

Morphometry of Human Placenta in Natural Conception and Assisted Reproduction with its Clinical Significance

Ananthi V¹, Rajkumar D², Muniappan V³

¹Tutor, Department of Anatomy, Rajah Muthiah Medical College, Annamalai University, Chidambaram, ²Dean, Faculty of Medicine, Rajah Muthiah Medical College, Annamalai University, Chidambaram, ³Professor and Head, Department of Anatomy, Rajah Muthiah Medical College, Annamalai University, Chidambaram.

Abstract

Introduction: Placenta is a mirror which reflects the antepartum status of fetus in utero. Our present study aimed to analyse the morphometry of placenta in normal and assisted reproduction. **Subjects and Methods:** 30 Placentas of natural conception and 42 placentas of assisted reproduction (18 cases of singleton pregnancies, 12 cases of twin pregnancies) were collected from OG department, Rajah Muthiah Medical College and from private fertility centre in and around Chidambaram immediately after delivery. Morphometric dimensions of placenta like thickness, diameter, area, number of cotyledons were measured placental weight, fetal weight were also measured. **Results:** Placental weight of natural conception was 489 ± 107.84 grams, 316.78 ± 88.24 grams in assisted reproduction. Thickness of placenta was 2.767 ± 0.68 cm in natural conception, 1.78 ± 0.68 cm in assisted reproduction. Number of cotyledons, fetal weight, feto - placental ratio were also reduced in assisted reproduction. **Conclusion:** This is the first study to analyse the morphometric dimensions of placenta in natural conception and in assisted reproduction. Overall there was a reduction in all dimensions of placenta in assisted reproduction. This will be useful for pediatricians who handle the newborns of assisted reproduction.

Keywords: Assisted Reproduction, Placenta, Morphometry, Feto-Placental Ratio.

Corresponding Author: Dr. Rajkumar D, Dean, Faculty of Medicine, Rajah Muthiah Medical College, Annamalai University, Chidambaram.

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Introduction

The placenta is the principle site of nutrient and gas exchange between mother and fetus, It acts as a mirror which reflects the fetal outcome. The placenta and fetal membranes perform special functions like protection, nutrition, respiration excretion and hormone production. It has two components

- i. The fetal portion is formed by villous chorion
- ii. The maternal portion is formed by deciduas basalis, the part of decidua (Uterine endometrium) which is related to the fetal component of the placenta.^[1]

The placenta is generally attached to the posterior wall of uterus near fundus. The site of attachment is determined by the point where the blastocyst becomes embedded. The maternal surface of the placenta is finely granular and mapped into some 15 – 20 lobes by series of fissures of grooves(fig 1). The lobes are otherwise known as cotyledons. This maternal surface is also referred as “Dirty Duncan”. Fetal surface is smooth, covered by amnion with umbilical cord attachment(fig 2). It is otherwise known as “placental Roof or Shini-Scultze”.^[2]

The umbilical cord is generally attached near the centre of the fetal surface and branches of the umbilical vessels radiate

out under the amnion from this point; the veins being deeper and larger than the arteries. There are many pathological form of placental adherence which includes accrete, increta, percreta.

The placenta is a flattened discoid mass. It may be circular or oval in shape. It has an average weight of 470 g, an average diameter of 18.5cm, and an average thickness of 23 mm. It is thick at centre, thin at periphery.^[3] The total number of cotyledons remain same throughout the gestation, but individual cotyledons continue to grow till term by Crawford.^[4]

Assisted Reproduction

Assisted reproduction is a technique, where the gametes are manipulated artificially and fertilized embryo can be re-inserted into the mother’s womb.

Assisted reproductive technique (ART) is an inestimable gift to the infertile couple those who exhausted by trying various infertility treatments. But there are many fall-outs in ART newborns like pre term birth, low birth weight, genetic disorders etc,. There are various methods in ART like Invitro fertilization (IVF), Gamete Intrafallopian transfer (GIFT), Intracytoplasmic sperm injection (ICSI).In our present study, we have collected the placentas from ICSI technique followed cases. Most of the cases in IVF

pregnancies are twin babies, the placentas and fetal membranes in those cases are Diamniotic Dichorionic [Figure 3].

Intracytoplasmic Sperm Injection

Spermatozoa sometimes fails to fertilize even when they are artificially placed in close proximity to eggs during conventional in vitro fertilization(IVF).Fertilization failure in IVF is particularly common where there are gross abnormal semen parameters or number of spermatozoa is insufficient. The placing of spermatozoan beneath the zona has yielded consistent results. The Intracytoplasmic sperm injection procedure entails the deposition of single spermatozoan directly into the cytoplasm of the oocyte, thus bypassing the zona pellucida and oolemma.^[5]

Our present study aimed to analyse the morphometric parameters of placenta in natural conception and in assisted reproduction.

Subjects and Methods

30 Placentas of natural conception and 42 placentas of assisted reproduction (out of 42, 18 cases are singleton pregnancies, 12 cases are from twin pregnancies) were collected from OG department, Rajah Muthiah Medical College and Hospital and from Private Fertility Centre in and around Chidambaram. Human ethical committee clearance was obtained before sample collection .Placentas were washed in running tap water to remove blood clots .Fetal surface and maternal surface were examined for placental cysts, calcification, Infarction, Membranes were trimmed and placental weight were measured using electronic weighing machine. Thickness of placenta, diameter of placenta was measured using measuring tape, metal ruler and compass. Maternal surface was examined and cotyledons number were counted [Figure 1]. Fetal weight was measured using electronic weighing machine. Feto placental ratio was calculated. Area of placenta was also calculated using diameter values.

Statistical Analysis:

Statistical analysis was performed using SPSS. The data obtained from the study was compiled and expressed as mean ± standard deviation. Mann – whitney test were performed. Two tailed t- test was done z values are also tabulated. P value of < 0.05 was taken as significant.

Results

Table 1: Clinical findings of natural conception and assisted reproductive pregnancies

S.No	Clinical Parameters	Normal (mean)	ART(mean)
1	Maternal age	28.33	32.93
2	Gestational age	37.03	36.16
3	Mode of Delivery	Caesarean	Caesarean
4	HB	11.07	11.77
5	APGAR Score	9/10	8/10

Thickness, Diameter and area of placenta were measured; number of cotyledons was also counted. Fetal weight, placental weight and feto-placental ratio were also measured and tabulated. There was a significant increase in the

maternal age of assisted reproduction when compared to natural conception [Table 1].Gestational age reduced in assisted reproduction [Table 1].

Table 2: Morphometric findings of Placenta

S.No	Parameters	Normal Mean ± Std. Deviation	ART: Mean ± Std. Deviation	Z Value	P Value
1	Thickness of Placenta (cm)	2.767 ± 0.679	1.781 ± 0.681	5.27	0.000
2	Diameter of Placenta (cm)	18.233 ± 2.763	16.881 ± 2.287	1.977	0.048
3	Area of Placenta (cm ²)	266.79 ± 83.23	227.70 ± 60.61	1.732	0.083
4	No. of Cotyledons	13.967 ± 2.773	9.714 ± 2.382	5.595	0.000

P< 0.05 is significant

Table 3: Placental and Fetal weights of two groups

S.No	Parameters	Normal Mean ± Std. Deviation	ART Mean ± Std. Deviation	Z Value	P Value
1	Placental weight (gms)	489 ±107	316.78 ± 88.21	5.73	0.0000
2	Fetal weight (kgs)	2.92 ± 0.45	2.417 ± 0.56	3.693	0.0000
3	Feto-Placental ratio	6.15 ± 1.223	8.127 ± 2.89	3.524	0.0000

P< 0.05 is significant



Figure 1: Maternal Surface of Placenta with Cotyledons.

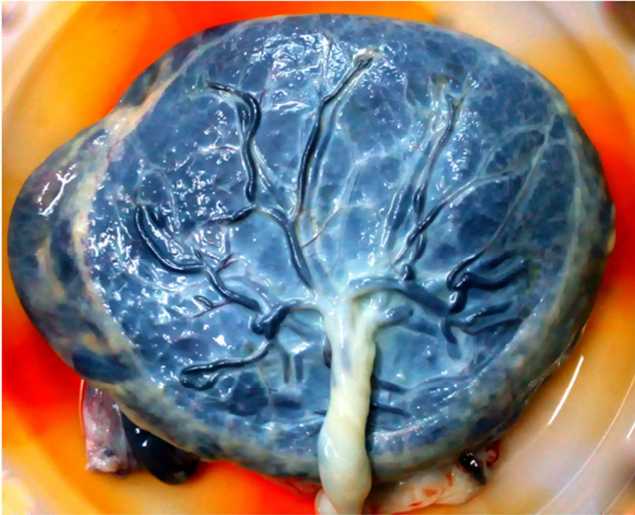


Figure 2: Fetal Surface of Placenta with Radiating Umbilical Vessels.



Figure 3: Placenta of Twin Pregnancy with Double Umbilical Cord.

Discussion

Placenta is a leading cause of maternal and perinatal mortality.^[6] Placenta reflects the most accurate record of prenatal life of an infant; it undergoes many changes in its dimension throughout the gestation.^[7]

The intrauterine growth and survival of fetus is dependent on placenta. It is a foeto – maternal organ shares the same stress and strain, to which the fetus is exposed. So any diseases affecting the mother and foetus, also affects the placenta.

According to Ambedkar Raj Kulandaivelu et al,^[8] the mean thickness of placenta was 1.42 cm, thickness was reduced in Pregnancy Induced Hypertension (PIH). In our present study, the mean thickness of placenta was 2.767 ± 0.679 cm in Natural conception, 1.781 ± 0.681 cm in assisted reproduction [Table 2].

According to Michel Yampolsky et al,^[9] abnormality of the placental vasculature affects the placenta thickness, resulting

in a small baby for given placental weight.

In Udaina A and Jain ML et al,^[10] mean weight of placenta was 495 grams in control group, 435 grams in mild PIH cases, 371.43 grams in severe PIH group. In our present study the mean weight of placenta was 489 grams in Natural conception, 316.78 in Assisted reproduction [Table 3].

According to Hosemann et al,^[11] in normal term pregnancy the mean placental weight was 400 – 1000 grams, where as Wigglesworth et al,^[12] found placental weight to be 360 – 570 grams. In our present study the mean placental weight was 489 ± 107 grams in Natural conception, 316 ± 88.24 grams in assisted reproduction. There was a significant reduction in the placental weight of assisted reproduction. These changes may affect the fetal growth indirectly.

The examination of placenta in utero as well as postpartum provides much insight into the prenatal growth of the infant and mother.^[13]

In Gunapriya et al,^[14] paucity of cotyledons was noted in PIH cases. In our present study, number of cotyledons was significantly reduced in assisted reproduction when compared to natural conception [Table 2].

According to Chakravorthy et al,^[15] mean placental weight of 410 grams in mild hypertension, 350grams in severe hypertension. The transverse diameter of placenta was significantly reduced in pre eclampsia group by Teasdale et al,^[16] in our present study the mean diameter of placenta was 18.23 ± 2.76 cm in Natural conception 16.88 ± 2.28 cm in assisted reproduction [Table 2]. There was a significant reduction in the placental diameter in assisted reproduction.

In cibils et al,^[17] placentas from hypertensive patients were significantly smaller than the normal.

In Kotgirwar et al,^[18] there was a significant reduction in the foeto – placental ratio and placental dimensions in case of idiopathic intrauterine growth retardation. In the present study, foeto-placental ratio was 6.149:1 in Natural conception, 8.13:1 in assisted reproduction [Table 3]. These results were varied from previous studies.

In the present study mean area of placenta was 266.76 ± 83.23 cm² in Natural conception, 277.70 ± 60.61 cm² assisted reproduction [Table 2].

We concluded that there was a significant reduction in the dimensions of placenta in assisted reproduction. Foeto-placental ratio was increased in assisted reproduction.

To the best of our knowledge, this is the first study to analyze the morphometric dimensions of placenta in assisted reproduction in our Indian population.

Conclusion

Our present study results showed that there was a significant reduction in all the dimensions of placenta in assisted reproduction. These placental maldevelopment may affect the fetal growth and development. These results would be useful for Neonatologists who handle the newborns of ART mothers. These results would be useful for obstetrician and gynecologists who handle infertile cases.

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