ORIGINAL RESEARCH

Impact of Antenatal Corticosteroids on Glycemic Variations in Gestational Diabetes Mellitus: A Single Center Observational Study

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Abstract

Aim: The study evaluated the effect of prophylactic antenatal corticosteroids (ACSs) on maternal blood glucose (MBG) changes and insulin requirement in gestational diabetes mellitus (GDM).

Materials and methods: Patients with GDM received a conventional ACS regimen. Pre-meal glucose levels determined initiation of insulin or dose titration if already on insulin. All were monitored for 72 hours after the first dose of ACS. From day 3, fasting blood glucose, one hour post-meal glucose levels were assessed. Glycemic monitoring was continued for five days in those who had hyperglycemia during the first 72 hours after ACS.

Results: Of the 52 patients, 12 required insulin for the first time and 14 were already on it before ACS, remaining were managed with medical nutritional therapy (MNT). Maternal blood glucose declined from day 3 onwards, euglycemic status was reached on day 4 and sustained on day 5.

There was no significant change in the mean MBG during the first two days following ACS, but a gradual decline from day 3 was noticeable. The mean MBG change was independent of duration. There was a significant difference between the average insulin requirements. There was no fetal loss.

Conclusion: Antenatal corticosteroid-induced hyperglycemia increases the requirement of insulin, or add on oral hypoglycemic agents. Well-controlled glycemic status is achievable with MNT alone or in combination with pharmacotherapy under continued monitoring.

Clinical significance: Continuous monitoring, MNT to meet the increased nutritional needs, not increase MBG levels at the same time, and add on pharmacotherapy should be included in the treatment strategy.

Keywords: Antenatal corticosteroids, Gestational diabetes mellitus, Insulin therapy, Medical nutritional therapy.

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Introduction

It is estimated by the International Diabetes Federation in 2019 that hyperglycemia affected 20 million or 16% of live births, of which 84% were due to gestational diabetes mellitus (GDM), indicating that GDM affects 1 in 6 births. The prevalence is high in low- and middle-income countries;[1] prevalence of GDM in India is 6–21%, low in rural (6–9%), and two to three times high in urban areas (12–21%).[2] Accurate estimated pooled data on GDM in India are not available due to lack of large population-based studies. There is a huge variation in the reported prevalence in India, as its diverse population, food habits, use of different screening techniques, diagnostic criteria, and demographical differences in the study population.[3] The reported prevalence of GDM in India is 4–45.3%,[4–12] it is estimated that ~5–8 million females and one third of the births are affected annually.[3]

Treatment target aims at achieving optimal blood glucose levels in GDM. Medical nutritional therapy (MNT) and pharmacotherapy in the form of insulin and oral hypoglycemic agents (OHAs) are the mainstay of therapy. The American College of Obstetricians and Gynaecologists (ACOG) guidelines recommend short-acting insulin for GDM, though other oral agents such as sulfonylurea derivatives (glibenclamide) and metformin can be used, but the evidence for OHAs is insufficient. Safety of glibenclamide in GDM is controversial and still debated.

Gestational diabetes mellitus is a high-risk factor for preterm delivery; it is known to cause delayed fetal lung maturity for which antenatal corticosteroid (ACS) administration has shown to improve perinatal outcomes.[13] On the other hand, ACS is known to cause maternal hyperglycemia,[14] hence, it may worsen GDM status, if not monitored. Additionally, maternal blood sugar levels are variable, unpredictable with time and duration, and the level at which it warrants timely intervention yet remains uncertain. Weighing the risks and benefits, GDM is not a contraindication to ACS treatment for fetal lung maturation.[15]

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The adverse effect of maternal hyperglycemia induced by ACS is insufficient to counterbalance the potential benefits for the fetus, provided adequate glycemic control in the mother is enforced during and immediately after steroid therapy. Hence, it is necessary to observe the pattern of maternal glycemic levels in all pregnant women with GDM and receive ACS.

Materials and Methods

This prospective observational study was conducted by the Department of Obstetrics and Gynecology, of a teaching Hospital from August 2019 to August 2021, after obtaining an approval from the Institutional Ethics Committee. Prospective patients were screened for eligibility after obtaining written informed consent. The aim of the study was to evaluate the effect of ACS therapy on maternal blood glucose (MBG) changes and requirement of insulin among pregnant women with gestational diabetes. The primary objective was to evaluate the changes in MBG levels following ACS therapy in GDM and analyzing the dose and duration of insulin requirement in these patients was the secondary objective.

Pregnant women with singleton pregnancy, diagnosed to have GDM confirmed by elevated Diabetes in Pregnancy Study Group of India (DIPSI),[10] and anticipated threatened preterm labor between 28 and 36 weeks$^{\pm 6 \text{ days}}$ of gestation who received ACS, on MNT alone or along with insulin, were recruited. Those with type 1 diabetes mellitus, pre-labor, premature rupture of membranes, those in active labor, multiple gestation, and sepsis were excluded.

Detailed medical and obstetric history of (h/o) the eligible patients was taken. General physical and obstetric examinations were done. Patients received a conventional ACS regimen (injection betamethasone 12 mg intramuscularly, Q24 hours, 2 doses). Initiation of betamethasone therapy was irrespective of the specific time of the day.

Blood glucose was monitored in the hospital inpatient ward, finger prick capillary glucose test was performed using Bayer's contour plus one glucometer, a portable device using glucose test strips, with a measuring range of 10–600 mg/dL. The device is venous blood calibrated, readings reflecting plasma levels. Capillary blood sample was taken from a clean, dried finger after aseptic precautions. Fasting blood glucose (FBS), pre-lunch, pre-dinner, and one-hour post-dinner capillary blood glucose was performed for the first 48 hours. Depending on the pre-meal glucose levels, patients were initiated on injection insulin or dose was altered in those who were already on insulin. Fasting blood glucose and pre-meal levels of ≥100 mg/dL and one-hour post-prandial blood sugar (PPBS) ≥140 mg/dL were considered for initiation of injection insulin. From day 3, FBS, one-hour post-meal glucose levels were assessed. Fasting blood glucose and pre-meal levels ≤95mg/dL and one-hour post-meal level ≤120 mg/dL were considered as indicators of optimal glycemic control. All were monitored for 72 hours after the first dose of injection betamethasone. Glycemic monitoring was discontinued for those who were euglycemic for 72 hours after the first dose, 48 hours after the second dose of ACS, and those who did not require insulin. Those who had hyperglycemia were monitored continuously and treated accordingly. Glycemic variation in fasting capillary blood glucose with pre-lunch, pre-dinner, and one-hour post dinner were noted for the first 48 hours, 72 hours, and in a few for 5 days, based on their glycemic status. Glycemic variation with respect to one hour post-breakfast, post-lunch and post-dinner were compared from days 3 to 5. Dose and duration of insulin requirement were noted in patients requiring insulin for the first time and those who were already on insulin.

Statistical Analysis

Sample size was calculated based on the previous year's prevalence rate of GDM in our center, which was 12%. Based on that sample size required was 52.

Data collected on Microsoft Excel sheet was analyzed using SPSS V 22.0. Data were analyzed as proportion, mean, and standard deviation. Inferential statistics was analyzed using Student's *t*-test, Chi-square test, and *Z* test for proportion. Friedman's test was used for repeated measures of non-normal observation or highly fluctuated observations. *p*-value of < 0.05 considered as statistically significant.

Results

Fifty-two patients meeting the selection criteria were included. The Diabetes in Pregnancy Study Group of India was done as early as 14–20 weeks of gestation (n = 05, 9.6%) and as late as 31–34$^{\pm 6 \text{ days}}$ weeks (n = 03, 5.8%). All received ACS before 37 weeks of gestation (Supplementary Table 1).

Twelve (23.07%) patients required insulin for the first time after ACS and 14 (26.92%) were already on it before ACS.

Among the new insulin users (n = 12), seven (58.33%) were aged above 30 years, of whom three were above 35 years. Of the 12 patients, three were overweight, two had class 1 obesity, and the remaining had a normal body mass index (BMI). None were underweight. There were four (33.3%) primigravida and eight (66.6%) multigravidae. Three patients had previous h/o abortions.

Among those who were on insulin before ACS administration (n = 14), 4 (28.57%) were primigravidae and 10 (71.4 %) were multigravidae. Eight (57.14%) patients were aged above 30 years, among them, two (14.28%) were aged 36 and 37 years, respectively. Five patients were overweight, two with class 1 obesity and one was with class 3 obesity; remaining had normal BMI. Three women had previous h/o abortions and one of intrauterine fetal death.

Twenty-six patients did not require any medications and were managed with MNT throughout.

Blood sugar levels showed a decline by day 3 onwards, euglycemic status was reached on day 4 and sustained on day 5. There was no significant change in the mean glucose level (FBS, pre-lunch, pre-dinner, and one-hour post-dinner) compared between days 1 and 2 following ACS (Table 1).

There was a gradual decline in the mean blood sugar (FBS, post-breakfast, post-lunch, and post-dinner) from days 3 to 5. One-way repeated measures analysis of variance showed that there was no significant effect of duration (in days) on change in the average glucose level. The mean change in the glucose level was independent of duration (Table 2).

Summary of the MBG levels observed between days 3 and 5 is provided in Supplementary Table 2.

Mauchly's test indicated that due to high variation in glucose level, the relationship between different pair of glucose level is not the same.

Table 3 tabulates the insulin requirements as per the glycemic variation among those who were managed on MNT and insulin.

Friedman's test showed that there was a significant difference between the average requirement of insulin dose [i.e. median and interquartile range (IQR)]. There were 14 patients who were on insulin before the administration of ACS and insulin was stopped

on days 3 and 4, in two each; for the remaining 10 patients, insulin was continued till the last day of assessment. Hence, the test was applied considering only 10 patients.

Mean DIPSI reading among the patients who required insulin for the first time ($n = 12$) who were on MNT before ACS was 177 mg/dL.

Table 1: Daily glycemic variation after antenatal corticosteroids

Day	*Glucose test*	*n*	*Mean (mg/dL)*	*Standard deviation*
Day 1	FBS	52	100.52	22.365
	Pre-lunch	52	151.10	39.419
	Predinner	52	149.71	36.186
	1-hour post dinner	52	157.79	35.410
Day 2	FBS	52	103.58	21.195
	Pre-lunch	52	140.58	38.498
	Pre-dinner	52	146.19	40.522
	1-hour post-dinner	52	159.98	42.593
Day 3	FBS	52	101.58	26.172
	Post-breakfast	52	130.33	30.847
	Post-lunch	52	127.46	27.907
	Post-dinner	52	142.46	37.947
Day 4	FBS	43	95.12	20.137
	Post-breakfast	42	127.31	31.420
	Post-lunch	41	125.02	34.020
	Post-dinner	41	132.49	32.172
Day 5	FBS	25	93.60	20.585
	Post-breakfast	24	128.46	30.298
	Post-lunch	24	132.46	29.591
	Post-dinner	24	148.79	39.320

FBS, fasting blood sugar

Table 2: Glycemic variation on first two days following antenatal corticosteroids

Blood sugar	*Day*	*Mean*	*SD*	*Std. error mean*	*Mean diff./sig.*
FBS	Day 1	100.52	22.365	3.102	–3.058
	Day 2	103.58	21.195	2.939	$p = 0.422$
Pre-lunch	Day 1	151.10	39.419	5.466	10.519
	Day 2	140.58	38.498	5.339	$p = 0.114$
Pre-dinner	Day 1	149.71	36.186	5.018	3.519
	Day 2	146.19	40.522	5.619	$p = 0.520$
1-hour post-dinner	Day 1	157.79	35.410	4.910	–2.192
	Day 2	159.98	42.593	5.907	$p = 0.652$

$N = 52$. Paired samples statistics *p-value > 0.05 indicates not significance; FBS, fasting blood sugar

Mean insulin requirement was 17.8, 26, 28, 21, and 16 units on days 1 ($n = 12$), 2 ($n = 07$), 3 ($n = 06$), 4 ($n = 06$), and 5 ($n = 04$), respectively. Four patients required continuous glycemic management with insulin till delivery. There was a significant difference in mean and median score indicating that the patients initially were at different level of insulin requirement. Two patients each required insulin and OHA post-delivery.

There were 14 patients who were on insulin at the time of ACS (Table 4), 5 continued to receive insulin, OHA, or both, even after delivery.

There was no statistically significant difference in age ($p = 0.617$), BMI ($p = 0.124$) among the study population who received insulin before and after ACS. There was no statistically significant association found between primigravidae and multigravidae ($p = 0.613$) who received insulin before and after ACS.

Outcomes in the patients who were already on insulin at the time of administration of ACS is provided in Table 4.

Twelve patients received insulin for the first time after ACS who were later managed at discharge with MNT ($n = 06$), normal diet ($n = 02$), OHA (metformin 500 mg once a day; $n = 02$) and two continued to receive insulin (Table 5).

Of the 12 patients, 7 (58.33%) underwent lower (uterine) segment cesarean section (LSCS) and 5 had vaginal delivery. There was no fetal loss.

Discussion

Increasing prevalence of GDM, its impact on maternal and fetal outcomes is a challenge and a global concern. This subset of patients require multi-specialty approach by a team of physicians, obstetricians, endocrinologists, and pediatricians, but often receive sub-optimal care. Universal screening, monitoring of blood glucose levels if diagnosed to have GDM, pharmacotherapy, antenatal testing for fetal status have been recommended based on the evidence level, which was grade C (consensus, disease-oriented evidence, usual practice, expert opinion, or case series).[16–17] In our hospital, universal screening for hyperglycemia and GDM as per the Federation of Obstetric and Gynaecological Societies of India and the Government of India is followed. Management of GDM is managed by multi-specialty approach.

In our study, we followed the guidelines of DIPSI. The National Guideline of India for the Diagnosis and Management of GDM recommends the use of plasma-calibrated hand-held glucometer with properly stored test strips to measure plasma glucose as an alternative, if facilities for testing venous plasma glucose is not available. Hence, we used hand-held glucometer for assessing glycemic status of the study population, for the ease and patient convenience. Capillary blood glucose levels were tested for the first

Table 3: Insulin requirement according to glycemic variation among the patients who were on MNT and insulin

Insulin	*Mean*	*Standard deviation*	*Minimum*	*Maximum*	*Percentiles*		
					25th	*50th (median)*	*75th*
Insulin before ACS	5.80	7.642	0	22	0.00	1.50	10.75
Day 1	23.80	17.593	0	56	12.50	17.50	37.00
Day 2	32.000	23.5136	6.0	68.0	10.500	28.000	57.500
Day 3	29.40	14.284	13	58	18.75	24.00	38.75
Day 4	37.00	28.139	5	106	18.75	31.00	47.25
Day 5	24.80	15.576	4	54	13.50	20.50	39.75

$n = 14$

Table 4: Outcome of patients who were on insulin at the time of ACS

Sl. No.	*Gestational age at hospitalization*	*Interval between hospitalization and delivery*	*Gestational age at delivery*	*Treatment on discharge*	*Mode of delivery*
1.	36 weeks	7 days	37 weeks	MNT	LSCS
2.	33 weeks	10 days	34 weeks + 3 days	MNT	LSCS
3.	35 weeks + 2 days	5 days	36 weeks	Inj Actrapid 3U-7U-3U and inj Levamir 5U at night	LSCS
4.	32 weeks + 6 days	22 days	36 weeks	Metformin 500 mg once daily 6 weeks	VD
5.	29 weeks + 4 days	31 days	34 weeks	MNT	LSCS
6.	34 weeks + 1 day	6 days	35 weeks	MNT	VD
7.	29 weeks + 6 days	35 days	35 weeks + 1 day	MNT	VD
8.	35 weeks + 1 day	7 days	36 weeks + 1 day	Metformin 500 mg once a day for 2 weeks	VD
9.	35 weeks + 2 days	5 days	36 weeks	Metformin 500 mg twice a day for 4 weeks	VD
10.	33 weeks	27 days	36 weeks + 6 days	MNT	VD
11.	33 weeks + 3 days	6 days	34 weeks + 2 days	Inj Mixtard 10U-0-5U, Metformin 500 mg bd for a week	LSCS
12.	28 weeks	10 days	29 weeks + 3 days	MNT	LSCS
13.	35 weeks	5 days	35 weeks + 6 days	MNT	VD
14.	33 weeks	5 days	33 weeks + 5 days	MNT	LSCS

LSCS, lower (uterine) segment caesarean section; MNT, medical nutritional therapy; VD, vaginal delivery

Table 5: Outcome of patients who received insulin for the first time after ACS

Sl. No.	*GA at the time of admission and dose of insulin*	*Admission delivery interval*	*Gestational age at the time of delivery*	*Treatment at discharge*	*Mode of delivery*
1.	35 weeks	5 days	35 weeks + 5 days	MNT	
2.	34 weeks + 1	6 days	35 weeks	Normal diet	LSCS
3.	34 weeks + 2 days	8 days	35 weeks + 2 days	Tab Metformin slow release 500 mg for 6 weeks	LSCS
4.	33 weeks + 5 days	7 days	35 weeks + 5 days	Tab Metformin slow release 500 mg for 4 weeks	LSCS
5.	33 weeks + 2 days	9 days	34 weeks + 4 days	Normal diet	VD
6.	36 weeks	6 days	36 weeks + 6 days	MNT	VD
7.	34 weeks + 6 days	5 days	35 weeks + 4 days	MNT	VD
8.	32 weeks + 5 days	7 days	33 weeks +5 days	MNT	VD
9.	30 weeks + 4 days	6 days	31 weeks + 3 days	MNT	LSCS
10.	33 weeks	5 days	33 weeks + 5 days	MNT	LSCS
11.	35 weeks + 2 days	5 days	36 weeks	Inj Actrapid 7U-6U-5U and Insulatard 5 U at night for one week	LSCS
12.	31 weeks + 5 days	6 days	32 weeks + 4 days	Actrapid 2U-6U-2U and Insulatard 6U at night for 10 days	LSCS

n = 12. LSCS, lower (uterine) segment caesarean section; MNT, medical nutritional therapy; VD, vaginal delivery

48 hours as rapid variation is expected up to 48 hours and helps in guiding management of hyperglycemia.

In a cross-sectional study of 32,428 patients from India, Swaminathan et al.,[3] reported age-adjusted prevalence of GDM to be 1.3%. There was a direct relationship between the prevalence of GDM and age of the women, BMI, and wealth index. Geographically, GDM is more prevalent in South India.[3] There is a need to study the effect of glucocorticoid therapy on maternal serum glucose level as there exists difference in geographical area.[18]

Previous studies have mentioned that primiparous women are more likely to receive ACS, but in our study the proportion of multigravida receiving ACS was high (61.5% vs 38.5%). Our study is also indicating that women in the age group of above 25 years are more prone to develop GDM. Unlike other studies that have proved the association between high BMI and development of GDM, the proportion of those with normal BMI was high in our study. It has to be acknowledged that the distribution of fat may be > 30% even in those with normal BMI.[19] Distribution of fat is one

of the deciding cardiometabolic risk factor for the development of DM; central or visceral fat distribution even in those with normal BMI is a high-risk factor for the development of DM. There is a high prevalence of central obesity in those with normal BMI, hence, are in a high-risk category.

Ideally, screening for GDM is done in the second trimester of pregnancy as development of insulin resistance is expected at this period, which though seen in all, GDM develops in those who cannot handle the increasing glucose levels by increasing insulin production. Ideal time to screen the pregnant women for GDM is 24–28 weeks of gestation. In our study, DIPSI was done as early as before 24 weeks due to high risk for developing GDM and as late as 34 weeks due to late visit to the hospital. It is a common practice in India that pregnant women are taken care up to 6 months after delivery by parents, few from remote areas, come for the first consultation after 30 weeks and hence, delayed testing.

The guidelines by the American College of Obstetricians and Gynaecologists on ACS administration in pregnancy recommend single dose of corticosteroid to the pregnant women during $24^{0/7}$ weeks and $33^{6/7}$ weeks of gestation with threatened premature delivery; in few indications, repeat single dose can be given. We followed the ACOG guidelines and ACS was administered within 37 weeks of gestation to our patients.

Among those who were on insulin before the administration of ACS, there was a four-fold increase in the requirement of insulin dose. In our study, there were 14 patients who were managed with insulin and MNT, before ACS. There was approximately 4-fold increase in the requirement of insulin after ACS. Following ACS, insulin requirement was less on day 1 (mean 23.8 units) and maximum on day 4 (mean 37 units), with inter-day variations, but without any significant difference in the requirement of insulin. Five of these patients continued to receive insulin, OHA, or both, even after delivery.

We noticed an increase in the blood glucose levels (mean 177 mg/dL) following ACS, which indicated introduction of insulin to the treatment regimen in those who were previously managed with MNT ($n = 12$). Parallel to the changes in the blood glucose levels on days 1–5, there was a change in the insulin requirement, least on day 5 (mean 16 units) and less on day 1 (mean 17.8 units). Four patients continued to have high blood glucose levels, and required insulin till their delivery. Four among the 12 required OHA or OHA with injection insulin at the time of discharge. Two were advised normal diet and the remaining to follow MNT. There were seven births via LSCS.

Of the 14 patients who were on insulin before ACS, two were hospitalized between 29 and 30 weeks of gestation and managed to prolong pregnancy by 4–5 weeks. A patient who was hospitalized at 28 weeks, could prolong for another 10 days. Remaining delivered within 5–22 days of hospitalization. There was no difference in the mode of delivery, seven each delivered vaginally and via LSCS, respectively.

Owing to a high variation in glucose level, the relationship between different pair of glucose is not the same. There was a gradual decline in the mean blood glucose from days 3 to 5 of ACS. We noticed that the mean change in the glucose level is independent of duration. Pre-prandial protocol was used for the first 48 hours to safely limit the glucose elevations caused by betamethasone. We used short-acting subcutaneous insulin and dose adjustment was made according to the individual patient requirement periodically rather than sliding scale. No hypoglycemic episodes were documented. Mathiesen et al.[20] described one week of glycemicsurveillance, while Kalra et al.[21] proposed at least five days following ACS, we followed the latter in our patients.

Use of ACSs is associated with changes in the glycemic status, high after 9–10 hours and is expected to be greater after 2–4 days of administration.[21] ACSs increase the requirement of insulin (39–112%) in GDM or necessitate introduction of insulin (40%) in the treatment regimen, which are more noticeable in those managed with MNT.[22] Few may require additional OHA (glyburide).[23] In our study, we managed 50% of our patients on MNT, while 23% required additional insulin after ACS. In 27% who were on insulin before ACS, required dose increment. OHA (metformin) was prescribed to five and insulin to four patients at the time of discharge from the hospital, suggesting that a small percentage of these patients require long-term diabetic care apart from MNT.

The World Association of Perinatal Medicine clearly recommend ACS in GDM, close monitoring and treatment by an experienced obstetrical team to guarantee diabetic control and to avoid the possibility of severe transient hyperglycemia.[18] Hyperglycemia secondary to steroids usually begin approximately 6–12 hours after the first dose and gradually weans in 24–36 hours after the second dose of steroid. However, the hyperglycemic effects may begin or cease abruptly or may last as long as 5 days depending on individuals.[18] Refuerzo et al.[14] observed 16–33% increase in glucose levels in pregnant women without diabetes at 20, 40, and 68 hours after receiving first dose of ACS. Higher risk of 33–48% increase in blood glucose level was noticed at the same time periods in women with diabetes. Based on these, we monitored the patients for 3–5 days based on their glycemic status.

Kitzmiller et al.,[24] in a retrospective study on 55 patients with diabetes who received ACS assessed the impact on fasting and 2-hour post-prandial glucose. Fasting blood sugar elevated >95 mg% in over 90% of women on days 2 and 3 after ACS administration. At least one glucose value was elevated >120 mg in 81% of 98% of women on days 1–3.[18] In our study, there was a steady increase in the blood glucose levels in the initial two days following ACS, but started a downward trend by day 3; euglycemic status was reached on day 4 and sustained on day 5. However, there was no significant ($p > 0.05$) change in the mean glucose level (FBS, pre-lunch, pre-dinner, and one-hour post-dinner) compared between the days 1 and 2 following ACS. The mean change in the glucose level was independent of duration.

Maternal complications of GDM[25–29] necessitate assisted deliveries, hence, it is not infrequent that pregnant women with GDM end up in cesarian section.[29] A study from Qatar has reported incidence of GDM as 28% in their study and approximately one third of them delivered via cesarian section.[30] In our study, 26.9% delivered via LSCS.

As women with GDM are at a high risk of developing complications apart from compromising the safety of the fetus, use of ACS in this sub-group of patients is justifiable. However, its use after 37 weeks of gestation before elective CS is still debated, and more concrete evidences are required for recommendation.[31] Established safety profile of ACS in pregnancy has promoted its use in various obstetric indications[21] including threatened preterm delivery, pre-eclampsia, and premature rupture of membranes. Use of ACS in obstetrics is as high as 27.5–83.9%.[32–35] A study has documented that of 4429 pregnant women, 510 were diagnosed to be diabetic (329 GDM) of whom 86.1% were given ACS.[32] An Australian study on 306 women documented that 21.2% of them received ACS within seven days of delivery via elective cesarian section.[36] Osteen et al.[37] observed that 17.6% pregnant women received ANCs for

threatened abortion. In our study, ACS was given to those with threatened preterm delivery.

Administration of ACS in women with GDM is associated with development of hyperglycemic episodes even in those whose glycemic status is controlled by diet and lifestyle modifications, and our study is in support of this. All pregnant women with GDM are to be managed with insulin, route of administration is based on the maternal glucose levels. In those with GDM, glycemic levels reach maximum levels after 9–10 hours after administration of ACS, hence, the dosage of insulin has to be adjusted accordingly and glucose level has to be monitored closely. Insulin therapy following ACS can be discontinued once the glycemic status is well controlled but few may require it till delivery and rarely beyond delivery. Although there are promising reports with metformin, a recent study is not in favor of its use after ACSs in GDM.[38]

An intravenous insulin algorithm after administration of ACSs in pregnant women with diabetes to achieve optimal glycemic status was proposed and tested in 2003 by Kaushal et al.,[39] it was validated for pregnant women with type 1 diabetes mellitus as well,[40] but more evidence is needed to assure its applicability in all patients with GDM is still awaited.

This was a single center study with a small sample size. Having a control group that received ACS without GDM could have proved a better study design. Noting the neonatal outcomes and maternal follow-up, which would have been helpful. The genetic predisposition to GDM in the Indian scenario of large population-based studies is required.

ACS results in hyperglycemia and increases the requirement of insulin alone, or add on OHA to achieve optimal glucose levels. Initial increased blood glucose levels are seen in first two days of ACS. Well-controlled glycemic status is achievable with MNT alone or in combination with pharmacotherapy along with continued monitoring. If managed appropriately, adequately and in timely manner, maternal and fetal complications can be minimized. There were no episodes of hypoglycemia with the treatment algorithm followed. By adopting pre-prandial glucose monitoring and customized insulin correction following injection betamethasone for the first 48–72 hours found to be very effective. There was no fetal loss in our study reflecting the success of multidisciplinary approach.

Clinical Significance

Continuous monitoring, MNT to meet the increased nutritional needs and not increase MBG levels at the same time, and add on pharmacotherapy should be included in the treatment strategy.

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Supplementary Materials

The supplementary tables 1 and 2 are available online on the website of www. JSAFOG.com.

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