

SONOGRAPHIC ASSESSMENT OF FETALGROWTH RESTRICTION IN PREGNANT WOMEN WITH GESTATIONAL DIABETES AND HYPERTENSION IN 3RD TRIMESTER

Uzma Ramzan¹, Dr. Atia Ur Rehman^{*2}, Muhammad Nauman Saleem³, Rimal Aslam⁴

¹Bachelor of sciences in Medical Imaging Technology, Faculty of Allied Health Sciences, Rashid Latif khan Medical College, Lahore

²Professor, Faculty of Allied health Sciences, Rashid Latif khan university, Lahore

³Lecturer, Faculty of Allied Health Sciences, Rashid Latif khan university, Lahore

⁴Bachelor of sciences in Medical Imaging Technology, Faculty of Allied Health Sciences, Rashid Latif Medical college, Lahore

¹2021-mit-2501@rlmc.edu.pk, ²atia.urrehman@rlku.edu.pk, ³naumansaleem72@gmail.com,

⁴inshalaslam322@gmail.com

DOI: <https://doi.org/10.5281/zenodo.22913765>

Keywords

Fetal growth restriction (FGR), Third trimester, Pregnancy, Ultrasound assessment, Fetal growth, gestational diabetes, Hypertension, Gestational age.

Article History

Received: 16 June 2026

Accepted: 07 September 2026

Published: 23 September 2026

Copyright @Author

Corresponding Author: *

Dr. Atia Ur Rehman

Abstract

Background: Fetal growth restriction (FGR) is a major obstetric complication associated with increased perinatal morbidity and mortality. Maternal conditions such as gestational diabetes mellitus (GDM) and hypertension can impair placental function and adversely affect fetal growth. Ultrasound assessment plays an important role in the early detection and monitoring of fetal growth abnormalities during the third trimester.

Objective: To assess the relationship between fetal growth patterns in third-trimester pregnancies complicated by gestational diabetes mellitus and hypertension using ultrasound findings.

Methodology: A cross-sectional study was conducted at Arif Memorial Teaching Hospital over a period of six months. A total of 110 pregnant women in the third trimester were included. Ultrasound examination was performed to assess fetal biometric parameters including biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC), femur length (FL), estimated fetal weight (EFW), amniotic fluid index (AFI), placental grading, and Doppler studies. Data were analyzed using SPSS, and chi-square and Pearson correlation tests were applied.

Results: The study showed reduced fetal biometric parameters and lower estimated fetal weight in pregnancies complicated by hypertension and GDM compared with normal pregnancies. Abnormal umbilical artery Doppler was observed in 39.1% and abnormal MCA Doppler in 37.3% of cases. FGR was present in 58.2% of participants. A significant association was found between hypertension with GDM and FGR ($p < 0.001$). Negative correlations were observed between blood pressure and fetal growth parameters.

Conclusion: Pregnancies complicated by gestational diabetes mellitus and hypertension are strongly associated with fetal growth restriction and abnormal Doppler findings. Ultrasound evaluation in the third trimester is essential for early diagnosis, fetal surveillance, and timely intervention to improve maternal and fetal outcomes.

Introduction

Gestational diabetes is a common problem that can be happened during pregnancy. It occurs when women develop high blood sugar level during pregnancy [1]. GDM is different from type 1 and type 2 diabetes because it develops during pregnancy. The exact reason for GDM is still not know. Insulin normally helps to control blood sugar, but when body does not respond well to insulin blood sugar increases. GDM can cause health problems for the mother, pregnancy and baby [2].

The HAPO study found that higher blood sugar in the mother is associated with a higher chance of problems during pregnancy. Also establish the relationship between maternal hyperglycemia and adverse outcomes [3].

Those women have high GDM are at high risk then the women who have only small blood sugar .in the primer we mainly focus on women who are diagnosed with gestational diabetes mellitus according to IADPSG or WHO 2013 criteria. This means that high blood sugar is first found during pregnancy but the glucose level is not enough to be consider diabetes outside pregnancy.

GDM is important for two main reasons. First, it increases the risk of health problems during pregnancy for both women and baby. Mother are especially at high risk of high blood pressure but babies are at higher risk of excessive growth and increased body fat. Second women who have gestational diabetes mellitus and their children have a higher risk of developing diabetes, obesity and heart disease later in life [4].

Hypertensive disorders of pregnancy HDP and fetal growth restriction a FGR are important complications that increases the risk of illness and death for both the mother and baby. The early detection and management decrease the risks of pregnancy [5].

Hypertensive disorder in pregnancy are major cause of health problems and death in mother, babies, and newborns. They effect about 10% of pregnancies worldwide. The number of cases may increase due to the pregnancy at an older age and with obesity. Pregnant women with HDP have a higher risk of serious complications such as placental abruption, stroke, pulmonary edema, abnormal bleeding and organ failure. HDP can cause the poor growth in the womb, premature birth, at stillbirth. These risks can be mostly higher wen patients have preeclampsia which is a type of hypertension. More likely babies are born prematurely, have low fetal weight and fetal growth [6].

Two tests are performed for screening the gestational diabetes mellitus. First glucose tolerance test (GTT) in which women drinks a solution containing 50g of glucose, after 1 hour, her blood glucose level is checked. Second is oral glucose tolerance test (OGTT) in which if the glucose level is higher than the screening limits then she takes a 100 g t or 75 g glucose test. blood glucose is checked while fasting and after 1 and 2 hours also called this criteria Carpenter and coustan (C-C). GDM is diagnosed when both tests are above the normal limits. This method also used by many organizations, including the National diabetes Data Group (NDDG) [7].

Fetal growth restriction happens when baby does not grow as much as it should inside the womb because the placenta is not working properly. Babies with FGR have a higher risk of problems around the time of birth, death before or shortly after birth, long term health problems, poor brain and learning development, heart and hormones related disease later in life. FGR occurs in about 5-10% of pregnancies [8].

Baby is considered likely to have FGR if its estimated weight or abdominal circumferences is below the 10th percentile for its gestational age.

However not every small baby has FGR. About 20% of babies are small but completely healthy. These babies are called small for gestational age and may simply be naturally small [9].

Gestational hypertension is considered severe if there is sustained elevation in systemic Bp to at least 160mmHg or diastolic Bp at least 110 mmHg for at least 6 hours [10]. Blood pressure should be measured correctly. Use a blood pressure cuff that fits the patient properly. The patient should have an empty bladder and should avoid caffeine or nicotine for at least 30 minutes before the measurements. Before checking the blood pressure, the patient should rest quietly 5 minutes. The patient should sit comfortably with their feet flat on the floor and not crossed, with back and arm support. the arm should be supported at the same level as the heart. Gestational diabetes treated through medical nutrients, physical activity and insulin therapy. Hypertension is treated with hypertensive medications such as labetalol [11].

During my clinical rotations, I observed a wide variation in fetal growth patterns among pregnant women in their 3rd trimester. This made me curious about factors influencing fetal growth and weight. in the 3rd trimester, pregnancies complicated by hypertension and gestational diabetes are at increased risk of fetal growth restriction due to uteroplacental insufficiency and placental dysfunction. Maternal hypertension impairs placental blood flow, while poorly controlled gestational diabetes contributes to endothelial damage and reduced nutrient transfer. ultrasound assessment of fetal biometry and doppler indices in the 3rd trimester is essential for early detection of FGR, enabling timely

surveillance and intervention to improve perinatal outcomes [12].

Methods

This was a cross sectional study conducted by using convenient sampling technique. Total 110 pregnant women participated in the study. The study was conducted for six months in Radiology Department of Arif Memorial Teaching Hospital. Pregnant women who came for an obstetrics ultrasound during third trimester were included after taking their informed consent. Information such as age, marital status, address, previous pregnancy history, and medical conditioned was collected through an interview. A physical examination and ultrasound were performed. the study included pregnant women with one baby, with a pregnancy age of 28 to 40 weeks, who agreed to participate. Women with twin or multiple pregnancies, known fetal abnormalities, non-pregnant women, serious maternal diseases preserve substance abuse were excluded.

Data was collected through a structure interview and abdominal ultrasound. Each participant had an ultrasound examination while lying on her back. While 3.5-5MHz ultrasound probe and coupling gel were used to get clear images. The ultrasound measures the baby biparietal diameter (BPD), head circumferences (HC), abdominal circumferences (AC), femur length (FL) and estimated fetal weight (EFW). These measurements used to estimated the fetal weight using standard formulas. Care was taken not press the ultrasound probe too hard, especially over placenta, because this could effect the measurements.

Results

Table 4.1: Distribution of participants according to age

Age group (years)	Frequency (n)	Percentage (%)
20-35	44	48.0
35-55	50	55.0
55-70	16	17.6
Total	110	100.0

The study included 110 participants. Most participants were aged 35-55 years (50 participants), followed by 20-35 years (44 participants) and 55-70 years (16 participants). The largest age group was 35-55 years.

Table 4.2: Distribution of participants according to parity

Parity	Frequency (n)	Percentage (%)
0	12	10.9
1	21	19.1
2	16	14.5
3	25	22.7
4	17	15.5
5	19	17.3
Total	110	100.0

Among 110 participants, parity 3 was most frequent category (22.7%), followed by parity 1 (19.1%), and parity 5 (17.3%), about 10.9 % of participants had never given birth (nulliparous).

Table 4.3: Distribution according to duration of hypertension

Duration of hypertension	Frequency (n)	Percentage (%)
Less than 1 year	8	7.3
1-3 years	17	15.5
3-5 years	10	9.1
More than 5 years	20	18.2
N/A	55	50.0
Total	110	100.0

Half of the participants (50.0%, n=55) were listed as N/A. while 18.2% had hypertension for more than 5 years, 15.5% for 1-3 years, for 1-3 years 9.1% and 7.3% for less than 1 year (7.3%).

Table 4.4: Distribution according to antihypertensive medication

Medication for hypertension	Frequency (n)	Percentage (%)
No	55	50.0
Yes	55	50.0
Total	110	100.0

An Equal number of participants were taking hypertension medication and were not taking it. out of 110 participants 55 (50%) were taking medications, while 55(50%) were not taking medication.

Table 4.5: Comparison of fetal biometric parameters according to hypertension and GDM status

Fetal parameter	No hypertension/GDM Mean $\pm$ SD	Hypertension + GDM Mean $\pm$ SD
BPD (mm)	85.13 $\pm$ 8.739	82.20 $\pm$ 9.863
HC (mm)	311.65 $\pm$ 32.628	303.45 $\pm$ 30.718
AC (mm)	284.38 $\pm$ 36.786	267.05 $\pm$ 41.207
FL (mm)	67.24 $\pm$ 8.579	62.95 $\pm$ 8.118
EFW (g)	2612.18 $\pm$ 780.814	2384.91 $\pm$ 835.163

Gestational age (weeks)	33.62 ± 3.240	33.75 ± 3.836
AFI (cm)	12.86 ± 2.968	11.91 ± 2.809

The group with hypertension and gestational diabetes had lower average BPD, HC, AC, FL EFW, compared with without Hypertension and GDM. the biggest difference was seen in

abdominal circumference and estimates fetal weight. gestational age was almost the same in both groups, while AFI was slightly lower in hypertension and GDM group.

Table 4.7: Distribution of placental location according to hypertension and GDM status

Placental location	No hypertension/GDM n (%)	Hypertension + GDM n (%)
Anterior	34 (30.9)	32 (29.1)
Fundal	32 (29.1)	24 (21.8)
Low lying	14 (12.7)	22 (20.0)
Posterior	30 (27.3)	32 (29.1)
Total	110 (100.0)	110 (100.0)

Anterior and posterior placental locations were the most common locations. while Low-lying placenta was frequently in the hypertension and

GDM group (20.0%) than in the non-hypertension/non-GDM group (12.7%).

Table 4.8: Distribution of umbilical artery Doppler findings

Umbilical artery Doppler	Frequency (n)	Percentage (%)
Normal	67	60.9
Abnormal	43	39.1
Total	110	100.0

Normal umbilical artery doppler findings were seen in 60.9% of participants, while 39.1% had abnormal findings.

Table 4.9: Distribution of fetal growth restriction (FGR/IUGR)

FGR/IUGR status	Frequency (n)	Percentage (%)
No	46	41.8
Yes	64	58.2
Total	110	100.0

FGR/IUGR was reported in 64 participants (58.2%), whereas 46 participants (41.8%) did not have FGR/IUGR.

Table 4.10: Association between FGR/IUGR and hypertension with GDM status

Statistical test	Value	df	p-value
Pearson Chi-square	33.409	1	<0.001
Continuity correction	31.145	1	<0.001
Likelihood ratio	36.393	1	<0.001
Fisher's Exact Test	—	—	<0.001
Valid cases	110		

The results show a significant relationship between FGR/IUGR and Hypertension /GDM Status ($\chi^2=33.409$, $df=1$, $p<0.001$). Fishers exact test also showed a significant relationship ($p<0.001$). Therefore, the Null hypothesis is rejected, indicating that maternal hypertension/GDM status significantly associated with FGR/IUGR in the study group.

Discussion

The present study was conducted to assess the relationship between fetal growth patterns in third-trimester pregnancies complicated by gestational diabetes mellitus (GDM) and hypertension using ultrasound findings. Fetal growth restriction (FGR) remains one of the most important causes of perinatal morbidity and mortality, particularly in pregnancies affected by maternal metabolic and vascular disorders. In this study, ultrasound parameters including biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC), femur length (FL), estimated fetal weight (EFW), amniotic fluid index (AFI), placental grading, and Doppler indices were evaluated to determine the effect of hypertension and GDM on fetal growth.

The mean maternal age in the present study was 29.43 ± 5.64 years, with ages ranging from 20 to 40 years. Most women belonged to the late twenties and early thirties age group, which is considered the common reproductive age. These findings are comparable with the study conducted by Nazia Wagan et al. (2021), where the mean maternal age was 28.99 ± 4.34 years among women diagnosed with gestational diabetes mellitus. Their study reported that increasing maternal age was significantly associated with the development of GDM. Similarly, the present study also included a large proportion of women in higher reproductive age groups, supporting the concept that advancing maternal age may contribute to pregnancy complications such as GDM and hypertension, ultimately affecting fetal growth.

The gravida and parity distribution in the current study showed that most participants had multiple previous pregnancies. Gravida 5 was the most

frequent category (28.2%), followed by gravida 6 (19.1%). Similarly, parity 3 accounted for the highest percentage (22.7%). These findings suggest that multiparity was common among the study population. Stefan Sajdak et al. (2020) reported that excessive maternal weight and repeated pregnancies were associated with higher risks of pregnancy-induced hypertension and gestational diabetes. The findings of the present study support previous evidence that multiparity may increase maternal susceptibility to metabolic and hypertensive disorders during pregnancy.

The present study demonstrated an equal distribution of hypertension and GDM, where 50% of participants had hypertension and 50% had gestational diabetes mellitus. This balanced distribution allowed comparison between affected and non-affected groups. Modzelewski et al. (2022) stated that GDM affects approximately 15% of pregnancies worldwide and is strongly associated with hypertensive disorders, cesarean delivery, and adverse fetal outcomes. The coexistence of hypertension and GDM in the present study may explain the high burden of fetal growth abnormalities observed.

Regarding duration of hypertension, 18.2% of women had hypertension for more than five years, while 15.5% had hypertension for 1–3 years. Women with chronic hypertension demonstrated persistently elevated systolic and diastolic blood pressure values. Mean systolic blood pressure ranged from 140 to 144 mmHg across hypertensive groups, while non-hypertensive women had a lower mean systolic blood pressure of 118.16 mmHg. Wang IK et al. (2021) emphasized that women with hypertensive disorders of pregnancy are at significantly increased risk of metabolic complications and vascular dysfunction. Chronic hypertension contributes to placental insufficiency by impairing uteroplacental circulation, which may lead to restricted fetal growth. The elevated blood pressure values observed in the present study support the possibility of compromised placental blood flow among hypertensive mothers.

Ultrasound biometric findings in this study revealed lower fetal measurements in pregnancies

complicated by hypertension and GDM compared with normal pregnancies. In the non-hypertensive and non-GDM group, the mean BPD was 85.13 mm, HC was 311.65 mm, AC was 284.38 mm, FL was 67.24 mm, and EFW was 2612.18 grams. In contrast, the hypertensive and GDM group showed reduced mean values, with BPD 82.20 mm, HC 303.45 mm, AC 267.05 mm, FL 62.95 mm, and EFW 2384.91 grams. These findings indicate comparatively reduced fetal growth in complicated pregnancies.

The reduction in abdominal circumference and estimated fetal weight observed in the present study is consistent with findings reported by Javier Cara deux et al. (2019), who demonstrated that third-trimester ultrasound measurements, particularly abdominal circumference and estimated fetal weight, are useful predictors of fetal growth restriction. Their study showed that fetuses with reduced abdominal circumference and EFW were more likely to develop FGR. Similarly, the present study found lower AC and EFW values in pregnancies complicated by hypertension and GDM, indicating impaired fetal growth.

The findings also correlate with the study conducted by Damon Maye et al. (2017), who reported that preeclampsia and severe hypertensive disorders significantly increase the risk of intrauterine growth restriction and low birth weight. In the present study, hypertensive pregnancies demonstrated lower fetal biometric indices and reduced fetal weight, further supporting the negative effect of hypertension on fetal growth.

The present study also evaluated placental characteristics. In pregnancies without hypertension and GDM, Grade II and Grade III placentas were most common, reflecting expected placental maturation in late pregnancy. However, in pregnancies complicated by hypertension and GDM, Grade I placenta was most frequent (49.1%), suggesting delayed or altered placental maturation. Furthermore, low-lying placenta was relatively higher in complicated pregnancies (20%) compared with normal pregnancies (12.7%).

These findings support the literature indicating that maternal hypertension and diabetes affect

placental structure and function. Previous studies have shown that placental insufficiency, abnormal vascular remodeling, infarction, and endothelial dysfunction are common in hypertensive and diabetic pregnancies. Such placental abnormalities impair oxygen and nutrient transfer to the fetus, contributing to fetal growth restriction. The delayed placental grading observed in this study may therefore indicate placental dysfunction associated with maternal disease.

The results are comparable with those reported by Fang Liu et al. (2018), who found that abnormal fetal hemodynamic indices were significantly associated with altered fetal growth in pregnancies complicated by gestational diabetes mellitus. Their study demonstrated that Doppler indices of the umbilical artery and middle cerebral artery correlated with fetal growth parameters and birth weight. Similarly, the present study identified a substantial number of abnormal Doppler findings among pregnancies complicated by hypertension and GDM, supporting the role of Doppler ultrasound in identifying fetuses at risk of growth restriction.

The present study showed a high prevalence of fetal growth restriction, with 58.2% of fetuses diagnosed with FGR/IUGR. Among women without hypertension and GDM, only 5 out of 55 pregnancies showed FGR, whereas 34 out of 55 pregnancies with hypertension and GDM demonstrated fetal growth restriction. The chi-square analysis revealed a highly significant association between FGR and maternal hypertension with GDM ($p < 0.001$).

These findings strongly agree with the study by Yu Chun Zhu et al. (2021), who reported an overall FGR incidence of 15.1% in hypertensive pregnancies, with significantly higher rates among women with severe preeclampsia. Their findings demonstrated that hypertensive disorders are major contributors to fetal growth restriction and adverse perinatal outcomes. Similarly, Wang T et al. (2021) reported that hypertensive disorders of pregnancy markedly increase the risk of intrauterine growth restriction, low birth weight, stillbirth, and preterm birth. The current study further confirms that maternal hypertension

combined with gestational diabetes significantly increases the likelihood of FGR.

The correlation analysis in the present study demonstrated a statistically significant negative relationship between systolic blood pressure and femur length ($r = -0.235$, $p = 0.014$). This finding suggests that increasing maternal blood pressure may adversely affect fetal skeletal growth. Moreover, strong positive correlations were observed among fetal biometric parameters such as BPD, HC, AC, FL, and EFW, indicating that reductions in one growth parameter are associated with overall fetal growth impairment.

These findings are supported by previous studies indicating that placental insufficiency secondary to hypertension reduces nutrient delivery to the fetus, thereby impairing fetal skeletal and somatic growth. The significant association between blood pressure and fetal growth measurements observed in the current study further strengthens the relationship between maternal vascular disease and fetal compromise.

Another important observation in the present study was the slightly lower amniotic fluid index among pregnancies complicated by hypertension and GDM (11.91 cm) compared to normal pregnancies (12.86 cm). Although AFI remained within relatively acceptable limits, reduced amniotic fluid may indicate placental insufficiency and fetal hypoxia. Similar observations have been reported in studies on high-risk pregnancies, where oligohydramnios frequently accompanies fetal growth restriction and abnormal Doppler findings.

The present study highlights the importance of ultrasound evaluation in third-trimester pregnancies complicated by maternal hypertension and gestational diabetes. Ultrasound provides valuable information regarding fetal biometry, estimated fetal weight, placental maturity, amniotic fluid volume, and fetal circulation. The use of Doppler ultrasound is particularly beneficial in identifying placental insufficiency and fetal adaptation to hypoxia before the development of severe complications.

The findings of the present study are also consistent with the literature emphasizing the

combined impact of hypertension and GDM on placental function. Both disorders contribute to endothelial dysfunction, oxidative stress, inflammation, and impaired uteroplacental perfusion. As a result, fetuses are more vulnerable to chronic hypoxia and restricted growth. The higher frequency of abnormal Doppler indices and FGR in this study reflects these pathophysiological changes.

Overall, the present study demonstrates that pregnancies complicated by hypertension and gestational diabetes are associated with reduced fetal biometric parameters, lower estimated fetal weight, abnormal Doppler findings, altered placental maturation, and a significantly increased prevalence of fetal growth restriction. These findings are in agreement with previous national and international studies and further support the importance of careful antenatal monitoring and ultrasound surveillance in high-risk pregnancies.

Conclusion

The present study concludes that gestational diabetes mellitus and hypertension significantly affect fetal growth during the third trimester of pregnancy. Pregnancies complicated by these maternal disorders showed reduced fetal biometric measurements, lower estimated fetal weight, abnormal Doppler findings, and a higher prevalence of fetal growth restriction compared with uncomplicated pregnancies. The study also demonstrated a strong statistical association between hypertension with GDM and FGR. Ultrasound examination, including fetal biometry and Doppler assessment, proved to be an effective and reliable tool for identifying fetal compromise and monitoring high-risk pregnancies. Early diagnosis and proper antenatal surveillance can help reduce adverse maternal and fetal outcomes associated with fetal growth restriction.

Authors contribution: UR conceptualized and designed the research work and assisted in data collection and analysis. RA was involved in the designing and interpretation of the findings, and critically revised the manuscript for important intellectual content. Both authors have read and approved the final manuscript.

Conflict of Interest: Authors declare no conflict of interest.

Funding and Ethics: This research was self-funded by the author. The study was conducted in accordance with ethical guidelines.

REFERENCES

- American Diabetes Association. Classification and Diagnosis of Diabetes: Standards of Medical Care in Diabetes—2018. *Diabetes Care* 2018; 41, S13–S27.
- Plows J, Stanley J, Baker P, et al. The pathophysiology of gestational diabetes mellitus. *Int J Mol Sci* 2018; 19:3342.
- Metzger BE, Lowe LP, Dyer AR, et al. /HAPO study cooperative research group. Hyperglycemia and adverse pregnancy outcomes. *N Engl J Med* 2008; 358:1991–2002.
- Clausen, T. D. et al. Overweight and the metabolic syndrome in adult offspring of women with diet treated gestational diabetes mellitus or type 1 diabetes. *J. Clin. Endocrinol. Metab.* 94, 2464–2470 (2009)4.
- Daly, B. et al. Increased risk of ischemic heart disease, hypertension, and type 2 diabetes in women with previous gestational diabetes mellitus, a target group in general practice for preventive interventions: a population-based cohort study. *PLOS Med.* 15, e1002488 (2018).
- Hung, T.-H.; Skepper, J.N.; Burton, G.J. In Vitro Ischemia-Reperfusion Injury in Term Human Placenta as a Model for Oxidative Stress in Pathological Pregnancies. *Am. J. Pathol.* 2001, 159, 1031–1043.
- Regitz-Zagrosek V, Roos-Hesselink JW, Bauersachs J, Blomström-Lundqvist C, Cifková R, De Bonis M, et al. 2018 ESC Guidelines for the management of cardiovascular diseases during pregnancy. *Eur Heart J.* 2018;39(34):3165–241.
- Classification and diagnosis of diabetes mellitus and other categories of glucose intolerance. National Diabetes Data Group. *Diabetes* 1979; 28:1039–57.
- Froen JF, Gardosi JO, Thurman A, Francis A, Stray-Pedersen B (2004) Restricted fetal growth in sudden intrauterine unexplained death. *Acta Obstet Gynecol Scand* 83:801–807
- McCowan L M Figueras F Anderson NH. Evidence-based national guidelines for the management of suspected fetal growth restriction: comparison, consensus, and controversy. *Am J Obstet Gynecol.* (2018) 218: S855–68. 10.1016/j.ajog.2017.12.004
- ACOG Committee on Practice Bulletins—Obstetrics. Diagnosis and management of preeclampsia and eclampsia. *Obstetric Gynecol* 2001; 98:159–67.
- ACOG practice bulletin NO 203: chronic hypertension in pregnancy. *Obstet Gynecol* 2019;133(1): e 26–50.
- ACOG practice bulletin NO 202: gestational diabetes and hypertension and preeclampsia. *Obstet gynecol* 2019;133(1):e1–25.