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The Contribution of Ultrasonography to the Detection of Fetal Macrosomia in the Later Pregnancy and Its Impact on Neonatal Morbidity

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Abstract **Case Report**

Fetal macrosomia is associated with several maternal and fetal complications. Early detection of macrosomia may allow preventive measures to be taken to avoid the occurrence of these complications. The aim of our study was to evaluate the value of ultrasound in late pregnancy in the detection of fetal macrosomia and its impact on obstetric and neonatal outcomes. ***Patients and Methods*:** We conducted a retrospective cross-sectional study from 01 January to 31 June 2017. The study included 123 women who gave birth in the obstetric gynaecology department of the Groupe Hospitalier Intercommunal le Raincy-Montfermeil in France. The data were entered using Microsoft Excel 2013 and analysed with Epi info Version 6 software. The fisher's exact test and Pearson correlation were used with a significance level set at 0.05. ***Results*:** Out of 1082 live births, the incidence of fetal macrosomia was 6.3%. An emergency caesarean section was performed in 26.1% of cases. Neonatal status was better with a good Apgar (>7) in 89%. There was a weak correlation of 0.01 between uterine height and birth weight of the child, but a significant correlation between ultrasound fetal weight estimation at the end of pregnancy and birth weight of the child was found (0.56). ***Conclusion*:** Screening for fetal macrosomia appears to be more effective in late pregnancy with ultrasound. Rigorous training in the technique of measuring ultrasound biometrics should be required.

Keywords: Ultrasonography, Screening, Macrosomia, Pregnancy.

INTRODUCTION

Monitoring proper fetal growth is essential during pregnancy. In France, the regular measurement of uterine height and the three recommended ultrasounds are intended to detect fetuses whose estimated weight is outside the norm, this is usually between the 10° and 90° percentile. Macrosomia is defined as a fetal weight above the 90th percentile for the given gestational age or a birth weight above 4000g [1]. The predisposing factors for macrosomia, numerous and often interrelated, are constitutional or acquired [2]. Their relative influence remains poorly known. Its frequency is 5 to 10% according to the French National Authority for Health (HAS) [3]. Macrosomia is the cause of increased maternal and neonatal morbidity. The neonatal consequences of macrosomia are mainly shoulder dystocia with or without brachial plexus injury, fractures, metabolic disorders and respiratory distress [4]. The obstetrical consequences are a higher risk of caesarean section, longer labour, more frequent use of oxytocics, perineal injury, instrumentation, caesarean section in labour and haemorrhage [5]. As a result, the problem of macrosomia is becoming a real public health issue, and it is necessary to consider the best screening test for this extreme weight. Uterine height measurement is a simple and inexpensive clinical screening test, but its reliability has not been proven [6]. Nevertheless, its use is recommended as it is the only test that can be used in routine practice. Despite its modest performance in screening for fetal growth anomalies, ultrasound remains the reference screening test [7]. In France, the last screening ultrasound is performed at around 32 weeks' gestation. The study by Souka *et al*., showed a better sensitivity of ultrasound screening for fetal growth anomalies at 36 weeks' gestation compared to 32 weeks' gestation [8]. But its impact on maternal and fetal morbidity has not been evaluated. The aim of our study was to assess the value of ultrasound in late pregnancy for screening for fetal macrosomia and its impact on obstetric and neonatal outcomes.

PATIENTS ET METHODS

We carried out a retrospective monocentric observational study at the Groupe Hospitalier Intercommunal le Raincy-Montfermeil in France, level 2 B maternity hospital, from 01 January 2017 to 31 June 2017.The study involved women who gave birth in the obstetric gynaecology department of the Groupe Hospitalier Intercommunal Montfermeil. At least one additional ultrasound scan was performed between 36 and 41 weeks' gestation, in most cases after suspicion at 32-33 weeks' gestation.

All women seen in the 3rd trimester of pregnancy with suspected fetal macrosomia either by uterine height or by obstetrical ultrasound were included in this study. We did not consider in this study patients who had delivered in another facility, those with multiple pregnancies or a fetus with a morphological anomaly. Lack of accurate dating by first trimester ultrasound was also a criterion for non-inclusion in this study.

Data were collected from the computerised patient records and the birth room register available at the Centre Hospitalier Intercommunal Montfermeil.

The demographic data collected were mainly: maternal age, weight, height, body mass index in kg/m², weight gain during pregnancy.

Obstetrical data were collected on: parity, history of caesarean section or uterine surgery (scarred uterus), whether or not there was gestationaldiabetes on a diet, mode of entry into labour (spontaneous, cervical ripening/declination, scheduled caesarean section), route of delivery (spontaneous or instrumental vaginal route, caesarean section), severe perineal injury (affecting the anal sphincter), immediate postpartum haemorrhage, shoulder dystocia.

The following ultrasound data were collected from 32SA to 40 SA: gestational age at the time of the ultrasound, fetal biometrics, estimated fetal weight (EFW) in grams from the ultrasound report in the patient's chart. During this ultrasound, a fetal weight estimation, a fetal vitality check, an estimation of the amount of amniotic fluid and a focused examination of the placenta were performed.

As for neonatal data, the following characteristics were collected: neonatal weight, sex, pH at cord, Apgar score at 5 min, transfer or not to neonatal intensive care.

Data entry was performed using Microsoft Excel 2013.

The data were analysed with Epi info Version 6 software. The fisher's exact test and Pearson correlation were used with a significance level set at 0.05.

The primary endpoint of our study was birth weight after screening for fetal macrosomia.

Secondary endpoints included obstetric and neonatal outcomes with: number of inductions, as well as for the newborn the pH at birth, the APGAR at 5 minutes and the admission to neonatal intensive care.

Anonymity and privacy were assured for the collected data.

RESULTS

In sum, we collected 99 predicted and 24 non-predicted macrosomes at the Groupe Hospitalier Intercommunal le Raincy Montfermeil.

- **Mothers**

❖ **Frequency**

We recorded 1082 live births during the period from 01 January 2017 to 30 June 2017, representing a frequency of 6.3% of fetal macrosomia at the GHI Montfermeil.

❖ **Age**

Among the macrosomies, the average age of the mother was 31.05 years with extremes of 18 to 43 years, 46.8% (n=58) of the patients were under 30 years of age. Pregnancies over 35 years of age accounted for 22.8% (n=28) of macrosomal births.

❖ **Medical and obstetric history**

Most patients were pauciparous with 61% (n=75) (Table I). There was 75% (n=35) of gestational diabetes compared to 12% (n=1) of type 2 diabetes associated with pregnancy in the screened mothers. Almost one third of the patients 28% (n=34) had a history of fetal macrosomia in the macrosomia group (Table I).

Table I: Distribution of patients according to obstetrical history and mode of delivery

Variables	Percentage
Parity	
Primiparous	29,3%
Pauciparous	61%
Multiparous >4	9,7%
Obstetrical history of macrosomia	
No	72,36%
Yes	27,64%
Uterine height	
<36 cm	81%
≥36 cm	18,6%
Triggering of labour	
Yes	65,04%
No	34,96
Route of delivery	
Spontaneous vaginal delivery	57.7%

Variables	Percentage
Emergency caesarean section	26.01%
Scheduled caesarean section	9,75%
Instrumental extraction	6,50%

❖ **Body mass index**

The average BMI was 25 kg/m2 in 52.46% (n=65) of the mothers screened for macrosomia. We found 20% (n=25) of morbid obesity and 2.4% (n=3) of severe obesity.

Progression of the pregnancy

Almost 20% (n=22) of the patients had a uterine height of 36 cm or more (p=0.01) (Table I). There was a statistically significant difference between uterine height and birth weight. We did not have data on uterine height for 5 cases.

❖ **Fetal weight estimation on ultrasound in late pregnancy**

The mean ultrasound fetal weight estimate from 36-41 SA was 4222 grams in the macrosomic group. We found a significant correlation between the fetal weight estimate on ultrasound at the end of pregnancy and the birth weight of the child with a correlation coefficient of 0.56 (p<0.05).

❖ **Delivery**

The majority of patients (65.04%, n=80) with macrosomia were induced for suspected fetal macrosomia (p=0.0012) (Table I).

The mean term of delivery was 38-39 weeks' gestation.

The majority of women identified as macrosomic delivered by spontaneous vaginal delivery, 57% (n=71) and 6.50% (n=8) by instrumental extraction (Table I).

❖ **Complications at delivery**

We recorded one case of shoulder dystocia corrected by reverse Wood, 2 cases of delivery haemorrhage, 5 cases of respiratory distress and 6 cases of hospitalization in neonatology. The perineal tears were simple and uncomplicated.

The child and neonatal status

❖ **Sex**

In the macrosomia group, 67% (n=82) were male.

❖ **Birth weight**

The mean birth weight was 3971 grams in our series, 56%(n=69) of the neonates had a birth weight above 4000 grams.

❖ **Apgar and umbilical cord blood pH**

Neonatal status was better with good Apgar (>7) in the majority of cases, 89% (n=109).

We found that 95% (n=117) of macrosomic newborns had a pH >7.25.

❖ **Correlation between birth weight and uterine height**

We found a statistically significant difference between uterine height and birth weight in our series (p=0.01) (Table II). We found a low correlation coefficient of 0.01 between uterine height and birth weight of the child (p<0.05).

Table II: Distribution of birth weight according to uterine height

Uterine height (cm)													
Birth Weight (in gram)	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**42**	**Total**
3000-4000	2	2	11	15	7	3	9	4	0	1	0	0	54
4001-4500	3	3	8	13	13	3	5	3	3	1	0	1	56
4501-5000	0	0	2	1	1	1	1	0	0	0	2	0	8
Total	5	5	21	29	21	7	15	7	3	2	2	1	118
%	4,24 %	4,24 %	17,80%	24,58%	17,80%	5,93 %	12,71%	5,93 %	2,54 %	1,69 %	1,69 %	0,85 %	100,00%

❖ **Correlation between birth weight and predicted macrosomia**

In our series, the birth weight of the newborns varied significantly with the outcome of fetal macrosomia screening (p value <0.05) (Table III).

Table III: Distribution of birth weight according to fetal macrosomia screening outcome

Fetal macrosomia screening				
Birth Weight (in gram)	**No**	**Yes**	**Total**	
3000-4000	3	53		56
%	5,36%	94,64%		100,00%
4001-4500	20	39		59
%	33,90%	66,10%		100,00%
4501-5000	1	7		8
%	12,50%	87,50%		100,00%
TOTAL	24	99		123
%	19,51%	80,49%		100,00%

DISCUSSION

❖ **Age**

Among the macrosomes, the mean age of the mother was 31.05 years with extremes of 18 to 43 years, 46.8% (n=58) of the patients were under 30 years.

Pregnancies from the age of 35 onwards accounted for 22.8% of macrosomal births.

The frequency of births from 35 years of age found in this study is higher than that of the 2010 perinatal survey which was 19.2% [9].

Medical and obstetrical history

❖ **Parity**

In our study, 61% of the women were pauciparous, which is very different from the findings of the 2010 perinatal survey (33.9%) [9].

The 2010 perinatal survey found 43.6% primiparous women compared to 29.3% in our study [9].

❖ **Gestational diabetes**

Gestational diabetes was common (75%) in mothers with fetal macrosomia. We had no cases of insulin-dependent diabetes compared to 0.3% in the 2010 perinatal survey [9].

❖ **Obstetrical history**

A history of fetal macrosomia is a risk factor for recurrence of fetal macrosomia. Mothers had a history of fetal macrosomia in 28% of cases. It is associated with a risk of shoulder dystocia at delivery.

❖ **Body mass index**

The mean BMI was 25 kg/m2 in 52.46% of the mothers screened for macrosomia. The frequency of morbid obesity in this study was close to that of the 2010 national survey, 20% compared with 18.5%. In addition, the 2010 survey reported 17.5% of women as overweight and 9.9% as obese [9].

Pregnancy course

❖ **Total weight gain**

Total weight gain was greater than 12 kg for most mothers, corresponding to 50.8% of cases. This is slightly lower than the 2010 general population value of 13.3 kg [9]. However, these results remain above the norm and should alert us, as significant weight gain during pregnancy leads to fetal macrosomia [10].

Labour and delivery route

Regarding induction of labour, we find a higher rate than in the general population because we were only interested in inductions due to suspected fetal macrosomia.

Regarding the different routes of delivery, 57% of women detected with macrosomia delivered by spontaneous vaginal delivery and 6.50% by instrumental extraction.

This means that more than 63.5% of all deliveries were by vaginal delivery, a lower frequency than in the 2010 national survey (66.9%) of vaginal deliveries and 12.1% of instrumental extractions [9].

In our study we noted a caesarean section rate of 9.75%, which is lower than the national survey of 2010 (21%) [9]. Most of the caesarean sections indicated during labour were due to failure to fully dilate, stagnation or fetal-pelvic disproportion.

Indeed, a large 10-year study in Europe showed that in cases of fetal macrosomia there is a 10% risk of prolonged labour, 13% of emergency caesarean sections and 10.9% of instrumental extractions [11].

The child and neonatal status

❖ **The sex of the child**

In 2012, according to the National Institute of Demographic Studies (INED), there were more male than female births. We also found a male predominance (67%) [12].

❖ **Apgar score**

In our study, 89% of the newborns had an Apgar score greater than 7.

The 2010 national survey reported an Apgar score of less than 7.3% in the macrosomic group, a score close to ours [9].

❖ **Correlation between uterine height and child birth weight**

We found a low correlation coefficient of 0.01 between uterine height and birth weight of the child ($p < 0.05$).

A recent study found a higher correlation coefficient of 0.66 by coupling the measurement of uterine height with the Leopold manoeuvre, which is a method of abdominal palpation, during the active phase of labour. This study also states that the prediction of macrosomia remains difficult [13].

The results are very satisfactory between 37 and 40 weeks' gestation with a correlation coefficient of up to 0.71 between the clinical examination and birth weight [14].

This suggests that uterine height at term is more reliable.

❖ **Correlation between fetal weight estimation on ultrasound and birth weight of the child**

Our study showed a significant correlation between fetal weight estimation on ultrasound at the end of pregnancy and the birth weight of the child with a correlation coefficient of 0.56 ($p<0.05$).

Pregnancy monitoring in Europe

If we look at pregnancy monitoring on a European scale, some countries have increased monitoring at the end of pregnancy because of the greater maternal-fetal risks. In France, it is compulsory to have one consultation per month from the 4th month of pregnancy. This is more regular than in Sweden, Germany and the United Kingdom, where the frequency of consultations increases at the end of pregnancy, with visits every 2 to 3 weeks. However, they have an equivalent or even lower number of consultations than France. In addition, the content of consultations is the same in these countries as in France, with the measurement of uterine height systematically. We have seen that this measurement is recommended in 17 countries of the European Union because it is the simplest and most reproducible clinical means of evaluating foetal growth [15, 16].

In Sweden, pregnancy monitoring is less codified than in France because it is the consultation that determines whether or not complementary examinations are carried out. Pregnancy monitoring in Europe also differs in the number of ultrasounds. In France, Germany and Italy, 3 ultrasounds are recommended; one in each trimester. This is not the case in the UK, where there is no 3rd trimester ultrasound, nor in Sweden where there are one or two ultrasounds depending on the mother's age. When the mother is under 35, only one ultrasound is performed between 17 and 20 weeks In Sweden, pregnancy monitoring is less codified than in France because it is the consultation that determines whether or not complementary examinations are carried out.

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As we have seen previously, clinical and ultrasound measurements seem to be more reliable in late pregnancy [18, 19].

Strengths and limitations of this study

One of the strengths of this study is the fact that it was carried out in a level 2B maternity hospital with more than 2500 live births per year, but also the existence of few studies dealing with the effectiveness of uterine height measurement and ultrasound fetal weight estimation in the detection of fetal macrosomia in late pregnancy.

The main limitation of this study is the limited size of our sample and its retrospective design.

CONCLUSION

In our study conducted at the end of pregnancy, we were unable to show a clear correlation between uterine height and birth weight of the child. However, we did show a relationship between the ultrasound weight estimate and the birth weight.An abnormal measurement should lead to an additional ultrasound scan and increased clinical surveillance. Therefore, rigorous training in the technique of measuring uterine height and ultrasound biometrics should be required. It might be possible to consider, at least on signs of call, to accentuate the monitoring at the end of pregnancy or even to reorganise the monitoring of pregnancy in France with a particular attention at the end of pregnancy.

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Conflict of Interest: The authors declare no conflicts of interest related to this article.

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