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Original Research Article

Perinatal outcome in intracytoplasmic sperm injection conception versus spontaneous conception: a retrospective study

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ABSTRACT

Background: Aim of the study was to compare the perinatal outcome between intracytoplasmic sperm injection (ICSI) conception and spontaneous conception. The retrospective analysis of perinatal outcome between the ICSI conception and spontaneous conception was conducted in Institute of Reproductive Medicine, Madras Medical Mission Hospital, Chennai.
Methods: All singleton babies delivered in Institute of Reproductive Medicine between January 2023 to December 2023 had been included in this study. Patient selection was done based on inclusion and exclusion criteria. All data regarding the study variables were collected from the maternal and newborn case sheets, neonatal intensive care unit (NICU) register and parturition register retrospectively and chi square test was used to analyse the statistical significance.
Results: In this study, 50 spontaneous conceptions and 50 ICSI conceptions were included. The advanced maternal age (p=0.00015), gestational age at delivery (p=0.003), mode of delivery (p=0.003), birth weight (p=0.005), and Apgar score at 5 min (p=0.004) were found to be statistically significant. The incidence of intrauterine growth restriction (IUGR), NICU admissions, lower segment caesarean section (LSCS) rate, Doppler changes, and need for antenatal steroids was also found to be higher in the ICSI conception group.
Conclusions: This study concluded ICSI conception is associated with higher chances of adverse perinatal morbidity in comparison with spontaneous conception. Further studies in large scale are needed to bring out the exact mechanism of these complications associated with these adverse perinatal outcomes.

Keywords: Maternal age, Perinatal outcome, ICSI conception, Assisted reproduction, Natural conception

INTRODUCTION

In the recent years the accessibility to assisted reproductive technology (ART) has been drastically increased allowing many infertile couples to conceive through these advanced techniques.[1] The ART protocols have been modified over years based on their safety and efficacy. The high-risk pregnancies are increasing among the ART pregnancies than the spontaneous conceptions in the recent years.[2,3]

The increase in risk of complications in ART pregnancies could be due to following factors like influence of the milieu of the follicles, egg cell quality through ovarian stimulation, influence of sperm preparation, manipulation of the fertilization procedure through intracytoplasmic sperm injection (ICSI) and imprinting defects. Inspite of many couples conceiving with help of assisted reproduction techniques, the studies about the maternal health, perinatal morbidity and mortality is still conflicting and not clear.

Various studies have found that the assisted conceptions are associated with preterm birth, intra uterine growth retardation ,gestational diabetes, pre-eclampsia, low birth

weight, and increased rates of caesarean sections.[3,4] However some studies have pointed out the low perinatal morbidity in comparison with the spontaneous conceptions.[4,5] This study is conducted to focus and analyze the literature gap in identifying the perinatal outcome in terms of morbidity and mortality in spontaneous conceptions and ICSI conceptions.

METHODS

This is a retrospective study conducted in Institute of Reproductive Medicine, The Madras Medical Mission Hospital. The institutional scientific and ethical committee approval was obtained.

Inclusion criteria

All singleton babies delivered in Institute of Reproductive Medicine between January 2023 to December 2023 had been included in this study. Maternal age between 20 to 35 years of age, both spontaneous and ICSI conceptions were included in this study.

Exclusion criteria

Multiple pregnancies, conception by ovulation induction or intrauterine insemination, and post fetal reduction were excluded from this study.

All data regarding the study variables were collected from the maternal and newborn case sheets, NICU register and parturition register retrospectively. Maternal age, parity, maternal comorbidities, mode of conception, gestational age during delivery, mode of delivery, birth weight, umbilical cord arterial and venous PH, Apgar score at 1 and 5 minutes, NICU admission, anomalies diagnosed after birth, sex of baby, fetal Doppler changes in antenatal period, antenatal steroid administration, and presence of IUGR were taken as study variables to assess the perinatal outcome in the newborn.

Statistical analysis

Statistical analysis of the collected data is done by Chi square test to establish the differences in the perinatal outcome between spontaneous and ICSI conception and their significant association with each variable is given by p value (Tables 1 and 2). P value <0.05 is considered as statistically significant.

RESULTS

In this study total 100 singleton pregnancies were taken for analysis out of which 50 belonged were IVF conceptions and 50 were spontaneous conceptions. Maternal age was categorized into three categories as less than or equal to 25 years, 26 to 30 years and more than 30 years (Table 1). Many women were found to be older than 30 years in the IVF group (72%), whereas majority of women in spontaneous conception belonged between 26 to 30 years of age (62%).

Age was found to be statistically significant (p=0.00015) indicating that increased maternal age is associated with higher perinatal morbidity. In the IVF group 90% of women were primiparous and only 10% women. Out of 50 women in spontaneous conception 72% were primi and 28% were multiparous. In spontaneous conception 60% women had delivery by term, whereas in the assisted conception 68% of women had delivery before 37 weeks of gestation.

Elective LSCS was found higher in the ICSI conception and out of 50 women, 22 went for elective and 19 women delivered by emergency LSCS (Table 1). On comparing the rate of normal vaginal delivery, it was found that spontaneous conception group had higher rate (50%), where as in ICSI group it was only 18%. The risk for LSCS is found to be 32% more in the assisted conception than spontaneous conception group.

Table 1: Distribution and analysis of variables.

Variables	IVF N (%)	Spontaneous, N (%)	P value
Age (years)			
≤25	1 (2)	4 (8)	
26 to 30	13 (26)	31 (62)	0.00015
>30	36 (72)	15 (30)	
GA at delivery (weeks)			
≤34	6 (12)	0 (0)	
35 to 37	28 (56)	20 (40)	0.003
>37	16 (32)	30 (60)	
Mode of delivery			
Vaginal	9 (18)	25 (50)	
Elective LSCS	22 (44)	12 (24)	0.003
Emergency LSCS	19 (38)	13 (26)	
Birth weight (kg)			
≤2.5	24 (48)	9 (18)	
2.6 to 3.0	14 (28)	19 (38)	0.005
>3.0	12 (24)	22 (44)	
NICU admission	15 (30)	8 (16)	0.09
IUGR	10 (20)	3 (6)	0.03
APGAR at 1 min			
≤8	9 (18)	3 (6)	0.06
>8	41 (82)	47 (94)	
APGAR at 5 min			
≤8	2 (4)	2 (4)	0.06
>8	48 (96)	48 (96)	0.04

Birthweight was categorized into three, as ≤2.5 kg, 2.6 to 3 kg and more than 3 kg and it was found that many new born were found to have birthweight less than 2.5 kg (48%) in assisted conception group but babies weighed more than 3 kg (44%) in the spontaneous conception group. Hence the statistical analysis showed that gestational age at

delivery (p=0.003), mode of deliver (p=0.003) and birth weight of the baby (p=0.005) impacts the perinatal outcome of the child.

High number of NICU admissions (30%) and IUGR babies (20%), low APGAR values were found in babies born out of assisted conception in comparison with the spontaneous conception group (Table 2). No significance was found in the umbilical blood gas analysis both in the arterial and venous sample. The risk of low birth weight (30%), NICU admissions (31%) IUGR (53%) more in ICSI group.

Table 2: Distribution and analysis of variables.

Variables	IVF N (%)	Spontaneous N (%)	P value
Arterial pH			
≤7.2	4 (8)	6 (12)	0.33
>7.2	46 (92)	44 (88)	
Venous pH			
≤7.2	3 (6)	4 (8)	0.31
>7.2	47 (94)	46 (92)	
Arterial base excess			
≤8	43 (86)	38 (76)	0.20
>8	7 (14)	12 (24)	
Venous base excess			
≤8	41 (82)	37 (74)	0.33
>8	9 (18)	13 (26)	

Many women who had ICSI conception also had co morbid complications like hypothyroid, diabetes and gestational hypertension where as in spontaneous conception was found to have lesser maternal complication. The fetal complications were also found to be higher in ICSI group (56%), where 12% fetus had doppler changes before delivery and 38% fetus required antenatal steroid administration before delivery. In spontaneous conception group, 8% of fetus had doppler changes and only 14% required antenatal steroids.

This study concludes that spontaneous conception was found to have better perinatal outcome as ICSI conception had higher number of LSCS, IUGR babies, high NICU admissions post-delivery, need for antenatal steroids, low birth weight, preterm delivery and doppler changes in the fetus (Tables 1 and 2).

DISCUSSION

The maternal age has a great impact on the oocyte quality which in turn determines the pregnancy outcome. Various studies identified the relation between perinatal outcome and advanced maternal age. In these studies, it was found that advanced maternal age is associated with compromised oocyte quality which is evident by the adverse perinatal outcome like preterm birth, IUGR, intrauterine death and leads to maternal complications like gestational diabetes, and preeclampsia.[2,6] This study further emphasizes the significance of maternal age on perinatal outcome (Table 1).

The gestational age and mode of delivery plays an important role in the perinatal outcome according to various literatures.[3,7] In a study by Pavlovic et al, he concluded that preterm births are more common in assisted conception (p<0.001) but the mode of delivery does not hold any statistical significance.[7] In contrary to this our study found that rate of LSCS (32%) was higher in ICSI conception group and the cause depends on various medical as well as social factors as these are considered to be precious pregnancies.

The birth weight of the baby plays an important role in the perinatal period as it determines the progress in their health status. Willem et al analyzed the perinatal outcome between natural and assisted conception in 1655 singleton pregnancies and found that low birthweight and prematurity are statistically significant in relation to high perinatal morbidity and mortality.[8] However this study did not find any difference in perinatal outcome caused by other factors like maternal age, mode of delivery, maternal and fetal complications, NICU admissions, and congenital anomalies in counter to this present study.

The role of Apgar scores and umbilical cord blood gas analysis was clearly explained in a study by Armstrong et al, in terms of diagnosis acidosis and its cause in the newborn.[9] These values predict the perinatal morbidity and mortality pertaining to NICU admission and further medical interventions in the newborns. This study found that Apgar scores at 5 minutes of life had statistical relevance regarding perinatal outcome as it was found to be lower in the assisted conception group similar to the study by Dimaling et al.[10]

Ferrira et al concluded that umbilical blood gas analysis as an independent predictor in managing neonatal hypoxia and acidosis.[11] On the other hand this study did not discover any statistical relevance in blood gas analysis between the ICSI conception and spontaneous conception group. As the ICSI conceptions are considered as high risk pregnancies, the close monitoring during antenatal period helps in diagnosing IUGR and placental insufficiency at the early stages.[12] This helps in early intervention to prevent any adverse perinatal outcome. Larcher et al found that ICSI conceptions are associated with increased placental insufficiency which is evident by the umbilical doppler changes and high incidence of IUGR in babies born through assisted conceptions further substantiating this present study results.[13]

The modern medical techniques have evolved over years in assisted reproduction to bring out a healthy pregnancy outcome. However, in comparison with natural conceptions, the assisted conception found to have higher adverse perinatal morbidity and mortality.[6,8,14,15] The ICSI conceptions have many confounding factors like advance maternal age and age related maternal comorbidities which

in turn worsens the maternal health during pregnancy leading to poor perinatal outcome. This study highlights the importance of close antenatal monitoring in ICSI conceptions to diagnose these complications in both mother and fetus for early intervention and to bring out a better perinatal outcome in these precious pregnancies.

CONCLUSION

This study concludes that the adverse perinatal outcome is higher in the ICSI conception than spontaneous conception. The maternal age, gestational age at delivery, mode of delivery, birth weight, Apgar score was statistically significant emphasizing their role in the perinatal morbidity and mortality. Higher incidence of LSCS, intrauterine growth restriction, NICU admissions and doppler changes, maternal complications were also seen in the ICSI conception group. This illustrates the reason for considering the assisted conceptions as high-risk pregnancies. Further studies in large scale are needed to bring out the exact mechanism of these complications associated with these adverse perinatal outcomes.

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