Intrauterine Growth Retardation (IUGR): Epidemiology and Etiology

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Abstract

Intrauterine growth retardation (IUGR) is mainly due to a pathologic slow-down in the fetal growth pace, resulting in a fetus that is unable to reach its growth potential. IUGR frequency will vary depending on the discrimination criteria adopted. It is extremely important to use local or national fetal growth graphs in order to avoid some confounding factors.

IUGR incidence in newborns would be between 3% and 7% of the total population. In our experience it is 5.13%, a figure similar to the one obtained by other authors but with a progressively higher incidence during the last decade.

There are multiple maternal factors that can generally be grouped into constitutional and general factors given that they affect age, weight, race, maternal cardiac volume, etc, socioeconomic factors with key incidence in the mother’s nutrition level, where a poor maternal nutrition level would be the key factor in this group. We have evaluated multiple factors as possible contributors to the IUGR risk: race, parents’ age, mother’s height (cm), mother’s birth weight and before pregnancy (kg), ponderal gain and blood pressure during pregnancy, and previous SGA newborns. Socioeconomic factors like social class, parents’ profession, habitual residence, salary, immigration, and diet were also evaluated. We also included variables such as total daily working time and time mothers spent standing up, daily sleeping time (hrs), stress self-perception test at work and primiparity age. Toxic factors during pregnancy: tobacco (active and passive), alcohol, drugs and coffee consumption. Fetal or utero-placental factors were considered.

In our study, the most significant etiologic factors were: Active and passive tobacco consuming, mother’s stress level, increase of total months worked during pregnancy, total daily working hours and time mothers spent standing up and finally, the parent’s height.

Our data support the main objective of reducing the incidence of SGA newborns after IUGR by fighting against tobacco from all fields, including the passive smoking habit, and improving the laboral conditions of the pregnant mother, lowering the number of daily hours worked, the physical activity and trying to avoid and to cope with stressful situations.


Key words: SGA; Epidemiology; Ethiology

Introduction

Intrauterine growth retardation (IUGR) is mainly due to a pathologic slow-down in the pace of fetal growth, resulting in a fetus that is unable to reach its growth potential. That requires a good balance between this and the environment in which it develops during pregnancy. There are ethnic, racial and individual variations that must be taken into account in order to classify a newborn as Small for Gestational Age (SGA) due to IUGR.

Although from a conceptual point of view the situation may be evident, actual identification may be more complex. We accept the statistical definition, accepted by most neonatologists, that a newborn who is small for gestational date, is one whose weight falls below the 10th percentile. Other authors take the 3rd percentile in the fetal growth graphs as the reference threshold, the mean limit less two standard deviations in the weight index (See Definition in this issue).

IUGR frequency will vary depending on the discrimination criteria adopted: 3 vs. 10 percentiles, -1 vs. -2σ, the gestational age calculation method used and population differences (individual and ethnic variations, socioeconomic level, etc.). It is extremely important to create fetal growth
graphs on the autochthonous population in order to avoid calculation errors.

IUGR incidence in newborns would be between 3 and 7% of the total population (1,2). In our experience it is 5.13% (Figure 1), a figure similar to the one obtained by other authors but with a progressively higher incidence during the last decade (3).

Newborns with IUGR constitute a very heterogeneous group with multiple etiology in most cases. It is extremely important to identify the etiologic factors causing this condition since both the prenatal diagnosis and the subsequent monitoring will depend on them.

Some authors classify etiologic factors as intrinsic and extrinsic (4). However it is hard to differentiate when the fetus, placenta, and mother all affect fetal growth development, hence the need to divide the root causes into three groups: maternal, fetal and uteroplacental causes.

There are multiple maternal factors that can generally be grouped into constitutional and general factors given that they affect age, weight, race, maternal cardiac volume, etc, and socioeconomic factors among which a poor maternal nutrition level would be the key factor in this group. The monitoring of the weight gain during pregnancy is extremely important in order to monitor fetal growth properly. There are alarming situations such as weight gains below 3 kg. up to week 20 or a weight gain below 1 kg. per month during the second half of the pregnancy (5).

We have evaluated multiple maternal factors as contributors to IUGR risk. We considered the following variables: race, parents’ age, mother’s height (cm), weight before pregnancy (kg) and weight gain during pregnancy, IUGR cases in prior newborns and socioeconomic factors: social class, parents’ profession, habitual residence, salary, immigration, diet and diet supply. We also included variables such as total daily working time and time mothers spent standing up, daily sleeping time (hrs), stress self-perception test at work, primiparity age, toxic factors during pregnancy: tobacco, alcohol, drugs, coffee consumption, fetal or uteroplacental factors and high blood pressure with and without preeclampsia.

**Casuistics**

We performed a prospective case-control study in consecutive newborns and a retrospective evaluation of data for each one of them: 100 SGA newborns as compared with 100 controls of normal pregnancies. The sample selection was aleatory and the limitation of sample size has possibly affected the number of variables to study.

The test for being included in SGA cases was any newborn whose weight fell below the 10th percentile. Excluded from both groups were malformed newborns, chromosomopathies, intrauterine infection, multiple pregnancies and also other organic pathology in the mothers.

The statistical analysis was performed using the computer-based SPSS 11.0 (Statistical Package for the Social Sciences) program. Pearson’s test and multivariate analysis of logistic regression application were used to analyze the qualitative variables. The Modified Graffar Scale and stress self-perception test were used for studying socioeconomic factors.
Results

We present only the results in the situations with significant statistical differences between SGA cases compared to normal controls.

Among the maternal and paternal constitutional factors, the mother’s height (Figure 2), prior newborns small for date and the lack of weight gain during the second half of pregnancy have the most influence in the incidence of new SGA cases.

Among socioeconomic factors worthy of mention are the incidence of physically intensive work-related activity for the mother, large number of hours worked per day (Figure 4 y 5), and additional stress (Figure 3).

As expected, we have confirmed the negative effect of active and passive tobacco exposure as the most important external avoidable factor (Figure 6) (6). Control group smokers (18%) 5.8 cig/day vs 10.44 cig/day in SGA group (48%).

Comments

Tobacco, alcohol and drugs are toxic factors that cause lack of weight gain in the fetus. The cause and effect relationship between tobacco and lack of fetal weight gain in newborns to mothers who smoke 10 or more cigarettes per day is widely documented (7). Additionally, tobacco consumption in a pregnant woman leads to lower food consumption levels, thereby contributing to the weight reduction of the newborn. Lately, the negative effect of tobacco on placental development due to the absence or diminished effect of the epidermal growth factor (EGF) has been proved (8). Similarly, alcohol reduces fetal weight, which has been confirmed both experimentally and in real human cases. The weight of newborns whose mothers consumed high levels of alcohol is reduced (9,10). On the other hand, the alcoholic fetal syndrome was established long ago with perfectly defined characteristics. The reduction in weight, height and head circumference is important as well as other alterations and malformations that configure in this syndrome (11).

The intimate acting mechanism of drug addiction on the reduction of some of the parameters of fetal growth is
unknown to date, although it has been demonstrated how, mainly heroin but also cocaine, marihuana, etc. cause a significant reduction in fetal weight.

Maternal illnesses are closely related to IUGR and, among them all, the most relevant are high blood pressure and toxemia or preeclampsia. According to Carrera et al. (12), utero-placental ischemia is responsible for intrauterine retardation as well as other alterations that accompany it such as fetal stress due to the reduction in oxygen consumption by the placenta. The histopathologic study of placentas in these cases shows evidence of multiple infarcts and deposits of fibrin material in the villous and intervillous vessels.

Among the maternal obstetric factors, the marginal or velamentose insertion of the placental cord (13) and the presence of areas of stroke in the placenta were significantly associated with the presence of SGA newborns (14).

There are other factors of fetal origin such as chromosomopathies, malformation syndromes, twins, intrauterine infections, etc., that have an unfavorable effect on fetal growth and development.

In our study, the more significant etiologic factors were: tobacco (increase of number of daily cigarettes) stress level in the mother, increase of total months worked during pregnancy, more total daily working hours and time mothers spent standing and finally, the parents’ height.

It is evident that there are several etiologic factors producing IUGR but all of them act through common pathogenic mechanisms. This is done primarily by reducing the intrinsic growth potential, uteroplacental vascular deficiency with modifications in the supply line and combined etiopathogenic mechanisms.

The genetic potential can be altered by inhibiting cellular development and growth thereby triggering a reduction in the fetal growth potential.

On other occasions, the retardation is produced by a reduction in the supply of nutrients and oxygen to the placenta as well as by an alteration of the transport or transfer through it. Maternal malnutrition is the most frequent cause of IUGR in some countries, the intensity of growth retardation depending on the degree of malnutrition and above all its duration.

By means of combined etiopathogenic mechanisms, a special IUGR can be generated in those IUGR caused by infectious embryopathies as well as those caused by tobacco abuse. In the latter, there are several mechanisms that reduce fetus weight: high levels of carboxyhemoglobin in maternal blood, deviation of the hemoglobin dissociation curve, the nicotine vessel effect and alterations to the mother’s nutrition, anemia, insufficient placental perfusion due to lower plasma volumes in the mother, etc.

**Prevention**

Prophylactic measures must obviously be taken before gestation, mainly in the selected population. Once growth retardation has set in, the chances of improving it are very slim, especially during the last trimester.

Our data support the main objective of reducing the incidence of SGA newborns after IUGR by fighting against tobacco from all aspects, including the passive smoking habit, and improving the labour conditions of the pregnant mother, lowering the number of daily hours worked, physical activity and trying to avoid and to cope with stressful situations.
Thus it is essential to optimize the socioeconomic, physical, nutritional and psychic conditions of the woman, eliminating toxic habits and making the correct diagnosis and treatment of pathology related to IUGR. Subsequently, early identification must be made of any pregnanat women at risk of suffering an IUGR, i.e. all those pregnant mothers with some of the previously mentioned risk factors. However, it must be said that the cause of approximately one third of IUGR cases cannot be identified due to the absence of known IUGR risk factors.

Summary

In our experience the IUGR incidence is 5.13% with progressively higher incidence in the last decade. We have evaluated multiple maternal factors as contributors to the IUGR risk. We considered the following variables: race, parents’ age, mother’s height, weight before pregnancy and weight gain during pregnancy, IUGR cases in prior newborns. Socioeconomic factors include social class, parents’ profession, habitual residence, salary, immigration, diet and diet supply. We have also included variables such as total daily working time, stress self-perception test at work, primiparity age. Toxic factors during pregnancy: tobacco, alcohol and drugs, coffee consumption. Fetal or uteroplacental factors, and high blood pressure with or without preeclampsia.

Statistical analysis was carried out using the computerised SPSS 11.0 program, the Pearson test and multivariant analysis of logistic regression application to analyze the qualitation variables.

Among the constitutional factors, the mother’s height and prior small for date babies and poor weight gain in the second half of the pregnancy are the ones that most influence the incidence of SGA cases. Physically intensive work, high numbers of hours worked daily, perception of stress and time that mothers spent standing, are the most important socioeconomic factors. We have confirmed the negative effect of passive and active tobacco use as being the main cause among the toxic factors.

Disclosures

The authors have nothing to disclose

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