The Significance of Maximum Vertical Pocket in Predicting Fetal Distress among Overdue Pregnant Women

Wisam Akram FICOG*

Background; post term delivery accounts for 5- 10 % of the overall deliveries in labor wards. The main adverse of overdue pregnancy and post term labor include oligohydramnios, placental insufficiency and increased fetal weight with increased incidence of fetal injury at birth. Among the above factors, oligohydramnios is considered as the main factors which determine the onset of adverse side effects. Once develops induction of labor is mandatory.

Aim of the study; to evaluate the maximum vertical pocket as an independent risk factor which can predict fetal distress during labor. Maximum vertical pocket is defined as the maximum cord free space measurable by ultrasound around buttock fetal area.

Methods; a total of 60 women who are overdue yet less that 294 days from the last menstrual period date has been collected from the labor ward at AL-Yermouk Teaching Hospital. All of them came with spontaneous onset of labor. 30 women had normal vaginal delivery with no evidence of fetal distress, while 30 women had fetal distress requiring delivery by cesarean section. For all women maximum vertical pocket, amniotic fluid index, maximum deceleration with fetal distress as well as Apgar scores were recorded and correlated

Results; there was a statistically significant correlations between maximum vertical pocket with longest deceleration, apgar score at 1 and 5 minutes, P values less than 0.001 for each. The cut off values for maximum vertical pocket was 3 cm with 83.33 % sensitivity and specificity. However it was not superior to that for amniotic fluid assessment by amniotic fluid index.

Conclusion; there is no evidence that assessment of amniotic fluid volume by maximum vertical pocket is superior to that by amniotic fluid index in predicting fetal distress during labor. However in case that new scoring system for fetal well being in overdue pregnancy, maximum vertical pocket may be easier and more accurate to measure.

Introduction

Post term pregnancies account for 5- 10 % of the overall pregnancies presenting at labor wards [1]. Overdue pregnancy is defined as pregnancy which has 280 days from the date of the last menstrual period up to 294 days.

Pregnancies which have surpassed 294 days are referred to post term pregnancy [2]. Post term pregnancy is significantly associated with increased fetal neonatal morbidity and mortality.

There are three significant changes associated with post term pregnancy, namely oligohydramnios, placental insufficiency and increased fetal weight [3]. Reduced amount of amniotic liquor coupled with placental insufficiency is associated with reduced oxygen supply to the fetus, consequently leading to fetal hypoxia and fetal death.

While increased fetal weight with more ossification of the fetal skull contribute to mechanical difficulties during labor and more precisely to intra cranial hemorrhage [4].

With the advent of cervical ripening agents like prostaglandins and nitric acid donors, it is more customs to induce overdue pregnancies at about 10 day beyond term.

During this 10 days the fetal well being test in the form of non stress test and bio physical profile should be used to monitor the fetal condition. Doppler studies of the umbilical arteries may be also used [5]. Amniotic fluid changes accounts for the most significant variables which determine the timing of induction of labor [6].

If the overdue pregnancy is complicated by oligohydramnios, induction of labor is mandatory as prolonging pregnancy may induce further hypoxia to the fetus [7].

Oligohydramnios is usually assessed by amniotic fluid index through routine ultrasound examination.

Other method to assess the amniotic fluid volume is the maximum vertical pocket which is defined as the largest vertical cord free space around the buttock as measured by ultrasound scan [8].

Aim of the study

So the aim of this study is to evaluate the maximum vertical pocket as an independent variable whether it can predict fetuses at risk of fetal distress among overdue pregnancies.

Patients and methods

- **Setting**

The study was conducted at AL- Yermouk teaching hospital between August 2010 and May 2011. During this period a total of 60 patients have been selected to participate in the study. The study was approved by the committee of Arab Board of Obstetrics and Gynecology. For all the patients chosen in this study their consent was taken.

- **Protocol and patients selection**

All the patients chosen to participate in this study were selected from the labor ward at admission time. All of them were primigravida to avoid bias in the results. The only condition to approve the patient in this study as woman who has overdue pregnancy between 280- 294 day pos term and almost low risk pregnancy; namely no hypertension, diabetes and other high risk situation. All women had singleton cephalic presentation with spontaneous onset of labor, with intact membrane. It was originally planned to include patients with induction of labor, however it was omitted as induction per user increase the rate of fetal distress and bias the results.

Once the patient admitted, full examination was done for abdominal and pelvic assessment and the results were recorded in pre prepared data collection sheet.

Immediately afterward she was sent for ultrasound examination to assess the presentation, amount of liquor and placental localization.

Amount of liquor was assessed in the routine way by AFI measuring the deepest pool in every abdominal quadrant and adding the figures.

In the same context the maximum vertical pocket was measured meanwhile at the deepest cord free pool near the fetal buttock. Both measurements were recorded accurately also. After that the patient was scheduled for routine active management of labor with artificial rupture of the membrane as 4 cm cervical dilatation.

The amount and color of liquor was recorded. Afterward the patient was monitored for uterine contractions and fetal heart rate by routine cardiotocography. And partogram was set up for every patient.

Those patients who have uneventful labor they went into the second stage and delivered accordingly.

While those patients who have shown early deceleration progressing to late deceleration they were first put on their sides. Oxytocin infusion was stopped and oxygen supply was given.

Once late decelerations persist for 30 minutes afterward fetal distress was diagnosed and the patient was scheduled for emergency cesarean section.

The longest late deceleration was recorded and kept in the data and was measured in seconds.

Unfortunately fetal blood pH estimation is unavailable in all obstetrical units over Iraq, and that is why we have adopted this definition for fetal distress.

After delivery whether vaginally or by cesarean section, the newborn was examined by a registrar

Pediatrician for Apgar score at 1 and 5 minutes.

Bothe figures were also recorded and kept for data analysis.

At the end of the study a total of 30 patients with fetal distress requiring delivery by cesarean section versus 30 women with normal labor were collected and their data were further analyzed by statistical methods.

- **Statistical analysis**

For all the continuous variables, normality test was assessed by Kolmogrov Smirnov test.

Correlation between maximum vertical pocket with gestational age, amniotic fluid index, maximum deceleration in seconds and Apgar scores were done with linear regression and estimation of P value with t test for the slopes.

Pearson coefficient of correlation was chosen as that data were normally distributed.

Receiver Operator Characteristic curve was done to calculate the cut off value for maximum vertical pocket associated with fetal distress. T student test was used to compare the continuous variables. Levene test for homogeneity was used to assume equal variance P values less than 0.05 were considered as significant.

Results

At the end of this study a total of 30 patients with fetal distress requiring delivery by cesarean section versus 30 with normal delivery were collected. As far as the epidemiological characteristics, only age has been taken in this study. Comparison of between the age group of woman in with no fetal distress and with fetal distress requiring cesarean section is shown bellow

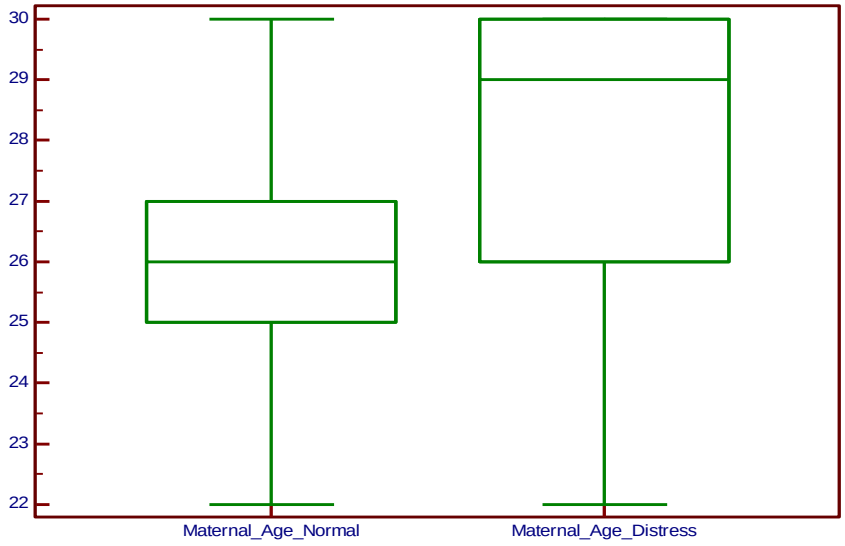

Figure 1 Showing Box and Whisker plot for age among women with normal labor outcome versus women with fetal distress

Table 1 Showing the details of t student test for maternal age among the two study groups

Sample 1	
Variable	Maternal Age Normal (No fetal distress)
Sample 2	
Variable	Maternal Age Distress (fetal distress at labor)

	Sample 1	Sample 2
Sample size	30	30
Arithmetic mean	26.0000	27.5667
Standard deviation	2.1335	2.5955

T-test (assuming equal variances)

Difference	1.5667
Test statistic t	2.554
Degrees of Freedom (DF)	58
Two-tailed probability	P = 0.0133

Assuming equal variance by Levene's test for normality, women in the fetal distress group were significantly older than those with normal labor outcome; 26 versus 27.56 years. P Value = 0.0133

Table 2: Showing the overall results of the study

Correlation	Slope	t- value	Pearson Coefficient	P- Value
MVP versus Gestational age	-0.7941	-34.1481	-0.9526	<0.0001
MVP versus AFI	0.5839	25.2014	0.9163	<0.0001
longest deceleration versus MVP	-11.5533	-15.6116	-0.8078	<0.0001
Apgar Score 1 minute Versus MVP	0.6171	7.8865	0.5175	<0.0001
Apgar Score 5 minutes Versus MVP	0.3166	3.8229	0.2013	0.0003

MVP; Maximum vertical pocket**, AFI;** Amniotic fluid index

- ***Correlation between maximum vertical pocket and gestation***

As shown above there exists a statistically significant correlation between maximum vertical pocket and fetal gestation age, P < 0.0001. The strongly negative coefficient of correlation between maximum vertical pocket size and gestational age beyond 280 days of gestation age, in other word it is a dependable factor for identifying other risk factors associated with fetal condition.

- ***Correlation between maximum vertical pocket and amniotic fluid index***

The statistically significant association between amniotic fluid index and maximum vertical pocket indicates strong dependency among them, P < 0.0001. Positive coefficient of correlation indicates proportional correlation between them, the higher AFI value the higher is the maximum vertical pocket value. Since low value of AFI is well known to be associated with post term pregnancy, this mean that low values of maximum vertical pocket is well associated with post term pregnancy.

- ***The correlation between maximum vertical pocket and longest time of deceleration***

In the table above the dependent/ independent variable were reversed. Taking the maximum vertical pocket as the primary independent factor based on the results obtained in the previous correlations mentioned above. It clearly shown that there exists statistically significant associated between the maximum pocket size and the occurrence of the longest period of deceleration in dips two P < 0.0001. The negative coefficient of correlation indicates inverse relationship in between them.

- ***Correlation between Apgar score at 1 and 5 minutes with maximum vertical depth***

Still as shown above, taking the maximum vertical pocket as independent factor, there exist a statistically significant association between Apgar

score at 1 and 5 minutes, and Maximum vertical pocket size, P< 0.0001 and p=0.0003, respectively .

The positive coefficient of correlation indicates higher expected Apgar score at 1 and 5 minutes with higher readings of maximum pocket size.

- ***Cut off value maximum vertical depth associated with fetal distress for maximum vertical pocket***

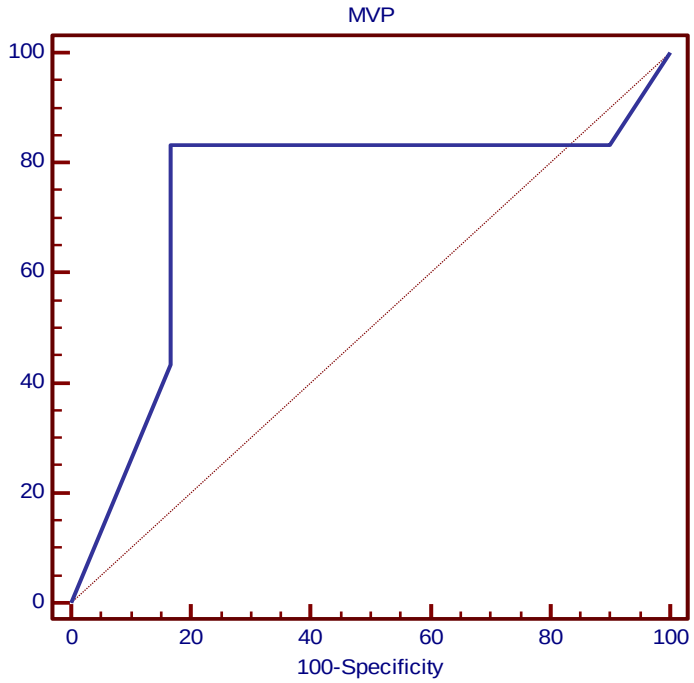

Figure 2 Showing the receiver operator characteristics curve for calculating the cut off value for fetal distress with regards to maximum vertical pocket

Table 3 which shows the different cut off values with their associated sensitivities and specificities

Criterion	Sensitivity	95% CI	Specificity	95% CI
< 1	0.00	0.0 - 11.6	100.00	88.4 - 100.0
<=1	43.33	25.5 - 62.6	83.33	65.3 - 94.4
<=3 *	83.33	65.3 - 94.4	83.33	65.3 - 94.4
<=6	83.33	65.3 - 94.4	10.00	2.1 - 26.5
<=7	100.00	88.4 - 100.0	0.00	0.0 - 11.6

From table 3 is shown that the value 3 cm or less for maximum vertical pocket size is associated with 83.33 % sensitivity and the same figure specificity. In other words, overdue pregnant woman presenting at labor time with maximum vertical pocket equal or less that 3 cm has 83.33 % chance to have fetal distress with delivery by cesarean section, while above this figure has 83.33 % chance to have vaginal delivery with no fetal distress.

- ***Cut off value amniotic fluid index associated with fetal distress for amniotic fluid index***

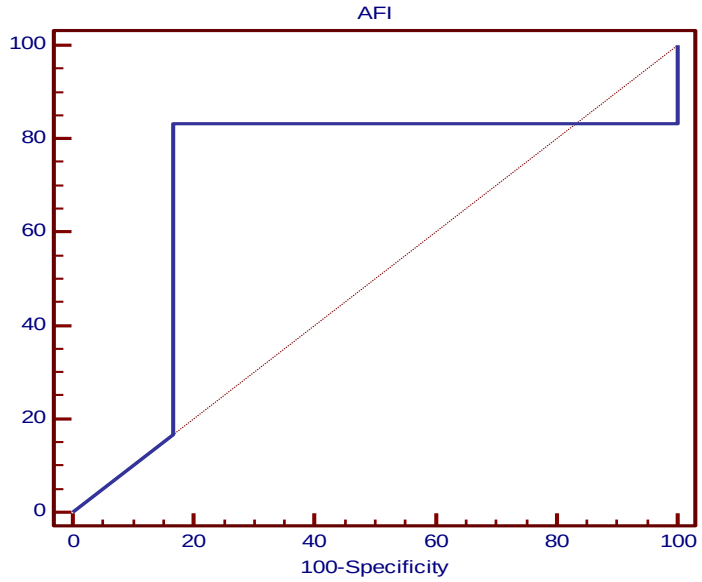

Figure 3: Showing the receiver operator characteristics curve for calculating the cut off value for fetal distress with regards amniotic fluid index

Table 4 which shows the different cut off values with their associated sensitivities and specificities

Criterion	Sensitivity	95% CI	Specificity	95% CI
< 1	0.00	0.0 - 11.6	100.00	88.4 - 100.0
<=1	16.67	5.6 - 34.7	83.33	65.3 - 94.4
<=5 *	83.33	65.3 - 94.4	83.33	65.3 - 94.4
<=10	83.33	65.3 - 94.4	0.00	0.0 - 11.6
<=15	100.00	88.4 - 100.0	0.00	0.0 - 11.6

More interestingly the cut off value associated with fetal distress is equivalent to the global standards, 5 cm. which means when AFI is above 5 cm among overdue pregnant women, the chance for having normal labor without fetal distress is still 83.33%, while bellow this figure the chance for have fetal distress jumps to 83.33 %, as shown in the table above. More interestingly those figures match exactly the cut off value 3 cm for maximum vertical depth measure. This concludes the overall results obtained in this study. Despite maximum vertical pocket can predict fetal distress during labor; however it is neither more sensitive nor specific than routine amniotic fluid index measurement.

Discussion

As far as obstetrical practice is concerned, it well established that any cause of oligohydramnios is almost always associated with fetal distress irrespective of placental insufficiency, Groome et al [9]. This simply explained by the fact that once oligohydramnios develops, the umbilical cord will be compressed between the fetal body and the uterine wall. This compression will ultimately reduce the blood flow in the umbilical artery irrespective of placental function, Trimmer et al [10]. The effect of oligohydramnios on fetal blood flow is irrelevant whether placental insufficiency is present or not and oligohydramnios per se may nictitate preterm delivery at 34 weeks of gestation for example in premature rupture of the membrane or preeclampsia, Leveno et all [11].

However the effect of oligohydramnios on blood flow is highly variable due to many factors mostly due to umbilical artery coiling and umbilical artery length. De Laat et all has found the coiling of umbilical artery may explain why some fetuses with severe oligohydramnios may survive fetal distress, simply the more coiled umbilical artery the more resistant to cord compression [12]. In this study it has been found that maximum vertical pocket correlates well with amount of liquor as assessed by amniotic fluid index.

This finding is consistent with results obtained by Williams et all [8], in which they have similar finding. In addition he has found good correlation between maximum vertical pocket and increased rate of fetal distress and delivery by emergency cesarean section. Also, it has been found in this study that the cut off values associated with fetal distress for maximum vertical pocket as well as amniotic fluid index are 3 and 5 cm, respectively. These findings match exactly the cut off values obtained by Dasari et al [13], who has calculated exactly the same figures in his study. However, analysis by receiver operator characteristic curve

analysis in their study has shown no advantage for maximum vertical pocket over amniotic fluid index in predicting fetal distress during labor.

This is consistent with results obtained by Carla et all [14].

In her study amount of liquor was assessed 2 days before delivery by both amniotic fluid index and maximum vertical pocket.

So far no advantage was noticed for maximum vertical pocket in predicting fetal distress during labor and neonatal complications compared to amniotic fluid index. This simply reflects the fact that depending on amount of liquor alone to predict fetal well being among women with oligohydramnios has still short benefits, Chauhan et all [15]. And these findings lead us to the final conclusion in this discussion.

Obviously depending on amount of liquor alone irrespective of the method of measurement, yield poor results than those which depend on scoring like biophysical profile, for predicting fetal well being. So if a new scoring system will be developed in the future taking into account the amount of liquor, we believe that maximum vertical pocket is better, easier and more accurate than amniotic fluid index. Such scoring system may involve Doppler study of umbilical blood flow. However unless such models are developed and tested clinically, this point of view will remain theoretical so far.

Conclusion

This study has shown that a maximum vertical pocket correlates well with gestational age above 40 weeks, fetal distress during labor. However it has not been proved to be superior to amniotic fluid index in predicting fetal distress. We recommend our colleagues to do similar studies to confirm or deny the results obtained in this study.

References

1- Savitz DA, Terry JW Jr, Dole N, Thorp JM Jr, Siega-Riz AM, Herring AH. Comparison of pregnancy dating by last menstrual period, ultrasound scanning, and their combination. Am J Obstet Gynecol. 2002 Dec;187(6):1660-6.

2- Bennett KA, Crane JM, O'shea P, Lacelle J, Hutchens D, Copel JA. First trimester ultrasound screening is effective in reducing postterm labor induction rates: a randomized controlled trial. Am J Obstet Gynecol. 2004 Apr; 190(4):1077-81.

3- Divon MY, Ferber A, Nisell H, Westgren M. Male gender predisposes to prolongation of pregnancy. Am J Obstet Gynecol. 2002 Oct; 187(4):1081-3.

4- Heimstad R, Romundstad PR, Eik-Nes SH, Salvesen KA. Outcomes of pregnancy beyond 37 weeks of gestation. Obstet Gynecol. 2006 Sep; 108(3 Pt 1):500-8.

5- Stokes HJ, Roberts RV, Newnham JP. Doppler flow velocity waveform analysis in postdate pregnancies. Aust N Z J Obstet Gynaecol. 1991 Feb; 31(1):27-30.

6- Morris JM, Thompson K, Smithey J, Gaffney G, Cooke I, Chamberlain P, Hope P, Altman D, MacKenzie IZ. The usefulness of ultrasound assessment of amniotic fluid in predicting adverse outcome in prolonged pregnancy: a prospective blinded observational study. BJOG. 2003 Nov; 110(11):989-94.

7- Clement D, Schifrin BS, Kates RB. Acute oligohydramnios in postdate pregnancy. Am J Obstet Gynecol. 1987 Oct; 157(4 Pt 1):884-6.

8- Williams K, Wittmann B, Dansereau J. Intraobserver reliability of amniotic fluid volume estimation by two techniques: amniotic fluid index vs. maximum vertical pocket. Ultrasound Obstet Gynecol. 1993 Sep 1; 3(5):346-9.

9- Groome LJ, Owen J, Neely CL, Hauth JC. Oligohydramnios: antepartum fetal urine production and intrapartum fetal distress. Am J Obstet Gynecol. 1991 Oct; 165(4 Pt 1):1077-80.

10- Trimmer KJ, Leveno KJ, Peters MT, Kelly MA. Observations on the cause of oligohydramnios in prolonged pregnancy. Am J Obstet Gynecol. 1990 Dec;163(6 Pt 1):1900-3

11- Leveno KJ. Amnionic fluid volume in prolonged pregnancy. Semin Perinatol. 1986 Apr;10(2):154-61. Review.

12- de Laat MW, Franx A, Bots ML, Visser GH, Nikkels PG. Umbilical coiling index in normal and complicated pregnancies. Obstet Gynecol. 2006 May;107(5):1049-55

13- Dasari P, Niveditta G, Raghavan S. The maximal vertical pocket and amniotic fluid index in predicting fetal distress in prolonged pregnancy Int J Gynaecol Obstet. 2007 Feb;96(2):89-93. Epub 2007 Jan 22.

14- Verrotti C, Bedocchi L, Piantelli G, Cavallotti D, Fieni S, Gramellini D. Amniotic fluid index versus largest vertical pocket in the prediction of perinatal outcome in post-term pregnancies. Acta Biomed. 2004;75 Suppl 1:67-70.

15- Chauhan SP, Magann EF, Morrison JC, Whitworth NS, Hendrix NW, Devoe LD. Ultrasonographic assessment of amniotic fluid does not reflect actual amniotic fluid volume. Am J Obstet Gynecol. 1997 Aug;177(2):291-6; discussion 296-7

* *Consultant Obstetrician & Gynecologist, Al-Yermouk Teaching Hospital*