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Original Research Article

Relationship between placental thickness and amniotic fluid index in single uncomplicated pregnancy

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Abstract

Background: An essential but transient organ develops in the uterine lining during pregnancy; this is the placenta. Nutrition, respiration, endocrine, immunological, and excretion are the main functions of the placenta for the foetus. Amniotic fluid plays an important role in musculoskeletal and pulmonary development of foetus. For normal amniotic fluid amount, a normally developed placenta is required. Thus the present study was conducted to assess the correlation between placental thickness and amniotic fluid index in third trimester in single uncomplicated pregnancies.
Aim and Objectives: To understand the relationship between placental thickness and amniotic fluid index.
Materials and Methods: A prospective case control study was conducted at GBCM & Dr. KKBM hospital, Dehradun, from August 2023 to February 2024. During this time, 100 Antenatal women who were carrying a singleton foetus and were in the third trimester (26-42 weeks) were ultrasonography evaluated. Cases having foetal congenital anomalies, placental abnormalities, multiple foetal gestations, maternal medical and gynaecological disorders, and maternal obstretical complications were excluded.
Results: Third trimester results showed an average placental thickness of 3.90±1.1 cm and an average amniotic fluid index (AFI) of 125.20±38.5.however, no significant correlation of placental thickness with gestational age was seen, No significant correlation of placental thickness with AFI was seen.
Conclusion: The amniotic fluid index and placental thickness were shown to have a linear relationship that was inversely correlated but not statistically significant.

Keywords: Placental thickness (PT), Amniotic fluid index (AFI), Pregnancy, Foetal, Placental.

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1. Introduction

An important topic of research in obstetrics is the association between placental thickness and the amniotic fluid index (AFI). This relationship provides insights regarding foetal health and the development of the placenta. Ultrasound measurements taken during pregnancy must include both the placental thickness (PT) and the amniotic fluid index (AFI).[1] The treatment of pregnancies, particularly those with complications such as gestational diabetes, preeclampsia, or intrauterine growth restriction (IUGR), can be greatly improved by gaining a better understanding of their interaction. One of the most important organs that grows within a pregnant woman is the placenta, which filters the blood of the developing baby and supplies it with oxygen and nutrients.[2] It clings to the uterine wall and, via the umbilical cord, links to the infant. Because the placenta helps the developing baby throughout the course of the pregnancy, its health is an important measure of the fetus's overall health. Ultrasound measurements of placental thickness are useful indicators of placental health.[3] As the pregnancy advances, the normal placental thickness typically rises, which is correlated with the gestational age. Problems may arise if the placental thickness is outside of the typical range. As an

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example, gestational diabetes or placental abruption might be indicated by a thicker placenta, whereas intrauterine growth restriction (IUGR) or placental insufficiency could be linked to a thin placenta.[4]

1.1. The Amniotic fluid index (AFI)

Foetal development is influenced by the amniotic fluid, a protective liquid that surrounds the foetus in the amniotic sac. It plays a crucial role in fetal muscular development by providing space and cushioning to foetus, facilitates better mobility, and helps in maturation of the lungs and digestive system.[5] Foetal urine output, swallowing, and maternal variables all have a role in the ever-changing amount of amniotic fluid.[6]

An ultrasound-based quantitative assessment of amniotic fluid is known as the amniotic fluid index (AFI). It is calculated by taking the vertical depths of the greatest amniotic fluid pocket in each of the four quadrants of the uterus and adding them together.[7] A typical AFI ranges from 8 to 18 cm. Problems such as foetal renal malformations or placental insufficiency can be indicated by oligohydramnios (AFI < 5 cm), whereas other foetal anomalies, gestational diabetes, or other maternal problems might be linked to polyhydramnios (AFI > 24 cm).[8] Deviations from this range can also signal additional disorders.

1.2. Interrelationship between placental thickness and AFI

There are a lot of factors at play in the complicated relationship between placental thickness and AFI. The placenta and the dynamics of the amniotic fluid are affected by the same physiological and pathological processes, which in turn influence both parameters. Conditions like maternal hypertension or diabetes, for instance, have the potential to influence amniotic fluid levels by changing the shape and function of the placenta. New evidence points to a possible association between aberrant placental thickness and abnormal AFI.[9] Polyhydramnios may be linked to a larger placenta as a result of increased foetal urine production, which can occur as a result of diseases such as gestational diabetes. On the other hand, oligohydramnios may occur in pregnancies with a thin placenta because of placental insufficiency, which causes the foetus to produce less urine.[10]

Important therapeutic considerations stem from the correlation between placental thickness and AFI. Additional research and careful monitoring are usually warranted in the event of abnormalities in either measure. For example, in order to rule out gestational diabetes, glucose tolerance tests may be necessary if there is a thicker placenta and a high AFI. Additional testing for foetal growth limitation and placental insufficiency may be necessary in cases when the placenta is thin and the AFI is low. Keeping an eye on these metrics also aids in the prompt treatment of possible issues.[11] For instance, oligohydramnios, which is characterised by a thin placenta, may call for an early birth to forestall complications, whereas polyhydramnios may call for measures to alleviate the mother's pain and delay the onset of labour.[12] One important area of attention in obstetric treatment is the link between placental thickness and the amniotic fluid index. Indicators of foetal well-being and gestational age are both provided by these metrics. Together, they can illuminate possible problems and direct therapeutic treatment to improved maternal and foetal outcomes.[13]

2. Materials and Methods

The present case control study was done from August 2023 to February 2024 in the Department of Obstetrics and Gynaecology, GBCM and Dr. KKBM Hospital in Dehradun. For this study, one hundred (100) pregnant women who were in their third trimester (26–42 weeks) were screened. Patients that were recruited were split into four groups based on their gestational age. Participants were women who provided written informed permission during an uncomplicated, singleton pregnancy lasting more than 26 weeks.

This study did not include any cases of foetal congenital abnormalities, placental anomaly, maternal medical disorders, maternal gynaecological diseases, or maternal obstetrical diseases. Prior first trimester ultrasound results verified the gestational age. The model LOGIQTM α 200 and the L&T Medical Sonata (version 3.1) ultrasound machines, equipped with a curvilinear 3.5 MHz transducer, were used for all the ultrasound examinations obeying PCPNDT rules 1996.

2.1. Exclusion criteria

Cases having foetal congenital anomalies, placental abnormalities, multiple foetal gestations, maternal medical and gynaecological disorders, and maternal obstretical complications were excluded.

2.2. Thickness (T) of placenta

Placental thickness was measured at the umbilical cord insertion by placing caliper at this point and other in a perpendicular direction at the level of basal plate of placenta.

2.3. Amniotic fluid index (AFI)

To get AFI, we added the vertical lengths of the four uterine quadrants, deepest fluid pockets. If no foetal component or umbilical cord was visible in such places, AFI was considered. Also checked for serious congenital defect in the foetus. We captured and saved the ultrasound pictures.

An Excel sheet was used for the transmission of data. Statistical software STATA 11.2 was used for data analysis.

3. Results

A total of 100 subjects were evaluated. **Table 1** show, Out of them with gestational age of 26 to 30 weeks, 30 to 34 weeks, 34 to 38 weeks and 38 to 42 weeks, the number of subjects were 21%, 26%, 41% and 12% respectively. Among subjects with gestational age of 26 to 30 weeks, 30 to 34 weeks, 34 to

38 weeks and 38 to 42 weeks, mean placental thickness was 3.56 cm, 4.01cm, 4.05cm and 3.75cm respectively (**Table 2**). Among subjects with gestational age of 26 to 30 weeks, 30 to 34 weeks, 34 to 38 weeks and 38 to 42 weeks, mean Amniotic fluid index (AFI) was 144.5mm, 134.18mm, 119.52mm and 91.41mm respectively. (**Table 3**)

A mean amniotic fluid index (AFI) of 125.20±38.5 mm and a mean placental thickness of 3.90±1.1 cm were determined during the third trimester. It was noted that the volume of amniotic fluid reduces as the placental thickness grows with gestational age. Nevertheless, a decline in both the mean placental thickness and the amniotic fluid index was noted in the last gestational group, which corresponds to 38 to 42 weeks of pregnancy.

Table 1: Distribution of subjects according to gestational age

Gestational age weeks)	Number	Percentage
26-30	21	21
30-34	26	26
34-38	41	41
38-42	12	12
Total	100	100

Table 2: Placental thickness according to gestational age

Gestational age (weeks)	Mean(cm)	SD
26-30	3.56	0.8
30-34	4.01	1.2
34-38	4.05	1.3
38-42	3.75	0.8
Total	3.90	1.1

Table 3: AFI according to gestational age

Gestational age (weeks)	Mean(mm)	SD
26-30	144.5	45.5
30-34	138.18	32
34-38	119.52	35.5
38-42	91.41	11.7
Total	125.2	38.5

Table 4 shows the correlation between gestational age, placental thickness (PT), and amniotic fluid index (AFI). The average placental thickness peaks between 34 and 38 weeks of gestation, after fluctuating throughout 26–42 weeks of pregnancy. At 26-30 weeks, AFI is 144.50 mm, but it drops to 91.41 mm at 38-42 weeks, indicating a diminishing tendency with rising gestational age. It is worth mentioning that placental thickness and AFI do not correlate linearly. However, differences in these measures across different gestational age bands indicate that the foetal body may undergo physiological adjustments. Further study is needed to fully understand the links between placental thickness, amniotic fluid dynamics, and foetal growth, since these findings suggest a complex interaction.

Table 4: Correlation of placental thickness (PT) with Amniotic fluid index (AFI**)**

Gestational age (wks)	Thickness(cm) Mean±S.D	Amniotic fluid index (mm) Mean±S.D.
26-30(n=21)	3.5±0.8	144.50±45.5
30-34(n=26)	4.01±1.2	134.18±32.0
34-38(n=41)	4.05±1.3	119.52±35.5
38-42(n=12)	3.73±0.8	91.41±19.7
Total(n=100)	3.90±1.1	125.20±38.5

Regression analysis revealed a linear relationship between the amniotic fluid index and placental thickness. The following equation was obtained from the analysis:

$$AFI = 125.5 – 0.7 * PT$$

In this context, PT stands for placental thickness and AFI for amniotic fluid index. If the thickness of the placenta rises by one unit, the amniotic fluid index will drop by 0.7 units, as shown in the previous calculation. The association was not statistically significant since the p-value was >0.05.

4. Discussion

During its brief lifetime, the placental shape often undergoes significant changes. Placental changes associated with the "Ageing" phenomena are likely to occur in tandem with the placenta's ongoing development and are thus likely to be a component of the maturation process. Immature villi are visible all the way to term since the placenta continues to develop until the 37th week of pregnancy.[14,15] The significance of placental disease should be evaluated statistically and evaluated in connection to fetal growth and maturation in order to fully understand the lesions' impact. One possible indirect indicator of the foeto-placental circulation is the placental thickness. It could be a sign of how much the mother and foetus exchange in terms of chemicals (gases, nutrients). Placental infarction, intrauterine growth retardation, essential hypertension, and preeclampsia are all potential causes of a thin placenta.

As the pregnancy progresses, the researchers found that the placenta becomes thicker. In our study, we noted that the mean placental thickness begins to decrease beyond a certain point, which was 38 weeks, despite this, the placenta is still growing by expanding its surface area. One possible explanation for hydramnios is that the placenta and intervillous space are squeezed due to the increased amniotic pressure. It remains to be seen, however, if this rationale can adequately account for the observed decline in placental thickness in healthy pregnancies, which occurs even after a decline in AFI. Therefore, in order to address the fore mentioned questions, more study and inquiry with a wide population is required.

There was no statistically significant relationship between placental thickness and amniotic fluid volume in

oligohydramnios patients was reported by Gupta et al.[12] The link between placental thickness and amniotic fluid index was examined in normal and polyhydramnios pregnancies by Akgunduz et al.[16] They hypothesised an inverse relationship between the two groups based on their finding that patients with polyhydramnios had considerably thinner placentas than the control group. In line with previous research, we found that a reduction in AFI was associated with an increase in placental thickness.

5. Conclusion

Normal placenta and adequate amniotic fluid, both are crucial for normal growth and development of fetus. In our research a linear but inverse correlation was observed between AFI and placental thickness .AFI significantly correlated with gestational age but no significant correlation of gestational age and placental thickness was found. Although placental thickness and AFI are correlated in normal pregnancies, the association is not statistically significant. In cases of hydramnios, for example, the only time placental thickness decreases statistically with increasing AFI is when AFI exceeds a certain threshold. The complex processes behind this connection need more investigation in order to improve prenatal care and maternal-fetal outcomes. To further understand the clinical consequences and temporal dynamics of this association throughout pregnancy, longitudinal studies are crucial. However, these findings add to our knowledge of prenatal physiology and might help doctors make better decisions when monitoring fetuses and dealing with pregnancy problems.

6. Source of Funding

None.

7. Conflict of Interest

None.

8. Ethical Approval

Ethical No.: GBCM/IEC/2023/11-03.

References

1. Aplin JD, Myers JE, Timms K, Westwood M. Tracking placental development in health and disease. *Nat Rev Endocrinol*. 2020;16(9):479–94. https://doi.org/10.1038/s41574-020-0372-6.
2. Rawal S, Ray S, Sharma N. Correlation between ultrasonographic placental thickness and adverse fetal and neonatal outcomes. *Cureus*. 2024;16(3):e56410. https://doi.org/10.7759/cureus.56410.
3. Nagwani M, Sharma PK, Rani A, Singh U, Mehrotra S. To study the correlation between placental thickness and amniotic fluid index (AFI) in third trimester of uncomplicated pregnancy in Indian females. *J Anat Sci*. 2018;25(2):74–7.
4. Appiah PK. Relationship between the morphology of the placenta, umbilical cord and perinatal outcome. Retrieved from knust.edu.gh, 2009
5. Fox H. The morphological basis of placental insufficiency. *J Obstet Gynaecol India*. 1975;25(6):441–50.
6. Habib FA. Prediction of low birth weight infants from ultrasound measurement of placental diameter and placental thickness. *Ann Saudi Med*. 2002;22(5-6):312–4. https://doi.org/10.5144/0256-4947.2002.312.
7. Bower SJ, Flack NJ, Sepulveda W, Talbert DG, Fisk NM. Uterine artery blood flow response to correction of amniotic fluid volume. *Am J Obstet Gynecol*. 1995;173(2):502–7. https://doi.org/10.1016/0002-9378(95)90273-2.
8. Fisk NM, Vaughan J, Talbert D. Impaired fetal blood gas status in polyhydramnios and its relation to raised amniotic pressure. *Fetal Diagn Ther*. 1994;9(1):7–13. https://doi.org/10.1159/000263900.
9. Ding H, Ding Z, Zhao M, Ji B, Lei J, Chen J, et al. Correlation of amniotic fluid index (AFI) and placental aquaporin 1 (AQP1) levels in terms of preeclampsia. *Placenta*. 2022;117:169–78. https://doi.org/10.1016/j.placenta.2021.12.010
10. Sherer DM, Ward K, Bennett M, Dalloul M. Current Perspectives of Prenatal Sonographic Diagnosis and Clinical Management Challenges of Nuchal Cord(s). *Int J Womens Health*. 2020;12:613–31. https://doi.org/10.2147/IJWH.S211124.
11. Emam A, El-Bassioune W, Hassan Emam A, Oun AE. Relation between placental thickness measurements and fetal outcome in patients with Intra-Uterine Growth Restriction (IUGR). *Int J Med Arts*. 2020;2(3):559–66. https://doi.org/10.21608/ijma.2020.22101.1078.
12. Gupta A, Musharaf S, Singh G, Gupta A. Morphological changes in placenta in cases of oligohydramnios. *Int J Reprod Contracept Obstet Gynecol*. 2018;7:1518–22. https://doi.org/10.18203/2320-1770.ijrcog20181347.
13. Vinchurkar KN, Aiyappan SK, Kumar CP, Shanmugam V, Singh A. Correlation of placental thickness with gestational age in second and third trimester using ultrasonography. *Egypt J Radiol Nucl Med*. 2023;54(1):164. https://doi.org/10.1186/s43055-023-01112-y.
14. O'Brien K, Wang Y. The placenta: A maternofetal interface. *Annu Rev Nutr*. 2023;43:301–25. https://doi.org/10.1146/annurev-nutr-061121-085246.
15. Carroll A, Desforges M, Jones CJP, Heazell AEP. Morphological and functional changes in placentas from prolonged pregnancies. *Placenta*. 2022;125:29–35. https://doi.org/10.1016/j.placenta.2022.01.009.
16. Akgündüz E, Erkılınç S, Tokmak A, Güzel Aİ, Özer İ, Danışman N. Decreased placental thickness and impaired Doppler indices in idiopathic polyhydramnios: a prospective case-control study. *J Matern Fetal Neonatal Med*. 2015;28(6):722–5. https://doi.org/10.3109/14767058.2014.929660.

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