

**THE EFFECTS OF GESTATIONAL DIABETES AND INFANT SEX ON THE
INCIDENCE OF BRACHIAL PLEXUS INJURY****Elhadi Araibi¹, Fatma Alashkham², Altayeb Elazomi*³, Abd Alla A. Mohamed⁴, Taher M. Abdelhameed⁴, Heba
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ABSTRACT

The brachial plexus is a bundle of nerves that carry signals from the spinal cord to the shoulder, arm, hand, and fingers. Brachial plexus birth palsy (BPBP) primarily involving the C5-C6 (the upper trunk) and sometimes the C7 (the middle trunk) of the brachial plexus. Studies have shown that several risk factors including fetal, maternal, and labor factors are responsible for the incidence of brachial plexus injury. The aim of the study was to assess the effect of maternal factor of gestational diabetes and the fetal factor of infant gender on the incidence of brachial plexus injury. 170 patients were admitted to physiotherapeutic center of Abogalasha in the city of Zawia, Libya between July 2012 and July 2017. From the clinic records, information including the maternal age, number of deliveries, incidence of gestational diabetes, birth weight, degree of macrosomia, degree and location of brachial plexus injury were collected and statistically analyzed. *Results:* Among 170 patients, the most frequent indication for admission of infants to the physiotherapeutic center was Erb's palsy in 124 patients (72.94%), followed by muscle atrophy in 27 patients (15.88%), and hypoesthesia in 19 patients (11.18%). Among 124 cases with Erb's palsy, 108 patients (87.1%) were born to mothers with gestational diabetes mellitus (GDM). Out of 108 patients, 74 patients (59.68%) were males, and 34 patients (27.42%) were females. There were 16 patients with Erb's palsy (13%) born to non-gestational diabetic mothers. Of these babies, 9 patients (7.26%) were males, and 7 patients (5.65%) were females. The type of delivery was vaginal delivery in most of patients. The incidence of Erb's palsy is a multifactorial in which both maternal factor of gestational diabetes and fetal factor of male gender are affecting the incidence of the disorder than any of these factors alone. Therefore, gestational diabetes mellitus and male gender both would be indicators for C/S to avoid the incidence of Erb's palsy.

KEYWORDS: Erb's palsy, Gestational diabetes mellitus, Infant gender.**INTRODUCTION**

The brachial plexus is a network of nerves that carry signals from the spinal cord to the shoulder, arm, hand, and fingers. Brachial plexus birth palsy (BPBP) involves injury to any nerve of the brachial plexus during birth. Erb's Palsy as an injury primarily involving the C5-C6 (the upper trunk) and sometimes the C7 (the middle trunk) of the brachial plexus.^[1,2] Brachial plexus injury can cause poor functions of the upper limb before recovery, and sometimes the functions cannot be fully recovered. It has been reported that Erb's Palsy occurs as a result of poor handling of the newborn during or after delivery.^[3] Furthermore, several maternal risk factors including gestational diabetes, multi-parity and having a previous child with a brachial plexus injury have been identified as major causes of this disorder. Maternal factors can cause fetal macrosomia and/or shoulder

dystocia, especially when using forceps or suction-associated deliveries that might cause traction nerve injury.^[4] Among maternal risk factors is the third type of diabetes which is called gestational diabetes mellitus (GDM). GDM is a form of diabetes that occurs during pregnancy. With this defect, there is an increase in blood glucose levels or glucose intolerance during pregnancy.^[5] GDM usually disappears after pregnancy. However, 35–60% of women with GDM will continue to have high blood glucose levels after delivery. These women usually develop type 2 diabetes, in years following the pregnancy.^[6,7] GDM results in fetal hyperglycemia. Therefore, hyperglycemia produces pancreatic islet cell (β cell) hyperplasia and fetal hyperinsulinism. Insulin is a growth hormone causes accelerated fetal growth and the extra glucose in the fetus is stored as body fat causing macrosomia.^[8,9] The fetus is prone to central growth,

with the trunk relatively large compared to the head. It has been shown that fetal exposure to intrauterine hyperglycemia is a risk factor for childhood overweight.^[10] We hypothesize that the incidence of brachial plexus injury is due to existence of maternal and fetal factors and its rate of incidence is determined by co-exist of these factors. Therefore, our study is to evaluate the role of GDM and the fetal gender on the incidence of brachial plexus injury.

MATERIAL AND METHODS

Sample collection

The population in this retrospective study included 170 records of babies with different defects who were referred to the physiotherapeutic Clinic at Abogalasha (in the city of Zawia) in the period between January 2011 to January 2017. Birth weight, patients' gender, and maternal blood glucose levels were recorded. The babies' information including age at which Erb's Palsy was diagnosed, and weight of the babies were also recorded. The data extraction sheet also captured information about the physiotherapy treatment. This included duration of physiotherapy, frequency and the content of physiotherapy.

Data analysis

The collected data were captured on a Microsoft Excel spreadsheet in preparation for analysis.

RESULTS

Among 170 patients, the most frequent indication of infants' admission to the physiotherapeutic center was Erb's palsy in 124 patients (72.94%), followed by muscle atrophy in 27 patients (15.88%), and hypoesthesia in 19 patients (11.17%). Among 124 cases with Erb's palsy, 108 patients (87.1%) were born to mothers with GDM. Out of 108 patients, 74 patients (59.68%) were males, and 34 patients (27.42%) were females. There were 16 patients with Erb's palsy (12.9%) born to non-gestational diabetic mothers. Of these babies, 9 patients (7.25%) were males, and 7 patients (5.65%) were females.

The incidence of brachial plexus injury among other birth injuries

Among 170 patients, the most frequent indication of infants' admission to the physiotherapeutic center was Erb's palsy in 124 patients (72.94%), followed by muscle atrophy in 27 patients (15.88%), and hypoesthesia in 19 patients (11.17%) as shown in figure 1.

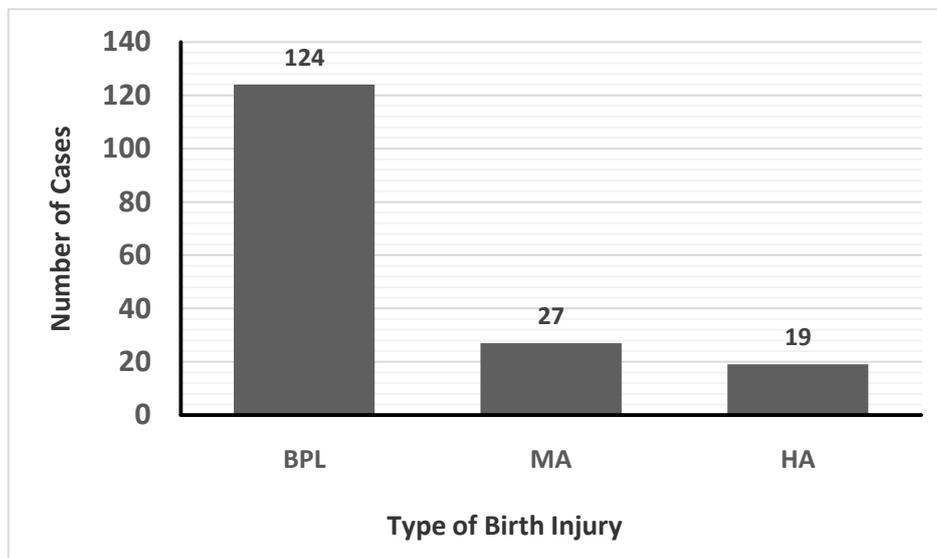


Figure 1: Shows the incidence of brachial plexus injuries among other birth injuries. The most cases referred to the clinic were diagnosed as Erb's palsy in 124 cases (72.94%), followed by muscle atrophy in 27 cases (15.88%), and 19 cases (11.18%) with loss of sensory stimuli known as hypoesthesia.

Effect of gestational diabetes on baby birth weight

Results showed that there is a higher birth weight among babies born to diabetic mothers especially male babies compared with birth weight of babies born to non-diabetic mothers as shown in figure-2. The average weight of male babies born to diabetic mothers was 4.68 kg, whereas the average weight of male babies born to non-diabetic mothers was 2.97 kg. The average weight of female babies born to diabetic mothers was 3.23 kg, whereas the average weight of female babies born to non-diabetic mothers was 2.85 kg.

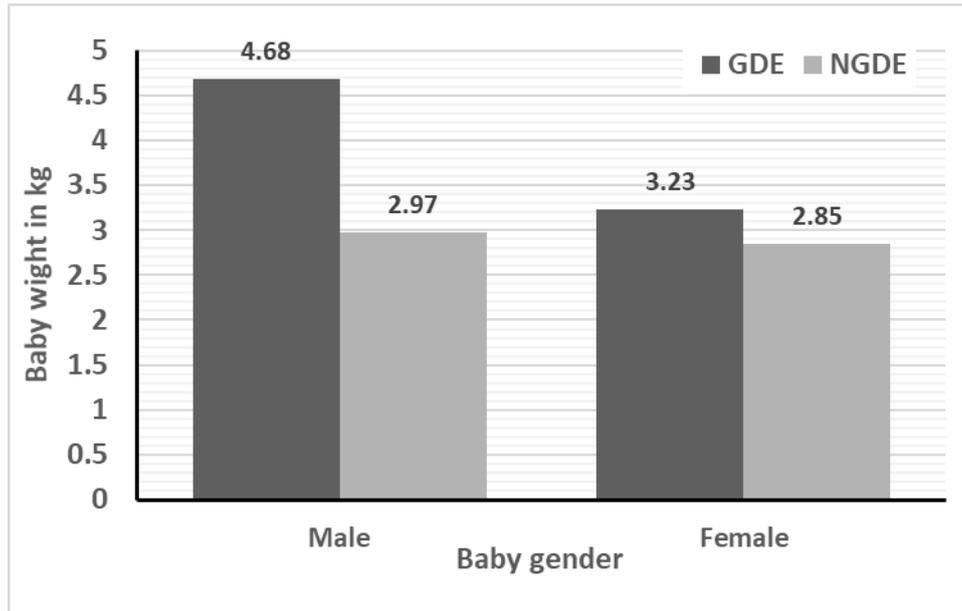


Figure 2: The effect of baby gender and mother diabetes status on baby weight. Male babies born to diabetic mothers (GD) have higher birth weight compared to female babies born to diabetic mothers and male and female babies born to non-diabetic mothers (NGD).

The collective effect of gestational diabetes and baby gender on the incidence of brachial plexus injury

Results data showed that male babies born to diabetic mothers have the highest incidence of Erb's palsy (59.68%) compared to all the others. The female babies born to diabetic mothers also have a high incidence of

Erb's palsy (27.42%). Both male and female babies born to non-diabetic mothers have low incidences of Erb's palsy with percentages of 7.26% and 5.65% respectively as shown in figure-3.

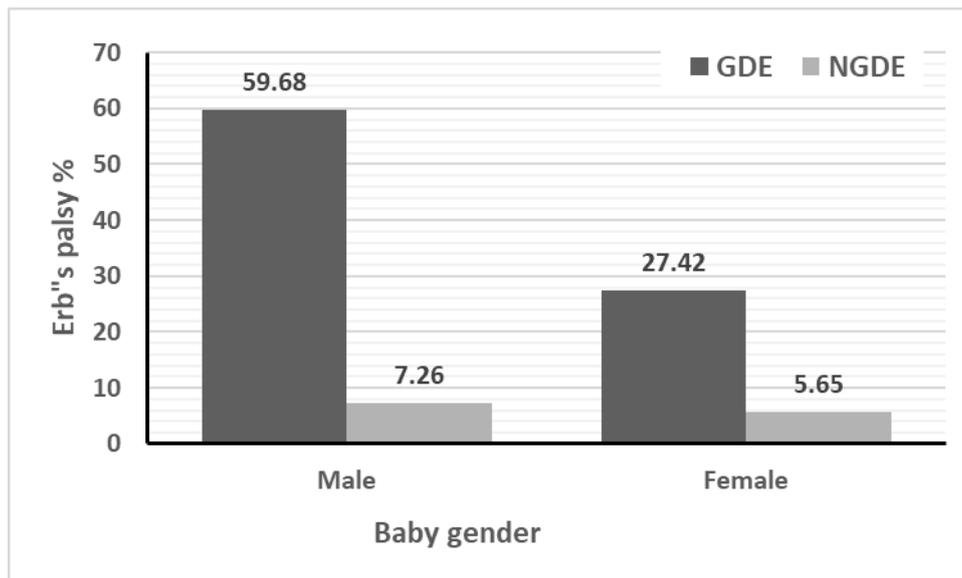


Figure 3: The effect of gestational diabetes and baby gender on the incidence of brachial plexus injury. Male babies born to diabetic mothers showed the highest percentage of Erb's incidence, then the female babies born to diabetic mothers. The Erb's incidence for both Male and female babies born to non-diabetic mothers was much lower.

DISCUSSION

Gestational diabetes mellitus (GDM) is defined as glucose intolerance of variable degrees with an onset, or first recognized, during pregnancy. Among the complications of GDM, macrosomia is the most

prominent. The high amounts of maternal glucose passing through the placenta stimulate fetal insulin secretion, leading to increased growth factors and macrosomia.^[11] Macrosomia is particularly responsible for increased frequency of difficult labor, and

predisposing to Erb's palsy and asphyxia.^[12] The prevalence of macrosomia incidence is 7-9% in the non-diabetic population, whereas this rate has been reported up to 16-45% in case of GDM.^[13] A study from Switzerland including 3322 mothers with GDM reported macrosomia as the most important cause of morbidity associated with birth trauma and asphyxia.^[14] Macrosomia is typically defined as a birth weight above or equal 4,000 g. It may affect 12% of newborns of normal women and 15-45% of newborns of women with GDM. Fetal macrosomia is a 3-fold higher rate when compared to normoglycemic controls. Additionally, obesity has partial role in the prevalence of macrosomia; it has been shown that the newborns of obese women had more than double the risk of macrosomia compared to those of women with normal weight.^[15] Our data showed that a strong positive correlation between GD and incidence of macrosomia among babies born to diabetic mothers. Our results are consistent with the findings collected from previous Studies that had indicated a significant correlation between fetal birth weight and second- and third-trimester postprandial blood sugar levels.^[16] Macrosomic fetuses in diabetic pregnancies develop a unique pattern of overgrowth, involving the central deposition of subcutaneous fat in the abdominal and interscapular areas.^[17] Because fetal head size is not increased, but shoulder and abdominal girth can be markedly augmented, the risk of Erb's palsy, shoulder dystocia and brachial plexus trauma is more common. However, skeletal growth is largely unaffected.^[18]

Pregnant women carrying a boy have a 4% higher relative risk of GDM than those carrying a girl. The fetus thus may have previously unsuspected effects on maternal glucose metabolism in pregnancy.^[19] It has been shown that male fetus was associated with poorer β -cell function, higher postprandial glycemia, and an increased risk of GDM in the mother. Thus, fetal sex potentially may influence maternal glucose metabolism in pregnancy.^[20] It has been suggested that gender is a risk factor for insulin resistance in intrauterine gestational life; the study showed that carrying a female fetus decreases the risk of insulin resistance in the mother, from as early as the first trimester.^[21] Our results showed that the birth rate of macrosomic male babies from mothers with GD was higher than birth rate of macrosomic babies from non-diabetic mothers. As macrosomia causes a labor difficulty results in Erb's palsy, it has been suggested that male infant has an impact role on the incidence of GD. Our study is consistent with the previous studies. Therefore, gestational diabetes, macrosomia, and brachial plexus injuries may be affected by the infant gender.

CONCLUSION

The incidence of Erb's palsy is a multifactorial in which both maternal factor of gestational diabetes and fetal factor of male gender have strong effects on the incidence of the disorder than any of these factors alone. Therefore, gestational diabetes mellitus and male gender

both would be indicators for C/S to avoid the incidence of Erb's palsy.

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