sepsis,	4 (9.30%)	14 (2.13 %)	< 0.001
Hypoxic-ischemic encephalopathy,	1 (2.33 %)	7 (1.07 %)	0.54
Neonatal necrotizing enterocolitis,	1 (2.33 %)	2 (0.3 %)	0.45
Intracranial Hemorrhage,	1 (2.33 %)	2 (0.3 %)	0.49

DISCUSSION

Traditionally, the causes for ‘‘pathological” growth restriction are subdivided into fetal, placental and maternal. Genetic and chromosomal disorders, fetal malformation, infection (e.g. rubella or cytomegalovirus), and toxic substances (e.g. alcohol, cocaine, or smoking) can contribute to FGR. Maternal diseases such as anemia and malnutrition may also affect fetal growth. However, classical utero-placental dysfunction accounts for the vast majority of cases of ‘‘placental” FGR, as well as to a variety of conditions such as pre-eclampsia and placental abruption.[4] SGA babies are more prone to hypoglycemia and hypothermia, which necessitates early recognition and immediate management. Despite optimal management of such babies, they are more likely to experience weak physical growth, poor neonatal neurodevelopmental outcomes, recurrent infections, and those surviving, in later life, are more likely to develop chronic diseases such as hypertension, obesity, hyperlipidemia, diabetes mellitus, and coronary heart disease.[5] Earlier, the main concern was to reduce complications and improve survival of SGA infants in the immediate neonatal period. Currently, more emphasis is being placed on long-term complications, including short stature, obesity, cardiovascular diseases, hypertension, polycystic ovary syndrome, and type 2 diabetes mellitus.[6] The prevalence of SGA ranged from 10.5% to 72.5% in Nepal, and 12.0% to 78.4% in India, depending on the reference population. Females had higher rates of SGA than males using reference populations that were not sex specific. SGA prevalence was lowest when using reference populations from low-income countries. Infants who were both preterm and SGA had much higher mortality risk than those who were term and appropriate-for-gestational-age. Risk ratios for those who are both preterm and SGA ranged from 7.34–17.98 in Nepal and 5.29–11.98 in India, depending on the reference population.[7] Tunny S *et al.*,[8] studied data from 36,674 deliveries, the incidence of SGA was 11.4% in 1996 and 8.4% in 2010. Women who had multiple pregnancies had the higher odds of having SGA babies, 2.8 (2.3-3.3) times. The women with hypertensive disease had 1.8 (1.5-1.9) times higher odds of having SGA. Underweight women had 1.7 (1.3 - 2.1) times and anaemic mothers had 1.29 (1.01 - 1.6) times higher odds. The mothers who had cardiac disease were 1.4 (1.01 - 2.0) times at higher odds for SGA. In teenage pregnancies, the odds of SGA was 1.3 (1.1 - 1.5) times higher than mothers in the age group 20 to 35 years. There is a significant reduction in the incidence of SGA by 26% over 15 years. In study by Chaudhary N *et al.*,[9] out of 4000 delivered babies, 77% (n = 3078) were AGA, 20.3% (n = 813) were SGA and 2.7% (n = 109) were LGA. The proportion of female-SGA was greater in comparison to male-SGA (n = 427, 52.5% vs n = 386, 47.5%). SGA babies were born to mothers who had term, preterm, and post term delivery in 70.1%, 19.3%, and 10.6%, patients respectively. In addition to low socioeconomic status (OR 1.9, 95% CI 1.1, 3.2), other prognostic factors associated with SGA were lifestyle factors such as low maternal sleep duration (OR 5.1, CI 3.6, 7.4) and monthly or less frequent meat intake (OR 5.0, CI 3.2, 7.8). Besides smoking (OR 8.8, CI 2.1, 36.3), the other major environmental factor associated with SGA was exposure to household air pollution (OR 5.4, 4.1, 6.9) during pregnancy. Similarly, some of the adverse health conditions associated with a significantly higher risk of SGA were anemia, oligohydramnios, and gestational diabetes. Subramanian S *et al.*,[10] noted that prevalence of SGA was 13.6% (95% CI 9.4-17.8). Fifty-three percent were in the age group of 20-24 years, 68% were primigravida and 75% of multigravida women had previous history of SGA child. Mothers of SGA fetuses had median BMI of 22.4 kg/m2 and gained 8 kg in pregnancy. Each kilogram gain in pre-pregnancy weight reduces the risk of having SGA fetus by 0.8%. Each earlier week of delivery increased the risk of LBW by 20%. Each gram of low hemoglobin increased the risk of having SGA fetus by 7.6%. Mothers with previous history of SGA had odds of 36 times to have SGA fetus in the current pregnancy. Liu Q *et al.*,[11] compared 181 SGA cases with 1299 cases of AGA with the same gestational age. The frequencies of maternal risk factors such as pregnancy-induced hypertension, abnormal placenta and twins in the SGA group were significantly higher than that in the AGA group ($P<0.05$). The incidence of hyperbilirubinemia and hypoglycemia in the perinatal period was also higher in the SGA newborns group ($P<0.05$), while there were no significant differences in the incidence of pneumonia, apnea, septicemia, intracranial hemorrhage, neonatal asphyxia, congenital malformations, hypoxic ischemic encephalopathy, respiratory distress syndrome and necrotizing enterocolitis between the two groups. SGA can cause perinatal complications including neonatal hypoglycemia and hyperbilirubinemia. It is necessary to strengthen the perinatal monitoring and antenatal care to reduce SGA and the perinatal complications of SGA. Essential to the SGA definition is accurate dating of gestational age [12,13] and accurate assessment of birth weight.[14] Early ultrasound (accuracy ±5 days if first trimester and ±7 days after first trimester), ideally in the first trimester, is the gold standard for gestational age assessment.[15] Gestational age assessment based on last menstrual period (LMP) date has lower accuracy (±14 days) given different cycle duration in women, ovulation/ conception timing, and recall error.[16] Despite the presence of many pathophysiological events that may lead to intrauterine growth restriction, Small for gestational age

(SGA) is not universally associated with growth restriction. Fetuses that are SGA are not necessarily growth restricted; they in fact may be constitutionally small.[12]

CONCLUSION

Assessment of risk factors for SGA fetus at booking, , improving detection of fetal growth restriction helps to provide the earliest effective intervention for prevention of SGA. Postnatally SGA babies are more prone to hypoglycemia and hypothermia, which necessitates early recognition and immediate management.

REFERENCES

1. WHO Expert Committee. Physical Status: The Use of and Interpretation of Anthropometry, Report of a WHO Expert Committee. Geneva: World Health Organization, https://apps.who.int/iris/handle/10665/37003 (1995).
2. Rathakrishnan GS. Serum PAPP-A and Maternal Risk Factors in Prediction of SGA: A Retrospective Study. Int J Infertil Fetal Med 2022;13(2):52–55.
3. Prada JA, Tsang RC (1998) Biological mechanisms of environmentally induced causes of IUGR. Eur J Clin Nutr 52 Suppl 1: S21–27; discussion S27–28.
4. RCOG. The investigation and management of the small–for–gestational–age fetus. Green-top Guideline. 2nd ed.; 2014.
5. Calkins K, Devaskar SU. Fetal origins of adult disease. Curr Probl Pediatr Adolesc Health Care. 2011;41(6):158-176.
6. Liberatore Junior RD, Kochi C, Menezes Filho HC. Baixa estatura idiopática. A criança nascida pequena para idade gestacional. Temas Atuais Ped. 2012; 1(8):1-16.
7. Katz J, Wu LA, Mullany LC, Coles CL, Lee ACC, et al. (2014) Prevalence of Small-for-Gestational-Age and Its Mortality Risk Varies by Choice of Birth- Weight-for-Gestation Reference Population. PLoS ONE 9(3): e92074.
8. Sebastian, T., Yadav, B., Jeyaseelan, L. et al. Small for gestational age births among South Indian women: temporal trend and risk factors from 1996 to 2010. BMC Pregnancy Childbirth 15, 7 (2015).
9. Chaudhary N, Yadav SN, Kalra SK, et al. Prognostic factors associated with small for gestational age babies in a tertiary care hospital of Western Nepal: A cross-sectional study. Health Sci Rep. 2021;4:e250
10. Subramanian S, Remadevi S, Subramaniam K. Prevalence, characteristics and maternal risk factors of small for gestational age fetuses in a tertiary care center from Kerala. The New Indian Journal of OBGYN. 2020; 7(1): 76-81.
11. Liu Q, Yang H, Sun X, Li G. Risk factors and complications of small for gestational age. Pak J Med Sci. 2019;35(5):1199-1203.
12. Quinn JA, Munoz FM, Gonik B, Frau L, Cutland C, Mallett-Moore T, et al. Brighton collaboration preterm birth working group. preterm birth: case definition and guidelines for data collection, analysis, and presentation of immunisation safety data. Vaccine 2016.
13. Harrison MS, Eckert LO, Cutland C, Gravett M, Harper DM, McClure EM, et al. Pathways to preterm birth: case definition and guidelines for data collection, analysis, and presentation of immunization safety data. Vaccine 2016.
14. Saenger P, Czernichow P, Hughes I, Reiter EO. Small for gestational age: short stature and beyond. Endocr Rev 2007;28:219–51.
15. Blencowe H, Cousens S, Chou D, Oestergaard M, Say L, Moller AB, et al. Born too soon: the global epidemiology of 15 million preterm births. Reprod Health 2013;10(Suppl 1):S2.
16. Lynch CD, Zhang J. The research implications of the selection of a gestational age estimation method. Paediatr Perinat Epidemiol 2007;21(Suppl 2):86–96.
17. Lee AC, Katz J, Blencowe H, Cousens S, Kozuki N, Vogel JP, et al. National and regional estimates of term and preterm babies born small for gestational age in 138 low-income and middle-income countries in 2010. Lancet Glob Health 2013;1:e26–36.

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