A comparison between amniotic fluid index and the single deepest vertical pocket technique in predicting adverse outcome in prolonged pregnancy

Paolo Rosati[1]
Lorenzo Guariglia[1]
Anna Franca Cavaliere[1]
Paola Ciliberti[1]
Silvia Buongiorno[1]
Andrea Ciardulli[1]
Stefano Cianci[2]
Salvatore Giovanni Vitale[2]
Pietro Cignini[3]
Ilenia Mappa[1]

[1]Department of Obstetrics and Gynecology, Catholic University of the Sacred Heart, Rome, Italy
[2]Department of General Surgery and Medical Surgical Specialties, University of Catania, Catania, Italy
[3]Department of Prenatal Diagnosis, Altamedica Fetal Maternal Medical Centre, Rome, Italy

Corresponding author:
Salvatore Giovanni Vitale
Department of General Surgery and Medical Surgical Specialties, University of Catania
Via Santa Sofia 78
95123 Catania, Italy
E-mail: vitalesalvatore@hotmail.com

Abstract

Objective: **to compare perinatal outcome in induced postterm pregnancies with normal amniotic volume and in patients with prolonged pregnancy undergone induction for oligohydramnios, evaluated by two different ultrasonographic methods.**
Methods: **amniotic fluid volume was measured, using Single Deepest Vertical Pocket (SDVP) and Amniotic Fluid Index (AFI), in 961 singleton uncomplicated prolonged pregnancies. In 109 of these patients, hospitalization was planned for induction of labor, during or after 42 weeks of gestation, for oligohydramnios, postterm pregnancy and other indications in 47, 51 and 11 cases, respectively. Perinatal outcome included: rate of caesarean section, fetal distress, non reassuring fetal heart tracing, presence of meconium, umbilical artery pH < 7.1, Apgar score at 5 minutes < 7, admission to neonatal intensive care unit (NICU).**
Results: **oligohydramnios was diagnosed in 4.89% of cases, when at least one of the two methods was used. A reduced AFI and SDVP value identified 4.47% and 3.75% of cases, respectively, even if without statistical difference. No statistical differences were reported in perinatal outcomes in postterm *versus* prolonged pregnancies with oligohydramnios, also in relation to the two different ultrasonographic methods.**
Conclusions: **oligohydramnios is more frequently diagnosed using AFI than SDVP, consequently determining a higher rate of induction of labor. Moreover, perinatal outcome in prolonged induced pregnancies is not affected by oligohydramnios.**

Key words: amniotic fluid index; post-term pregnancy; prolonged pregnancy; single deepest vertical pocket.

Conflict of interest: No Author has any potential conflict of interest.

Introduction

Terms of postterm and prolonged pregnancy are poorly defined. Prolonged pregnancy is considered as menstrual age ranged from 41 to 41 6/7 weeks of gestation, while a pregnancy beyond 42 0/7 weeks is defined postterm (1). Frequently, postterm pregnancy is associated with oligohydramnios (2). It is probably related to a decrease in placental function and/or in fetal renal perfusion with reduction of urine production (3-5). In this period of pregnancy, amniotic fluid volume is considered an important predicting factor of fetal wellbeing. In fact, oligohydramnios is usually associated with an increased risk of fetal heart rate tracing abnormalities, meconium-stained amniotic fluid and caesarean sections for fetal distress (6-8). At present, there is no consent about the efficacy in predicting adverse perinatal outcome with the ultrasonographic methods currently used to determine amniotic fluid volume (9-13, 8).
Aims of the present study concern: a) the comparison between the perinatal outcomes in prolonged pregnancies, complicated with oligohydramnios, and the outcomes in postterm pregnancies without oligohydramnios; b) the evaluation of perinatal outcome in relation to different ultrasonographic methods for the examination of amniotic fluid volume in those cases complicated with oligohydramnios.

Materials and methods

In the period between May 2011 and April 2013, we

examined 961 singleton prolonged pregnancies at our Department. The mean maternal age was 33.1 ± 3.4 years (years ± SD; range 24-45 years) and the gestational age at the time of the last ultrasound examination was 290.35 ± 1.42 days (days ± SD; range 287-295 days). Gestational age was calculated from the date of the last menstrual period and confirmed at the first trimester scan. All pregnancies were uncomplicated, without any maternal and/or fetal disease; patients with fetal anomalies and/or abnormal fetal karyotype, detected during pregnancy or at delivery, were excluded. Amniotic fluid volume was determined for each patient at least 2 days before delivery, measuring both SDVP and AFI. SDVP is a semi-quantitative method that measures the largest vertical pocket of amniotic fluid, free from fetal parts or loops of umbilical cord (14). Oligohydramnios is defined as a single pocket with a depth < 2.0 cm (10, 14, 15). AFI is another semi-quantitative measurement of amniotic fluid volume; it is determined by the sum of maximum vertical pockets of amniotic fluid, in each of the four quadrants of the uterus with no fetal parts or loops of umbilical cord (16, 17). In prolonged and postterm pregnancies, oligohydramnios is defined as an AFI < 5.0 cm (15-17). An ultrasonographic device with a 3.5-MHz volume transducer (model Voluson 730, GE Healthcare, Zipf, Austria) was used.

Hospitalization was planned for induction of labor at or after 42 weeks. Labor was induced in 109 patients (11.34%). The indications for induction of labor were: reduction of amniotic fluid volume (n=47), postterm pregnancy (n=51), non-reassuring fetal cardiotocography (n=9) and other indications (n=2). Non-reassuring fetal cardiotocography was diagnosed when variability was reduced in presence of persistent severe variable and/or late decelerations (18).

Perinatal outcome was assessed considering: rate of caesarean section, caesarean delivery for fetal distress, non reassuring fetal heart tracing, presence of meconium, umbelical artery pH < 7.1, Apgar score at 5 minutes < 7, admission to neonatal intensive care unit.

Statistical analysis was performed by T-student and Chi-Square test ($p<0.01$).

Results

Oligohydramnios was diagnosed in 47 patients (4.89%), when at least one of the two methods used to evaluate amniotic fluid was below the cut-off considered. Considering an AFI value < 5.0 cm, oligohydramnios was diagnosed in 43 patients (43/961; 4.47%), while in 36 cases using SDVP < 2.0 cm (36/961; 3.75%) (p = n.s.). Labor was induced in all pregnancies with ultrasound diagnosis of oligohydramnios. Consequently, rate of induction of labor was higher when oligohydramnios was diagnosed by the AFI value (43/47 *vs* 36/47 cases), even with no statistical differences between the results of the two different methods. Furthermore, 32 out of 43 patients with an AFI < 5.0 cm, revealed a SDVP < 2.0 cm (74.42%). Similarly, in 32 out of 36 patients (88.89%) with a SDVP < 2.0 cm, AFI appeared < 5.0 cm. Moreover, 4 cases reported a SDVP < 2.0 cm and an AFI > 5. 0 cm and 11 cases showed a SDVP > 2.0 cm and an AFI < 5.0 cm. In Table 1 perinatal outcomes in deliveries induced for prolonged pregnancies with oligohydramnios and for postterm pregnancy are described. No statistical differences were reported in re-

Table 1. Perinatal outcomes in induced patients in relation to the different results of oligohydramnios and in postterm pregnancies.

Perinatal outcomes		Oligohydramnios			Postterm pregnancy
	Total cases	AFI < 5.0 cm and SDVP < 2.0 cm	AFI < 5.0 cm and SDVP > 2.0 cm	AFI > 5.0 cm and SDVP < 2.0 cm	
	n=47	n = 32	n = 11	n = 4	n = 51
	n (%)	n (%)	n (%)	n (%)	n (%)
Non-reassuring fetal heart rate tracing	18 (38.30)	13 (40.62)	4 (36.36)	1 (25.00)	14 (27.45)
Cesarean section	21 (44.68)	15 (46.87)	4 (36.36)	2 (50.00)	18 (35.29)
Cesarean delivery for fetal distress	16 (30.09)	11 (34.37)	4 (36.36)	1 (25.00)	11 (21.57)
Presence of meconium	19 (40.42)	13 (40.62)	5 (45.45)	1 (25.00)	16 (31.37)
pH umbilical artery <7.1	1 (2.13)	1 (3.12)	0 (0.00)	0 (0.00)	1 (1.96)
Apgar score <7 at 5 min	4 (8.51)	3 (9.37)	1 (9.09)	0 (0.00)	3 (5.88)
NICU	1 (2.13)	1 (3.12)	0 (0.00)	0 (0.00)	1 (1.96)

lation to the different two methods used to diagnose oligohydramnios.

Discussion

The aim of the antepartum surveillance tests is the prevention of adverse pregnancy outcomes, particularly in prolonged pregnancy. Multiple factors contribute to pregnancy outcomes in women undergoing antepartum fetal surveillance. Amniotic fluid volume is one of the parameters proposed for the assessment of fetal wellbeing. Different tests have been proposed to determine amniotic fluid volume as mean of evaluation of fetal wellbeing in prolonged and postterm pregnancies. The most common methods used to evaluate the amniotic fluid volume are AFI (16, 17) and SDVP measurements (14). The accuracy of amniotic fluid assessment is related, not only to the different methods and diagnostic criteria used, but even to other factors. Experience of operators, fetal position, presence of abdominal mass or scar could interfere with an adequate measurement (19, 8).

In different studies AFI and SDVP were compared as a screening for preventing adverse pregnancy outcomes (20, 21, 13). In our experience, AFI measurement detects more frequently oligohydramnios than SDVP, resulting in a higher rate of induction of labor, even with no significance at the statistical analysis, according to the reports of Morris et al. (22). Magann et al. (23) reported that 72% of women with an AFI ≤ 5.0 cm, still had a SDVP measurement greater than 2.0 cm. Randomized controlled trials and a recent meta-analysis (24, 20, 21, 25, 13) confirm these results, even if with different percentages and some confounders factors such as high risk pregnancies and evaluation at different gestational periods (close to / at term or in the postterm period).

In our case series, oligohydramnios was diagnosed with both AFI and SDVP measurements in 68.1% of the patients. Furthermore, an AFI < 5.0 cm and a SDVP > 2.0 cm was detected in 23.4% of cases and the other 8.5% showed an AFI > 5.0 cm and a SDVP < 2.0 cm.

Considering perinatal outcomes, our results showed no significant differences when labor was induced in pregnancies with normal and low amniotic fluid volume, despite the different diagnostic methods used. Therefore, the amniotic fluid volume, even when reduced, could not influence perinatal outcomes in induced prolonged pregnancy. Similar results are reported by Hofmeyr (26) and Verrotti et al. (27). Consequently, further studies need to be performed to determine the clinical validity and utility of amniotic fluid volume measurement in prolonged pregnancy, thus considering the great number of variables analyzed in the restricted group of our study. A prerequisite should be the reproducibility of the methods used for amniotic volume measurement, particularly in case of oligohydramnios. In fact, although these methods assess better a normal volume, they are characterized by a low sensitivity and specificity when detecting an abnormal volume (28).

References

1. ACOG Committee on Practice Bulletin-Obstetrics. ACOG Practice Bulletin. Clinical management guidelines for obstetricians-gynecologists. Number 55, September 2004. Management of Postterm Pregnancy. Obstet Gynecol. 2004; 3:639-646.
2. Peipert JF, Donnenfeld AE. Oligohydramnios: a review. Obstet Gynecol Surv.1991; 46:325-339.
3. Magann EF, Sandlin AT, Ounpraseuth ST. Amniotic fluid and the clinical relevance of the sonographically estimated amniotic fluid. Oligohydramnios. JUM 2011; 30:1573-1585.
4. Moore TR, Cayle JE. The amniotic fluid index in normal human pregnancy. Am J Obstet Gynecol. 1990; 162:1168-1173.
5. Oz AU, Holub B, Mendilciogiu I, Mari G, Bahado-Sing RO. Renal artery Doppler investigation of the etiology of oligohydramnios in postterm pregnancy. Obstet Gynecol. 2002; 100:715-718.
6. Chamberlain PF, Manning FA, Morrison I, Harman CR, Lange IR. Ultrasound evaluation of amniotic fluid volume. I.The relationship of marginal and decreased amniotic fluid volumes to perinatal outcome. Obstet Gynecol. 1984; 150:245-249.
7. Chauhan SP, Sanderson M, Hendrix NW, Magann EF, Devore LD. Perinatal outcome and amniotic fluid index in the antepartum and intrapartum period: A meta-analysis. Am J Obstet Gynecol. 1999; 181:1473-1478.
8. Sherer DM. A review of amniotic fluid dynamics and the enigma of isolated oligohydramnios. Am J Perinatol. 2002; 19:253-266.
9. Chauhan SP, Magann EF, Perry KG Jr, Morrison JC. Intrapartum amniotic fluid index and two-diameter pocket are poor predictors of adverse neonatal outcome. J Perinatol. 1997; 17:221-224.
10. Magann EF, Isler CM, Chauhan SP, Martin JN Jr. Amniotic fluid volume estimation and the biophysical profile: a confusion of criteria. Obstet Gynecol. 2000; 96:640-642.
11. Magann EF, Chauhan SP, Barrilleaux PS, Whitworth NS, Martin JN. Amniotic fluid index and single deepest pocket: weak indicators of abnormal amniotic volumes. Obstet Gynecol. 2000; 96:737-740.
12. Magann EF, Doherty DA, Chauhan SP, Busch FWJ, Mecacci F, Morrison JC. How well do the amniotic fluid index and single deepest pocket indices (below the 3rd and 5th and above the 95th and 97th percentiles) predict oligohydramnios and hydramnios? Am J Obstet Gynecol. 2004; 190:164-169.
13. Nabhan AF, Abdelmoula YA. Amniotic fluid index versus single deepest vertical pocket: a meta-analysis of randomized controlled trials. Int J Gynaecol Obstet. 2009; 104:184-188.
14. Manning FA. Dynamic ultrasound-based fetal assessment: the fetal biophysical profile score. Clin Obstet Gynecol. 1995; 38:26-44.

15. Magann EF, Chauhan SP, Bofill JA, Martin JN Jr. Comparatibility of amniotic fluid index and single deepest pocket measurements in clinical practice. Aust NZ J Obstet Gynaecol. 2001; 43:75-77.
16. Phelan JP, Smith CV, Broussard P, Small M. Amniotic fluid volume assessment with the four quadrant technique at 36-42 weeks'gestation. J Reprod Med. 1987; 32:540-542.
17. Phelan JP, Ahn MO, Smith CV, Rutherford SE, Anderson E. Amniotic fluid index measurements during pregnancy. J Reprod Med. 1987; 32:601-604.
18. Rainford M, Adair R, Scialli AR, Ghidini A, Spong CY. Amniotic fluid index in the uncomplicated term pregnancy. Prediction of outcome. J Reprod Med. 2001; 46:589-592.
19. Folk WY, Chan LY, Lau TK. The influence of fetal position on amniotic fluid index and single deepest pocket. Ultrasound Obstet Gynecol. 2006; 28:162-165.
20. Chauhan SP, Doherty DD, Magann EF, Cahanding F, Moreno F, Klause JH. Amniotic fluid index vs single deepest pocket technique during modified biophysical profile: a randomized clinical trial. Am J Obstet Gynecol. 2004; 191:661-667.
21. Magann EF, Doherty DD, Field K, Chauhan SP, Muffley PE, Morrison JC. Biophysical profile with amniotic fluid assessments. Obstet Gynecol. 2004; 104:5-10.
22. Morris JM, Thompson K, Smithey J, Gaffney G, Cooke I, Chamberlain P, et al. The usefulness of ultrasound assessment of amniotic fluid in predicting adverse outcome in prolonged pregnancy: a prospective blinded observational study. Br J Obstet Gynaecol. 2003; 110:989-984.
23. Magann EF, Kinsella MJ, Chauhan SP, McNamara MF, Gehring BW, Morrison JC. Does an amniotic fluid index < 5 cm necessitate delivery in high-risk pregnancies? A case-control study. Am J Obstet Gynecol. 1999; 180:1354-1359.
24. Alfiveric Z, Luckas M, Walkinshaw SA, McFarlane M, Curran R. A randomized comparison between amniotic fluid index and maximum pool depth in the monitoring post-term pregnancy. Br J Obstet Gynaecol. 1997; 104:207-211.
25. Moses J, Doherty DA, Magann EF, Chauhan SP, Morrison JC. A randomized clinical trial of the antepartum assessment of amniotic fluid volume: amniotic fluid index versus the single deepest pocket technique. Am J Obstet Gynecol. 2004; 190:1564-1569.
26. Hofmeyr JG. Prophylactic versus therapeutic amnioinfusion for oligohydramnios in labour. Cochrane Database Systematic Review. 2000; 2: CD000176.
27. Verrotti C, Bedocchi L, Piantelli G, Cavallotti D, Fieni S, Gramellini D. Amniotic fluid index versus largest vertical pocket in the prediction of perinatal out come in post-term pregnancies. Acta Biomed. 2004; 75 Suppl 1:67-70.
28. Gramellini D, Fieni S, Verrotti C, Piantelli G, Cavallotti D, Vadora E. Ultrasound evaluation of amniotic fluid volume: methods and clinical accuracy. Acta Biomed. 2004; 75 Suppl 1:40-44.