Accurancy of the sonographic determination of estimated fetal weight in anhydramnios

Maximilian Rauh (maximilian.rauh@barmherzige-regensburg.de)
Krankenhaus Barmherzige Bruder Regensburg https://orcid.org/0000-0002-7910-566X
Kathrin Rasim
University of Regensburg
Boerge Schmidt
University Hospital of Essen
Annegret Schnabel
University Department of Obstetrics and Gynecology At The Hospital St. Hedwig of The Order of St. John, University of Regensburg
Angela Köninger
University Department of Obstetrics and Gynecology At The Hospital St. Hedwig of The Order of St. John, University of Regensburg

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Research Article

Keywords: anhydramnios, estimated fetal weight, Hadlock formula, limit of viability, sonographic estimation accuracy, reduced amniotic fluid

Posted Date: April 14th, 2022

DOI: https://doi.org/10.21203/rs.3.rs-1530684/v1

Abstract

Purpose

To determine whether the presence of anhydramnios significantly influences the sonographic estimated fetal weight (EFW) compared to a matched sample with normal amniotic fluid volume.

Methods

The study sample of our retrospective case-control study consisted of 114 pregnant women who presented to our Level I Perinatal Center between 2015 and 2020. 57 of them with an anhydramnios and a matched sample of 57 women with normal amniotic fluid volume. At time of admission, gestational age varied between 22+4 and 42+6 weeks of pregnancy. All underwent detailed ultrasound assessment for EFW and amniotic fluid index. To determine EFW we used Hadlock's estimation formula I, which is based on measurements of biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC) and femur length (FL). The EFW was compared with the weight at delivery in cases and controls. The maximum time interval between measurement and delivery was 5 days.

Results

There was neither a significant difference between the case and control group with regard to gestational age at ultrasound in days (d) (median 249d vs 246d, p=0.97), nor to gestational age at birth (median 249d vs 247d, p=0.98). Concerning the newborns parameters, the body length at birth was not significantly different between the case and control group in centimeters (cm) (median 47 cm vs 47 cm, p=0.79). EFW in gram (g) was lower than birth weight in both groups and did not differ significantly between case and control group (estimated weight median 2247g vs 2421g, p=0.46; birth weight median 2440g vs 2475g, p=0.47). The difference between EFW and birth weight in percent (%) did not differ between the case and control group (median -3.9% vs -5.6%, p=0.70). Bland-Altman-plots showed that the mean difference between EFW and birth weight and the limits of agreement were almost identical in cases compared to controls. The maternal parameters showed that the patients in the case group were younger (median 31 years vs 38 years p= 0.20) and had a significantly higher BMI (median 27.3kg/m^2 vs 22.0kg/m^2, <0.001) compared to the case group.

Conclusion

Our study showed for the first time that EFW in women with anhydramnios can be determined sonographically just as accurately as in a matched cohort with normal amniotic fluid volume. A reliable estimation of fetal weight is crucial for optimal assessment of the newborns prognosis and counseling of the parents especially when advising women in the early weeks of pregnancy at the limit of viability.

Introduction

During pregnancy ultrasound examinations are performed to determine gestational age exactly, to recognize multiple pregnancies, to monitor fetal growth and to detect fetal anomalies [Mutterschaftsrichtlinie 2022]. Ultrasonographic fetal weight estimation has become an integral part of obstetric routine over the past few decades. In some clinical situations the estimated fetal weight [EFW] is of particular importance since various therapy options depend on fetal weight. For example opting for a distinct mode and time of delivery depends on EFW in cases of fetal macrosomia with known fetal and maternal risks [Beta 2019]. But also in extremely preterm births of infants at the limits of viability birth weight affects fetal outcome [Glass 2015, Shah 2011, Valcamonico 2009].

The accuracy of EFW essentially depends on the used estimation formula and the time interval between sonographic estimation and delivery [Faschingbauer 2015]. Measurement within seven days before delivery using the Hadlock formulas reveals optimal results [Hoopmann 2016, Faschingbauer 2015]. Describing and establishing of these formulas base on measurements that were gained within a maximum of 7 days before delivery [Hadlock 1985]. Sonographer´s experience plays a less important role [Sekar 2016].

Various other influencing factors are discussed controversially. A literature review by Huber et al in 2014 showed that maternal obesity, fetal position anomalies, gestational age, twin pregnancy or placenta position have no influence on the measurement accuracy [Huber 2014]. In cases of low and very high birth weight (< 2500g or > 4500g) or in growth-restricted and macrosomal fetuses, however, estimations become inaccurately [Ben-Haroush 2004, Cohen 2010].

According to current data, a reduced amniotic fluid volume and premature rupture of membranes [PROM] have no influence on the accuracy of EFW. Existing studies performed in 1988–2008 [Huber 2014] are confirmed by several recently published studies [Esin 2017, Janas 2019, Duncan 2020, Warshafsky 2021].

However, these publications deal exclusively with the influence of an oligohydramnios (with and without PROM) on the sonographic estimation accuracy. To our knowledge, there are no data that explicitly deal with the role of anhydramnios in this subject.

Therefore, in the present case-control study, we examined the influence of anhydramnios on the sonographic measurement accuracy of the estimated fetal weight at different gestational ages.

Material And Method

The present work is a retrospective case-control study of a total of 114 pregnant women who presented to our Level I Perinatal Center between 2015 and 2020. At the time of admission, gestational age varied between 22 + 4 and 42 + 6 weeks of pregnancy.

All parameters and measured values were drawn from a digital archive of our clinic system and had previously been collected during the inpatient treatment of the participants in our department. The study was approved by the ethics committee of the University of Regensburg (no. 21-2527-104).

The sonographic examination was carried out using a high-resolution convex transducer (3.5mHz). Voluson S8 and an E8 ultrasound machines were used (GE Healthcare GmbH, 42655 Solingen). The examinations were carried out in accordance with everyday clinical practice by experienced sonographers. The fetal parameters were documented using the ViewPoint program (ViewPoint™ ver. 5.6, GE Healthcare GmbH, 42655 Solingen).

Patients with sonographic evidence of anhydramnios were included in the case group (n = 57). Anhydramnios is defined as a complete lack of any amniotic fluid depots [Schlembach 2020]. In contrast, oligohydramnios is defined by measurement of a single deepest amniotic fluid pocket less than 2 cm (SDP: single deepest pocket). This is in line with the statement of the American Congress of Obstetricians and Gynecologists that declare that a measurable vertical amniotic fluid depot must be of at least 1cm [Practice Bulletin 175, 2016].

The causes of anhydramnios in our study were (preterm) premature rupture of membranes [(P)PROM] in 50 cases and placental insufficiency in 7 cases. (P)PROM was diagnosed by clinical examination and, if necessary, verified by measuring vaginal pH and performing a test to detect insulin-like growth-factor-binding protein (IGFBP-1) or placental alpha microglobulin-1 (PAMG-1) [Abdelazim 2012, Abdelazim 2014]. Exclusion criteria of the study were evidence of fetal malformations or the presence of oligohydramnios. Furthermore, cases were excluded in which the difference between sonographic weight estimation and birth was longer than 5 days and cases with incomplete sonographic measurement and missing estimated fetal weight calculation.

The control group (n = 57) included patients with normal amniotic fluid volume (SDP > 2cm) who presented to our clinic for delivery. The reasons for presentation in preterm birth were premature contractions, spontaneous labor near term or induction of labor. An amniotic fluid depot > 2 cm corresponds to the generally accepted differentiation between an adequate amount of amniotic fluid and oligohydramnios. It agrees with the findings of a multi-centre observational study on 1719 women of different ethnicities, that at all gestational ages (> 15th week of pregnancy) an SDP < 2 cm is below the 3rd percentile [Owen 2019]. The measurement of the SDP describes the vertical sonographic measurement of the largest amniotic fluid depot perpendicular to the ground without umbilical cord or fetal parts [Practice Bulletin 175, 2016].

The parameters collected in both subgroups included: maternal age (years), BMI (body mass index) (kg/m2), gestational age at examination (days), gestational age at birth (days), fetal body length at birth (in grams and in percentiles according to Voigt), birth weight (in grams and in percentiles according to Voigt [Voigt et al 2006]), estimated fetal weight (grams), the period between date of ultrasound and date of birth (days), the difference between estimated fetal weight and birth weight (in grams and in percent).

The percentiles according to Voigt were determined via the homepage "https://www.pedz.de". The percentage difference between the estimated and final weight was calculated using the formula "estimated weight – birth weight/birth weight x 100". Consequently, a negative value reflects an estimated weight lower than the actual birth weight. Weight estimation in our clinic is routinely performed using the ViewPoint program with Hadlock's estimation formula, which is based on measurements of biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC) and femur length (FL). The formula is the following; $\log_{10} G = 1.3596 - 0.00386 \times AC \times FL + 0.0064 \times HC + 0.00061\ BPD \times AC + 0.0424 \times AC + 0.174 \times FL$ and is referred to as "Hadlock I" [Hadlock 1985].

The sonographic measurements are collected according to the usual standards [Practice Bulletin 175, 2016]. Head circumference is measured either directly by placing an oval measurement window around the fetal head or indirectly by measuring the BPD and fronto-occipital diameter (OFD). The BPD describes the distance between the outer borders of the parietal bone of the fetus at the level of the cavum septi pellucidi. Perpendicular to this, the FOD is measured in the medio-sagital plane as the distance between the outer borders of the frontal and occipital bones. The head circumference is calculated from both parameters using a computer-based formula for calculating ellipses.

AC can be measured directly in a sonographic cross-section at the level of the fetal stomach and the umbilical vein. Alternatively, it can be calculated computer-based by determining the abdominotransversal diameter (ATD) and the anterioposterior diameter (APD) using a formula. The ATD is determined in the frontal plane at the level of the fetal stomach, the APD at a 90° angle to this in the mediosagital plane at the same level. The fetal skin serves as the outer border. Femur length is determined as the distance between the greater trochanter and the distal metaphysis.

The case and control groups were matched in pairs according to gestational age. The Wilcoxon test and the t-test for paired samples were performed to calculate differences between groups. To demonstrate the difference between sonographically estimated fetal weight and birth weight according to the control and anhydramnios group, Bland-Altman-Plots were performed. A p-value of < 0.05 was defined as statistically significant. SigmaPlot 14.0 (Inpixon GmbH, 40212 Düsseldorf) was used for statistical analysis.

Results

57 cases and controls of pregnant mothers and newborns were finally included in the study. Table 1 shows the analysed parameters determined in both subgroups:

There was no significant difference between the case and control group with regard to gestational age at examination in days (d): 249d [IQR (interquartile range) 214-276d] versus 246d [IQR 220-271d], ($p = 0.97$), nor to gestational age at birth 249d [IQR 214-276d] vs 247d [223-271d] ($p = 0.98$). Concerning the newborns parameters, the body length at birth in centimeter (cm) was not significantly different between the case and control group (median 47cm [IQR 41-51cm] vs 47 cm [IQR 41–50 cm], $p = 0.79$). The sonographically estimated weight in gram (g) was lower than the birth weight in both groups and didn't differ significantly between case and control group (estimated weight 2247g [IQR 1495-2995g] vs 2421g [IQR 1604-3188g], $p = 0.46$; birth weight 2440g [IQR 1510-3169g]) vs 2475g [IQR 1825-3225g], $p = 0.47$). The difference between estimated weight and birth weight in percent (%) differed not between the case and control group (median − 3.9% [IQR − 12.5-1.0%] vs -5.6% [IQR − 9.5–1.6%], $p = 0.70$). The negative value indicates that the estimated weight was lower than the birth weight.

The difference between sonographically estimated and birth weight was very small between groups, with the Bland-Altman-plots showing a mean difference of 120.3 g (limits of agreement: -352.1; 592.6) in the control (Fig. 1) and a mean difference of 125.2g (limits of agreement: -349.7; 600.1) (Fig. 2) in the case group.

The maternal parameters showed that the patients in the case group were younger (median 31 years [IQR 27-35years] vs 38 years [IQR 28-36years] $p = 0.20$) and had a significantly higher BMI (median 27.3kg/m^2 [24.9-32.4kg/m^2] vs 22.0kg/m^2 [IQR 21.0-25.5kg/m^2], < 0.001) compared to the case group.

Discussion

With this case-control study, we were able to demonstrate that the presence of anhydramnios does not significantly worsen the measurement accuracy of the estimated fetal weight, regardless of gestational age. Illustrated by Bland-Altman-plots, the mean difference as well as upper and lower limits of agreement between sonographically estimated and birth weight were almost identical.

We performed the sonographic weight estimation based on Hadlock's formulas, which showed a small deviation from the actual birth weight. We opted for a maximum of a five days interval (range 0–5 days) between sonographic weight estimation and birth, which is between the limits also used in comparable current publications [Ben-Haroush 2004, Faschingbauer 2015, Hoopmann 2016, Esin 2017, Janas 2019].

In 2015, Faschingbauer et al. conducted a study on 8721 singletons with the aim of determining the accuracy of common estimation formulas (Hadlock I, Hadlock II, Merz, Shepard, Warsof) and the influence of the time interval between weight estimation and birth. They were able to show that Hadlock's formulas, which tends to generally underestimate actual weight, predict birth weight most accurately if the scan was performed within a week before birth [Faschingbauer 2015].

In 2016, Hoopmann et al examined 35 common estimation formulas in a cohort of 3416 singleton pregnancies with an estimated fetal weight between 2500 and 4000g. They were able to confirm that formulas according to Hadlock (III and V) show the smallest percentage deviation on average. The maximum interval between the scan and birth was seven days [Hoopmann 2016].

It is well known that obesity has no influence on the measurement accuracy. Because of this we did not adjust the results for maternal BMI. The fact that the case group even had a higher BMI and that there was no difference between the EFW and the birth weight under this condition underpins the observations of current publications: Maternal obesity seems not to have an adverse effect on the measurement accuracy [Huber 2014].

Our results show for the first time that anhydramnios does not significantly affect the sonographic measurement accuracy of fetal biometry. In both patient cohorts, the sonographically determined fetal weight tended to be underestimated, i.e. the actual birth weight was slightly higher. The fact that a reduced amount of amniotic fluid has no significant effect on the accuracy of EFW is consistent with publications in recent years. However, only patients with oligohydramnios or a generally reduced amount of amniotic fluid were examined up to now.

In 2004, Ben-Haroush et al found in a study of 131 pregnant women with oligohydramnios at term that oligohydramnios had no effect on the accuracy of the EFW. Measurements taken no more than 3 days before birth were included. A uniform formula was not used [Ben-Haroush 2004].

In a study of 234 pregnant women, Esin et al. demonstrated that oligohydramnios did not affect the accuracy of estimated fetal weight measured within 7 days prior to delivery. Weight formulas according to Hadlock showed the lowest median estimation error [Esin 2017].

Janas et al. found in a study of 1831 pregnant women that the amount of amniotic fluid had no impact on the accuracy of estimating fetal weight. Women who had an ultrasound within 48 hours before birth were included. In oligohydramnios (n = 229), there was a non-significant tendency to overestimate fetal weight [Janas 2019].

In a study with 106 pregnant women, Duncan et al. were able to show that the measurement accuracy does not decrease significantly when the amount of amniotic fluid is reduced. In the subgroup analysis of patients with anhydramnios (n = 26), the percentage deviation of estimated weight from birth weight increased non-significantly [Duncan 2020].

By confirming that anhydramnios has no influence on the difference between estimated fetal weight and birth weight in an accurately performed fetometry, our results are particularly relevant for decision-making in the management of extremely preterm births. In the early weeks of pregnancy at the limit of viability between 22th and 24th weeks of gestation, the fetal weight plays an important role in assessing the prognosis. An estimation that is as accurate as possible helps the attending obstetricians and neonatologists to come to a joint decision with the parents-to-be regarding the optimal obstetric management and the postpartum neonatological care of the premature child.

A birth weight below 500g is particularly critical. Smith et al. conducted a prospective cohort study in 12 clinics in Belgium, France, Italy, Portugal and the UK on this topic in 2017. 1449 premature babies between 22 + 0 and 25 + 6 weeks of gestation who were born in 2011 and 2012 were included. The premature babies were divided into groups according to gestational age (in complete weeks of pregnancy) and birth weight over and under 500 g. It could be shown that regardless of the birth weight, no preterm infant born in 23th week of pregnancy survived despite intensive medical efforts. From the 24th week of pregnancy, the probability of survival in the weight class < 500g is less than 25%. None of the surviving children survived without serious impairments [Smith 2017].

A more detailed explanation of the role of birth weight was provided in a large Canadian retrospective cohort study from 2011. Data from 17 148 preterm infants (born between 22th and 32th weeks of gestation) who were treated in neonatal intensive care units in Canada between 2003 and 2008 were analysed. The primary endpoint was discharge without severe impairment (severe neurological impairment, chronic lung disease, retinopathy ≥ 3°, necrotizing enterocolitis ≥ 2°). It could be shown that female gender, higher gestational age at birth and higher birth weight are independent positive predictors of a good outcome. Based on the data, a graph was created for male and female preterm infants, showing the probability of surviving without serious impairment in relation to gestational age at birth and the birth weight. The probability to survive without a handicap when a baby is born at 25th week of gestation was less than 5% for male babies with a birth weight < 500g, < 10% with a birth weight of 600g and around 15% with a birth weight of 750g. Correspondingly, female preterm infants have a significantly better prognosis with a probability to survive without a handicap of 10% with a birth weight of 500 g, 15% with 600 g and 20% with 750 g [Shah 2011].

The presented studies point out that an accurate sonographic weight estimate is important for assessing the prognosis of extremely preterm born newborn. Our results illlustrate that even in the case of anhydramnios, EFW does not deviate from EFW of pregnancies with a normal amniotic fluid volume.

Conclusion

Our study shows for the first time that in pregnant women with anhydramnios up to 22th weeks of gestation, the estimated fetal weight can be determined sonographically using the Hadlock formula just as precisely as in a matched cohort with normal amniotic fluid volume. Physicians can use this knowledge in their advice on postpartum care, especially when advising pregnant women in the early weeks of pregnancy at the limit of viability. At this gestational age birth weight has a decisive influence on the prognosis with regard to morbidity and mortality. Therefore, a reliable estimation of EFW is crucial for optimal assessment of the newborns prognosis and counseling of the parents.

Declarations

Author contribution

M Rauh: manuscript writing

K Rasim: data collection

B Schmidt: data analysis

A Schnabel: manuscript editing

A Köninger: project development

Statement and declaration

The authors declare that no funds, grants, or other support were received during the preparation of this manuscript. The authors have no relevant financial or non-financial interests to disclose. The study was approved by the ethics committee of the University of Regensburg (no. 21-2527-104).

References

1. Abdelazim IA, Makhlouf HH (2012 Apr) Placental alpha microglobulin-1 (AmniSure(®) test) for detection of premature rupture of fetal membranes. Arch Gynecol Obstet 285(4):985–989. doi: 10.1007/s00404-011-2106-4. Epub 2011 Oct 30. PMID: 22037683
2. Abdelazim IA (2014 Apr) Insulin-like growth factor binding protein-1 (Actim PROM test) for detection of premature rupture of fetal membranes. J Obstet Gynaecol Res 40(4):961–967. doi: 10.1111/jog.12296. Epub 2014 Feb 26. PMID: 24612210
3. Ben-Haroush A, Yogev Y, Bar J, Mashiach R, Kaplan B, Hod M, Meizner I (2004) Feb;23(2):172-6 Accuracy of sonographically estimated fetal weight in 840 women with different pregnancy complications prior to induction of labor. Ultrasound Obstet Gynecol. doi: 10.1002/uog.940. PMID: 14770399
4. Beta J, Khan N, Khalil A, Fiolna M, Ramadan G, Akolekar R (2019 Sep) Maternal and neonatal complications of fetal macrosomia: systematic review and meta-analysis. Ultrasound Obstet Gynecol 54(3):308–318. doi: 10.1002/uog.20279. Epub 2019 Aug 2. PMID: 30938004
5. Cohen JM, Hutcheon JA, Kramer MS, Joseph KS, Abenhaim H, Platt RW Influence of ultrasound-to-delivery interval and maternal-fetal characteristics on validity of estimated fetal weight. Ultrasound Obstet Gynecol. 2010 Apr;35(4):434 – 41. doi: 10.1002/uog.7506. PMID: 20069655
6. Duncan JR, Schenone C, Dorset KM, Goedecke PJ, Tobiasz AM, Meyer NL, Schenone MH (2020) Estimated fetal weight accuracy in pregnancies with preterm prelabor rupture of membranes by the Hadlock method. J Matern Fetal Neonatal Med. May 22:1–5. doi: 10.1080/14767058.2020.1769593. Epub ahead of print. PMID: 32441170
7. Esin S, Hayran M, Tohma YA, Guden M, Alay I, Esinler D, Yalvac S, Kandemir O Estimation of fetal weight by ultrasonography after preterm premature rupture of membranes: comparison of different formulas. J Perinat Med. 2017 Feb 1;45(2):253–266. doi: 10.1515/jpm-2016-0258. PMID: 27935855
8. Faschingbauer F, Raabe E, Heimrich J, Faschingbauer C, Schmid M, Mayr A, Schild RL, Beckmann MW, Kehl S Accuracy of sonographic fetal weight estimation: influence of the scan-to-delivery interval in combination with the applied weight estimation formula.Arch Gynecol Obstet. 2016Sep; 294(3):487–93. doi: 10.1007/s00404-015-3989-2. Epub 2016 Jan 7. PMID: 26742730.
9. Glass HC, Costarino AT, Stayer SA, Brett CM, Cladis F, Davis PJ (2015 Jun) Outcomes for extremely premature infants. Anesth Analg 120(6):1337–1351. doi: 10.1213/ANE.0000000000000705. PMID: 25988638; PMCID: PMC4438860
10. Hadlock FP, Harrist RB, Sharman RS, Deter RL, Park SK (1985) Estimation of fetal weight with the use of head, body, and femur measurements–a prospective study. Am J Obstet Gynecol. Feb 1;151(3):333-7. doi: 10.1016/0002-9378(85)90298-4. PMID: 3881966

11. Hoopmann M, Kagan KO, Sauter A, Abele H, Wagner P (2016 Nov) Comparison of Errors of 35 Weight Estimation Formulae in a Standard Collective. Geburtshilfe Frauenheilkd 76(11):1172–1179. doi: 10.1055/s-0042-118598. PMID: 27904167; PMCID: PMC5123881
12. Huber C, Zdanowicz JA, Mueller M, Surbek D (2014) Factors influencing the accuracy of fetal weight estimation with a focus on preterm birth at the limit of viability: a systematic literature review. Fetal Diagn Ther 36(1):1–8 Epub 2014 May 23. PMID: 24863502
13. Janas P, Radoń-Pokracka M, Nowak M, Staroń A, Wilczyńska G, Brzozowska M, Huras H (2019) Mar;58(2):278–281 Effect of oligohydramnios on the accuracy of sonographic foetal weight estimation in at term pregnancies. Taiwan J Obstet Gynecol. doi: 10.1016/j.tjog.2019.01.020. PMID: 30910153
14. Owen J, Albert PS, Buck Louis GM, Fuchs KM, Grobman WA, Kim S, D'Alton ME, Wapner R, Wing DA, Grantz KL (2019) Jul;221(1):67.e1-67.e12 A contemporary amniotic fluid volume chart for the United States: The NICHD Fetal Growth Studies-Singletons. Am J Obstet Gynecol. doi: 10.1016/j.ajog.2019.02.030. Epub 2019 Feb 18. PMID: 30790566; PMCID: PMC6592729
15. practice bulletin no 175 (2016) Committee on practice b-o the american institute of ultrasound in m practice bulletin no 175 2016
16. Richtlinien des Gemeinsamen Bundesausschusses über die ärztliche Betreuung während der Schwangerschaft und nach der Entbindung („Mutterschafts-Richtlinien“) in der Fassung vom 10. Dezember 1985 (veröffentlicht im Bundesanzeiger Nr. 60 a vom 27. März 1986) zuletzt geändert am 16. September 2021 veröffentlicht im Bundesanzeiger (2022) AT 26.11.2021 B4 in Kraft getreten am 1. Januar 2022
17. Sekar R, Khatun M, Barrett HL, Duncombe G (2016 Feb) A prospective pilot study in assessing the accuracy of ultrasound estimated fetal weight prior to delivery. Aust N Z J Obstet Gynaecol 56(1):49–53. doi: 10.1111/ajo.12391. Epub 2015 Aug 24. PMID: 26299881
18. Shah PS, Ye XY, Synnes A, Rouvinez-Bouali N, Yee W, Lee SK (2012 Mar) Canadian Neonatal Network. Prediction of survival without morbidity for infants born at under 33 weeks gestational age: a user-friendly graphical tool. Arch Dis Child Fetal Neonatal Ed 97(2):F110–F115. doi: 10.1136/archdischild-2011-300143. Epub 2011 Sep 6. PMID: 21900280
19. Smith LK, Blondel B, Van Reempts P, Draper ES, Manktelow BN, Barros H, Cuttini M, Zeitlin J, EPICE Research Group (2017 Sep) Variability in the management and outcomes of extremely preterm births across five European countries: a population-based cohort study. Arch Dis Child Fetal Neonatal Ed 102(5):F400–F408. doi: 10.1136/archdischild-2016-312100. Epub 2017 Feb 23. PMID: 28232518
20. Valcamonico A, Accorsi P, Sanzeni C, Martelli P, La Boria P, Cavazza A, Frusca T (2007) Jun;20(6):465 – 71 Mid- and long-term outcome of extremely low birth weight (ELBW) infants: an analysis of prognostic factors. J Matern Fetal Neonatal Med. doi: 10.1080/14767050701398413. PMID: 17674256
21. Warshafsky C, Ronzoni S, Quaglietta P, Weiner E, Zaltz A, Barrett J, Melamed N, Aviram A Comparison of sonographic fetal weight estimation formulas in patients with preterm premature rupture of

membranes. BMC Pregnancy Childbirth. 2021 Feb 19;21(1):149. doi: 10.1186/s12884-021-03631-w. PMID: 33607956; PMCID: PMC7893917

Table

Table 1 is available in the Supplementary Files section.

Figures

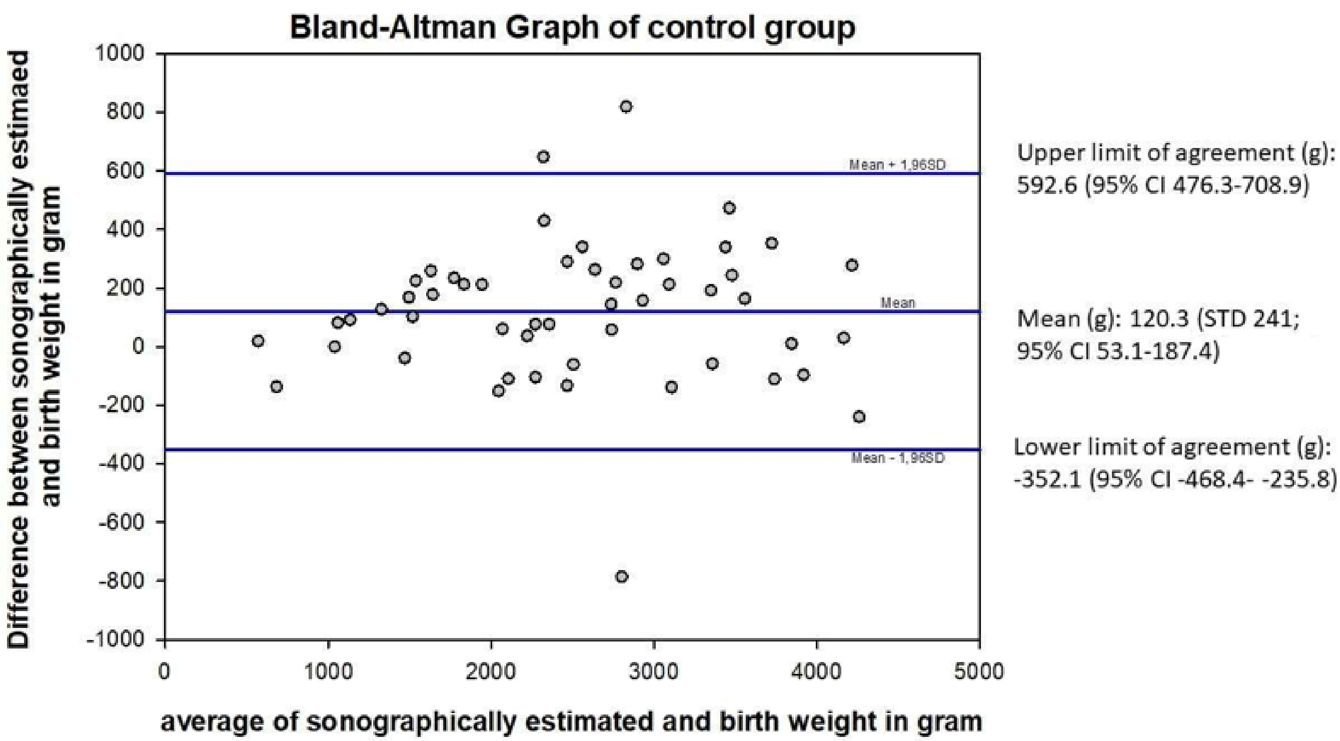

Figure 1:

Bland-Altman-Blot showing the mean difference with standard deviation (STD) and 95% confidence interval (CI) and upper and lower limits of agreement between sonographically estimated and birth weight in gram in **control cases**.

Figure 1

See image above for figure legend.

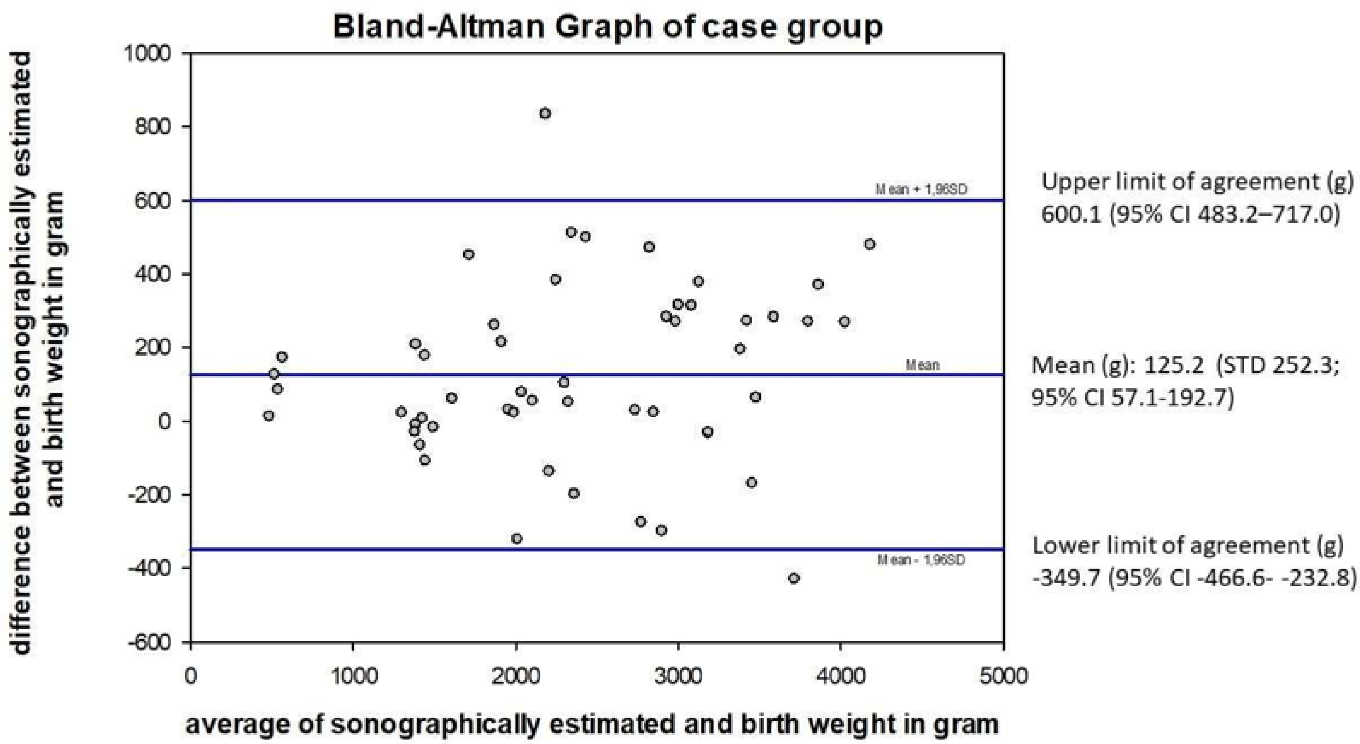

Figure 2:

Bland-Altman-Blot showing the mean difference with standard deviation (STD) and 95% confidence interval (CI) and upper and lower limits of agreement between sonographically estimated and birth weight in gram in **anhydramnios cases**.

Figure 2

See image above for figure legend.

Supplementary Files

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- Table1.png