

Associations between the Grade of Placental Maturity at Third Trimester Ultrasound and Maternofetal Outcomes at the Maternity of the Yaoundé Central Hospital: A Prospective Cohort Study

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ABSTRACT

Background: Placental maturity assessed by ultrasound has been classified into 3 grades by Grannum. Grade 3 before the 36th week of pregnancy is associated with adverse maternofetal morbidity. We sought to determine the prevalence of grade 3 placenta between the 34th and the 36th week of pregnancy and to assess its impact on maternofetal outcomes in Cameroon.

Materials and methods: This prospective cohort study was conducted from January 2012 to July 2013 in the maternity unit of the Yaoundé Central Hospital.

Results: One hundred and two women with singleton pregnancies between the 34th and 36th weeks were included. Grade 3 placenta accounted for 5.9% of our sample. Grade 3 was significantly associated with the following: anterior location of the placenta (RR = 5.36; 95% CI: 1.36–9.62; $p = 0.03$), pre-eclampsia (RR = 12; 95% CI: 3.52–20.8; $p = 0.003$), meconium-stained amniotic fluid (RR = 4.32; 95% CI: 1.65–11.51; $p = 0.04$) and intrauterine growth restriction (RR = 2.43; 95% CI: 1.33–15.6; $p = 0.007$).

Conclusion: Grade 3 placental maturity before the 36th week of pregnancy is significantly associated with some maternal and fetal morbidities. Therefore, it warrants close monitoring to detect and avoid complications.

Keywords: Maternofetal prognosis, Placental grade, Pregnancy.

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INTRODUCTION

The human placenta is a unique, autonomous and transitory organ that connects physiologically and biologically the embryo, and then the fetus to the uterine wall during pregnancy.¹

In 1973, Winsberg demonstrated the correlation between ultrasonographical variations of the placenta and fetal maturity.² In 1979, Grannum elaborated a scale to describe the evolution grades of placental maturity on ultrasound. His scale comprises 4 grades ranging from 0 (immature placenta) to 3 (mature placenta) (Figs 1 to 3). He concluded that all fetuses with grade 3 placenta have reached lung maturity. However, grade 3 before the 36th of pregnancy is associated intrauterine growth restriction (IUGR).³

The aim of this study was to determine the prevalence of grade 3 placenta between 34 and 36 weeks of pregnancy and to assess its impact on maternal and fetal outcomes.

MATERIALS AND METHODS

We conducted a 19-month (2nd January 2012 to 30th July 2013) prospective cohort study at the Maternity of the Yaoundé Central Hospital. The minimal sample size was calculated (using the formula of cohort studies) at 92. Written informed consent was obtained from all participants. Each participant underwent three ultrasounds: the first before the 12th week of pregnancy, the second between the 20th and the 22nd week and the third between 34th and the 36th week. All ultrasounds were done by a single operator following American norms with the device SONOSITE M-Turbo-C60X/5-3 MHz Transducer Ref: P08189-75; Made in United States of America. After the third trimester echography,

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Fig. 1: Placental body shows a few echogenic densities ranging from 2 to 4 mm in diameter. Chorionic plate shows small indentations. Mid 2nd trimester early 3rd trimester (~18–29 weeks)



Fig. 2: Chorionic plate shows marked indentations, creating comma-like densities which extend into the placental substance but do not reach the basal plate. The echogenic densities within the placental also increase in size and number. The basal layer comes punctuated with linear echoes which are enlarged with their long axis parallel to the basal layer. Late 3rd trimester (~30 weeks to delivery)



Fig. 3: Complete indentations of chorionic plate through to the basilar plate creating cotyledons (portions of placenta separated by the indentations). Thirty-nine weeks post dates

participants were divided into two groups: group 1 was made up of participants with grade 3 placentas (test group) and group 2 made up of those with grade 1 or 2 placentas (control group). Participants had antenatal consultations every 2 weeks. Exclusion criteria were sickle cell disease, diabetes, hypertensive disorders with onset before the 34th week, multifetal gestation and fetal malformations. The following variables were considered: age, matrimonial status, parity, grade of placental maturation, pre-eclampsia, route of delivery, aspect of amniotic fluid during labor, 5th minute Apgar score and birth weight. Data were collected using a pretested technical form. Analyses were done using Excel and Epi info 3.4.1 softwares. The Chi-square (Yates) and the Fisher's exact tests were used to compare qualitative variables. Difference was considered significant for p -value < 0.05 .

RESULTS

Out of 120 women included, 18 were lost to follow-up. Six (5.9%) participants were in the study group (grade 3) and 96 (94.1%) were in the control group (grade 1 or 2). Thus, the prevalence of grade 3 between the 34th and the 36th week was 5.9%.

In the test group, participants aged between 20 and 24 years accounted for 66.7%. In the control group, age group 25 to 29 was the most represented with 27.1%. The difference in age between groups was not statistically significant. There were more single women in the test group (66.7%) than in the control group (57.3%) but the difference was not significant. Concerning employment, unemployed women predominated in both groups (33.3% in the test group and 36.5% in the control group). The mean parity was 1.6 in the test group and 1.73 in control group. Pauciparous women predominated in both groups (66.7% in the test group and 75% in the control group).

The placenta was anterior in 83.3% of participants in the test group and in 42.7% of participants in the control group. The difference was statistically significant ($p = 0.03$).

The prevalence of pre-eclampsia in the test group was 50% and 4.2% in controls ($p = 0.003$).

In the test group, 50% of participants had meconium-stained amniotic fluid during labor *vs* 11.5% in control group. The difference was statistically significant ($p = 0.046$).

Intrauterine growth retardation (birth weight < 10 th percentile) was significantly more frequent in the test group (20%) than in the control group (8.3%). No significant difference was found between the groups concerning the 5th minute Apgar score and admission into the pediatric intensive care unit.

DISCUSSION

A major limitation of our study was the variation due to acoustic characteristics of each placenta. This limitation was addressed by the use of a single device by the same operator throughout the study. Another limitation was the number of patients lost to follow-up (18 out of 120).

Six out of 102 (5.9%) placentas were grade 3 between the 34th and 36th week of pregnancy (Table 1). This figure is similar to the rate of 3.9% reported by Lilyan in Irak.⁴

Participants aged between 20 and 24 years were predominant in the test group with 66.7%. In the control group, women aged between 25 and 29 years were predominant accounting for 27.2% of cases (Table 2). That difference in age distribution was not significant. Lilyan had similar results:⁴ grade 3 in 52.2% women aged less than 25 and grade 1 to 2 in 27.5% of women ($p = 0.01$). We found no statistical difference between the groups concerning marital status, profession and level of education.

In test group the mean parity was 1.6 and 1.73 in the control group without significant difference. Pauciparous participants were predominant in both test (66.7%) and control group (75%) but without significant difference. This is contrary to findings by McKenna (Ireland, 2005)

who reported 55.88% of grade 3 and 41.5% of grade 1 to 2 in nulliparous Caucasians with a significant difference ($p = 0.03$).⁵

Anterior placentas were 5 times more likely to be grade 3 between the 34th and the 36th week of pregnancy (Table 3).

Fifty percent of pregnancies in test group were complicated by pre-eclampsia vs 4.2% in control group, making a significant relative risk of 12 (95% CI: 3.52–20.8; $p = 0.003$). Thus, grade 3 between the 34th and the 36th week is significantly associated with pre-eclampsia (Table 4). Lilyan et al had similar findings with a relative risk of 4.94 (95% CI 1.15–21.29; $p = 0.021$).⁴ McKenna et al had a relative risk of 4.7 (95% CI 1.87–11.83; $p < 0.01$).⁵ In our study, grade 3 was neither associated with induction of labor nor with cesarean delivery. This is in accordance with results obtained by Chitlange et al in India.⁶ On the contrary, Cooley et al found that grade 3 before the 36th week was significantly associated with cesarean sections.⁷

Grade 3 placenta between the 34th and the 36th week was associated with intrauterine growth restriction (relative risk: 2.43 (95% CI: 1.33 – 15.61; $p = 0.007$). Lilyan et al and McKenna et al had similar findings.^{4,5} This is explained by the limitation of nutrients supply to the fetus by the premature aging of grade 3 placentas before 36 weeks of pregnancy. This growth restriction may also be due to pre-eclampsia. Grade 3 was significantly associated with meconium-stained amniotic fluid during labor (relative risk: 4.32 95% CI (1.65–11.51); $p = 0.04$) (Table 5). This was in accordance with results by Chitlange et al but different from those by Lilyan et al.^{4,6}

Table 1: Distribution of participants following the grade of placental maturity

Grade of placental maturity	Frequency (%)
Grade 3 (test group)	6 (5.9%)
Grade 1–2 (control group)	96 (94.1%)
Total	102 (100.0%)

Table 2: Sociodemographical characteristics

Variables		Test group <i>n</i> = 6 (%)	Control group <i>n</i> = 96 (%)	Total	Relative risk (95% CI)	<i>p</i> -value
Age (years)	15–19	0	7 (7.3)	7	1.24 (0.52–3.13)	0.96
	20–24	4 (66.7)	22 (22.9)	26	1.03 (0.25–4.27)	0.52
	25–29	1 (16.7)	26 (27.1)	27	1.87 (0.75–4.68)	0.98
	30–34	1 (16.7)	21 (21.9)	22	0.87 (0.59–1.35)	0.83
	35–39	0	17 (17.7)	17	1.39 (0.56–3.48)	0.76
	40–45	0	3 (3.1)	3	1.06 (0.36–3.11)	0.96
Matrimonial status	Married	2 (33.3)	37 (38.5)	39	0.96 (0.69–0.34)	0.69
	Single	4 (66.7)	55 (57.3)	59	1.07 (0.15–7.61)	0.25
	Divorced	0	4 (4.2)	4	1.02 (0.85–1.31)	0.95
Profession	Liberal job	1 (16.7)	14 (14.6)	15	0.95 (0.23–3.46)	0.24
	Employed	2 (33.3)	17 (17.7)	19	1.03 (0.15–7.28)	0.96
	Informal	1 (16.7)	30 (31.3)	31	1.34 (1.08–1.67)	0.86
	Unemployed	2 (33.3)	35 (36.5)	37	1.18 (0.65–2.11)	0.41
Level of education	Primary	0	22 (22.9)	22	1.86 (0.85–10.5)	0.62
	Secondary	4 (66.7)	38 (39.6)	42	1.42 (1.56–2.95)	0.24
	University	2 (33.3)	33 (34.4)	35	1.56 (0.85–2.52)	0.52
	Illiterate	0	3 (3.1)	3	0.65 (0.42–1.08)	0.46
Parity	0–2	4 (66.7)	72 (75)	76	1.42 (1.20–2.60)	0.56
	3–5	2 (33.4)	21 (21.9)	23	0.83 (0.65–1.85)	0.74
	6–9	0 (0)	3 (3)	3	0.75 (0.55–1.45)	0.94

Mean ages were 22.3 years in group 1 and 28.1 years in group 2



Table 3: Location of the placenta

Localization	Test group n = 6 (100%)	Control group n = 96 (100%)	Relative risk (95% CI)	p-value
Anterior	5 (83.3)	41 (42.7)	5.36 (1.36–9.62)	0.031
Posterior	1 (16.7)	55 (57.3)	1.82 (1.52–3.15)	0.062

Table 4: Maternal outcome

Outcome variables	Test group n = 6 (100%)	Control group n = 96 (100%)	Relative risk (95% CI)	p-value
Pre-eclampsia	3 (50)	4 (4.2)	12 (3.52–20.8)	0.003
Induction of labor	2 (33.3)	10 (10.4)	3.21 (0.81–11.42)	0.086
Spontaneous labor	2 (2.77)	69 (95.8)	1.88 (0.52–6.35)	0.163
Cesarean section	2 (33.3)	15 (15.6)	1.62 (1.21–5.25)	0.318
Indication for cesarean section				
CPD	0	5 (27.8)		
PMTCT /HIV	0	1 (5.6)		
Cord P	0	1 (5.6)		
SPE	1 (50)	6 (33.3)		
PP	1 (50)	4 (22.2)		
AFD	0	1 (5.6)		

CPD: Cephalo-pelvic disproportion; PMTCT/HIV: Prevention of mother to child transmission of the human immunodeficiency virus; Cord P: Cord prolapse; SPE: Severe pre-eclampsia; PP: Placenta previa; AFD: Acute fetal distress

Table 5: Fetal outcome

Outcome variables	Test group n = 6 (100%)	Control group n = 96 (100%)	Relative risk (95% CI)	p-value
Meconium-stained amniotic fluid	3 (50)	11 (11.5)	4.32 (1.65–11.51)	0.046
Neonatal resuscitation	5 (83.3)	66 (68.8)	1.21 (0.83–1.72)	0.083
BW < 10th percentile	1 (20)	8 (8.3)	2.43 (1.33–15.61)	0.007
5th Apgar score < 7	2 (33.4)	5 (5.2)	1.21 (0.96–3.26)	0.632
Admission in ICU	1 (16.7)	9 (9.4)	1.75 (0.26–11.80)	0.433

BW: Birth weight; ICU: Intensive care unit

In our study, there was no association between grade 3 and the following: 5th minute Apgar score <7, neonatal resuscitation and admission in pediatric intensive care unit (Table 5). Tan et al and Lilyan et al had similar results.^{4,8}

CONCLUSION

Grade 3 placental maturity before 36 weeks is associated with maternofetal morbidities. Such pregnancies should be closely monitored after the diagnosis and during labor to prevent those complications. We therefore recommend to all radiologists to systematically determine the grade of placental maturity between the 34th and the 36th week of pregnancy.

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