MACROSOMIA

1. INTRODUCTION

Macrosomia is associated with an increased risk of maternal complications and fetal morbidity and mortality. For this reason, early detection of macrosomic fetuses during pregnancy is important, as well as their correct management and follow-up in order to avoid adverse perinatal outcomes.

2. DEFINITION

In fetal weight, we must distinguish two different aspects:

- **Large-for-gestational-age (LGA) fetus:** estimated fetal weight (EFW) greater than the **97th percentile** for a given gestational age (two standard deviations above the mean).
- **Macrosomia:** neonate with birth weight greater than **4000 g**, whatever the gestational age.

Therefore, during the ultrasound follow-up, we will speak of a large fetus for gestational age and the term macrosomia will be reserved for neonates weighing more than 4000 g at birth.

The theoretical prevalence of the macrosomia in developed countries ranges between 8 and 10%, although during the periodic follow-up of pregnancy many of these LGA fetuses are identified and, consequently, the real incidence of the macrosomia is lower.

3. RISK FACTORS

We differentiate between constitutional risk factors (present before pregnancy) and gestational factors (appear during pregnancy).

A. Constitutional

- Previous child > 4000 g.
- Pre-gestational maternal BMI (obesity and overweight).
- Multiparity (> 4).
- Ethnicity (African or Latin race).
- Maternal birth weight > 4000 g.

- Maternal age < 17 years.
- Previous diabetes.
- Paternal obesity.

B. Gestational

- Excessive weight gain during pregnancy (> 16 kg).
- Male sex.
- Chronologically prolonged gestation.
- Gestational diabetes.

Primary prevention: all pregnant women will be recommended a balanced diet, active regular physical and a correct anamnesis will be carried out with the aim of:

- Early detection of risk factors.
- In diabetic patients, achieve optimal glycaemic control.
- In case of obesity, decrease in pre-pregnancy weight.
- In patients with normal weight: avoid excessive weight gain during gestation.

4. DIAGNOSIS

The ultrasound estimation of fetal weight requires 3 steps:

- A correct assignment of the gestational age of the fetus.
- The estimation of fetal weight using fetal biometry. The EFW will be calculated according to the algorithm that includes biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC), and femur length (FL) (Hadlock FP AJOG 1985). The abdominal circumference (AC) is the most important parameter to predict the risk of macrosomia, since it is the one that has the greatest impact on the estimation of estimated fetal weight.
- Estimation of weight percentile adjusted for gestational age, EFW, fetal sex and number of fetuses.

The positive predictive value of ultrasound for predicting birth weight increases as we get closer to the due date. For this reason, an ultrasound performed early in the third trimester has a low positive predictive value for birth weight.

Thus, depending on the gestational age of the ultrasound control, we will be more or less strict when considering a fetus as LGA and starting the corresponding study and follow-up:

- **< 37 weeks:** the diagnosis of an **LGA fetus** will be made when an **EFW greater than the 97th percentile** is observed in **two consecutive ultrasound controls** separated by 3-4 weeks.

- **> 37 weeks:** only **an ultrasound control with EFW > p97** will be necessary to make the diagnosis of a LGA fetus.

A particular case will be **patients with pregestational or gestational diabetes**, in whom **a single ultrasound control with EFW > p97** will be enough to consider the fetus as LGA and therefore initiate the corresponding controls.

5. STUDY AND MONITORING

Given the diagnosis of a large fetus due to gestational age, the following will be requested:

- The Oral Glucose Tolerance Test (**OGTT**) to rule out gestational diabetes. Although sometimes we will have a late diagnosis of gestational diabetes, this will be important to optimise glycaemic controls during the final phase of pregnancy and during delivery.
- Ultrasound with a **detailed morphological study** in order to rule out associated malformations.

Obstetric monitoring:

- **LGA associated with gestational/pre-gestational diabetes:**
  - Ultrasound control every 3-4 weeks assessing EFW and fetal well-being, including assessment of amniotic fluid (the appearance of polyhydramnios would be indicative of poor glycaemic control), fetal movements and middle cerebral artery pulsatility index (MCA-PI), which is the Doppler parameter that can best detect the fetal hypoxia that can occur in these fetuses.

- **Isolated LGA:**
  - Does not require additional monitoring. A weight control ultrasound will be scheduled at 38-39 seconds to assess the end of pregnancy.

6. END OF PREGNANCY

In LGA fetuses, **a growth control ultrasound will be scheduled between 38-39 weeks:**

- In case of **EFW > 4500 g, in diabetic patients, or EFW > 5000 g, in non-diabetic patients**, pregnancy will be completed by **elective caesarean section from week 39**.
  (The difference in weight in the indication is based on the fact that the LGA fetus of the diabetic patient is characterised by asymmetric growth of the abdominal

circumference, with excess accumulation of muscle and fat in the fetal abdomen and scapular area, increasing the risk of shoulder dystocia compared with fetuses born to non-diabetic mothers).

- In the case of EFW **> 4000 g (corresponds to p97 at 39 weeks), the end of pregnancy will be proposed at 39 weeks** in order to reduce the incidence of maternal and fetal complications during childbirth. It will be scheduled as a high-risk induction of uterine hyperstimulation.

7. LGA COMPLICATIONS

Complications of large-for-gestational-age fetuses can be summarised as:

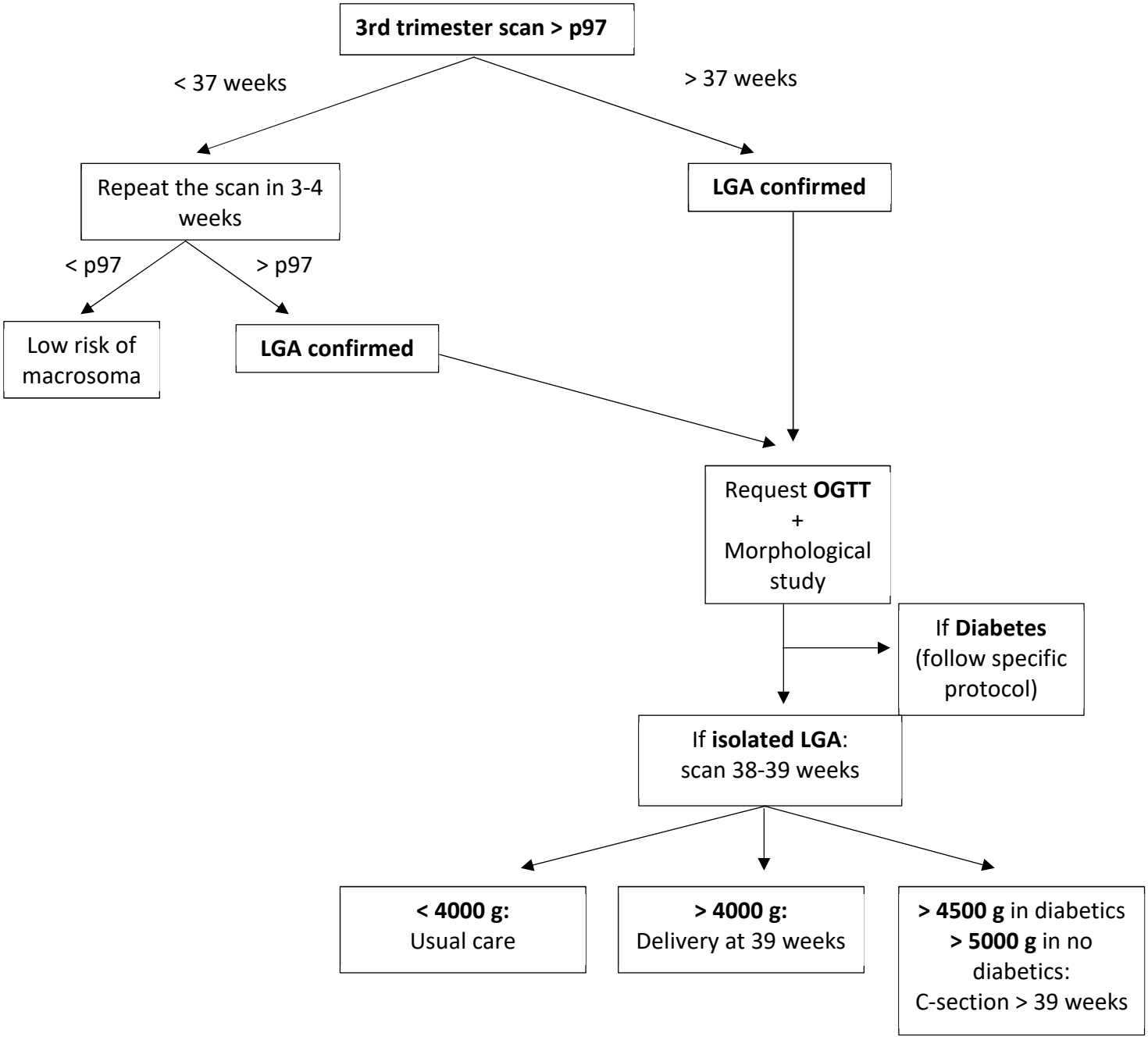
a) Maternal:
- Instrumental delivery.
- Caesarean section (x2).
- Perineal injuries.
- Postpartum haemorrhage.
- Uterine rupture.

b) Fetal:
- **Shoulder dystocia**. This is the main complication. As secondary complications we found: brachial plexus injury (x20) and fractures (x10).

c) Neonatal:
- **Hypoglycaemia:** by stopping the supply of glucose by the placenta.
- **Polycythaemia:** due to the increased production of erythropoietin as a result of hypoxia caused by increased oxidative demand associated with hyperglycaemia and hyperinsulinaemia.
- **Hyperbilirubinaemia:** secondary to polycythaemia.
- **Perinatal asphyxia:** more marked in children of diabetic mothers, due to the increase in intrauterine oxygen utilisation by hyperglycaemia and hyperinsulinaemia.
- Higher frequency of admissions and longer stay in **neonatal ICU**.
- **Neonatal mortality**.

d) Childhood and later: (in children of diabetic mothers)
- Obesity.
- Impaired glucose tolerance.
- Metabolic syndrome.
- Cardiac remodelling.

8. ALGORITHM



**LGA: large-for-gestational-age; OGTT: oral glucose tolerance test; g: grams; c-section: caesarean section.*

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ANNEX 1: GENETIC SYNDROMES ASSOCIATED WITH MACROSOMIA

Pallister-Killian	Diaphragmatic hernia, polyhydramnios, fetal hydrops, cardiac malformations, limb shortening
Beckwith-Wiedemann	Omphalocele, umbilical hernia, diastasis recti, macroglossia
Sotos	Macrocephaly, dolichocephaly, central nervous system disorders, congenital heart disease
Weaver	Retrognathia, hypertelorism, macrocephaly, scoliosis
Marshall-Smith	Micrognathia, craniosynostosis, hydrocephalus, agenesis of the corpus callosum
Periman	Polyhydramnios, macrocephaly
Costello	Polyhydramnios, increased nuchal fold, hydrops, short long bones, anomalous position of hands/feet, ventriculomegaly, macrocephaly
Simpson-Golabi-Behmel	Congenital heart disease, cleft palate, polydactyly
Megalencephaly-capillary malformation and polymicrogyria syndrome	Progressive macrocephaly, hydrocephalus, congenital cardiopathy, frontal bossing, polydactyly, limb asymmetry, polyhydramnios, hydrops, pleural effusion