Original Article

Ultrasound Assessment of Amniotic Fluid in Predicting Adverse Outcome in Prolonged Pregnancy

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Abstact

Postdated pregnancy has been shown to be a time of risk. Placental insufficiency is postulated to be the cause of the adverse obstetric outcomes. Ultrasound assessment of amniotic fluid volume has been widely introduced into clinical practice as a method of fetal surveillance. The present study tried to find out if a single ultrasound scan at or beyond 40 weeks of gestation, an amniotic fluid index <5 cm is clinically useful in predicting adverse fetal outcome. A case control study in the Department of Obstetrics and Gynaecology, Bangabandhu Sheikh Mujib Medical University, included 50 women at term pregnancy (control) and 50 women at or beyond 40 weeks of pregnancy (case). Most of the patients belonged to age group 20 29 years (78%/80%), were housewives (88%/72%), nulliparous (50%/52%), had no history of false labour pain (72%/66%), were on regular antenatal checkup (92%/84%), normal fetal movement (88%/80%), on labour pain 974%/54%), with fundal height <36 cm (90%/76%), amniotic fluid index ≥5cm (96%/84%), no meconium stained liquor (94%/74%). Most of the control group of women were delivered vaginally (66%) and cases abdominally (72%). Fetal head circumference was ≥ 35 cm in 10% vs 24%, birth weight >3.5 kg in 4% vs 14%, and Apgar score <6 in 4% vs 20%. Apgar score of significantly high number of babies was <6 when AFI was <5 cm (87.5%). Ultrasound AFI may be routinely used for assessment of fetal risk at or beyond 40 weeks gestation.

Key words: Ultrasound, Amniotic fluid index, Oligohydramnios, Postdated pregnancy.

Introduction

Prolonged pregnancy is associated with increased perinatal morbidity and mortality[1]. The risk increases from the expected date of confinement (40 weeks of gestation) such that placental insufficiency and postmaturity (greater than 42 weeks of gestation) are associated with an exponential increase in the risk of perinatal death[2]. Delivery beyond 42 weeks is associated with a fourfold increase in death in utero, as well as a threefold increase in neonatal death compared with delivery at term[3]. In addition to mortality, there is an increased risk of meconium aspiration syndrome, neonatal seizures and long term handicap[4].

Ultrasonographic assessment of amniotic fluid is used frequently to identify a fetus at risk of having an adverse outcome. There is no consensus about whether ultrasound assessment of amniotic fluid volume is a sufficiently sensitive test of fetal welfare and whether a single deepest pool or calculation of the amniotic fluid index (AFI) is the more reliable. Several studies have suggested that oligohydramnios detected by ultrasound is a useful test for detecting placental insufficiency[5-8]. Proper evaluation of a test, however, required that it be evaluated prospectively with clinicians blinded to the test result[9]. Amniotic fluid is sonolucent and readily distinguishable from maternal or fetal tissue. Quantifying the amount of fluid presents significant problems. The fetus is a complex, moving, three dimensional object with fluid gathered in pockets between juxtaposed fetal parts. Therefore, subjective estimates of amniotic fluid volume, and various semiquantitative estimates such as the 1 cm pocket, the 2 cm pocket, the 3 cm column, and the amniotic fluid index have been suggested[10-14].

The present study was undertaken to find out the usefulness of ultrasonographic measurement of amniotic fluid in women at or beyond 40 weeks of gestation in predicting perinatal morbidity and mortality.

Materials and Methods

This prospective case control study was carried out during October 2005 and February 2006 in the Department of Obstetrics and Gynaecology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka. The study included 50 women at term pregnancy (control) and 50 women at or beyond 40 weeks of pregnancy (case). Exclusion criteria for control and case group were women who were unable to give accurate history of their last menstrual period (LMP), had history of some irregularities of menstruation prior to existing pregnancy, high risk patients, e.g. preeclampsia, eclampsia, heart disease, diabetes, renal disease, women with essential hypertension, multiple pregnancy and congenital anomalies, pregnancy occurring during lactational amenorrhoea, women suffering from venereal disease and pregnancy with blood group incompatibility.

All study patients were on regular or irregular antenatal check up in the outpatient department or by specialist or by other doctors in rural areas. Gestational age on admission was evaluated by measurement of fundal height, girth of the abdomen, quantity of liquor amnii, lie, consistency of fetal head, fetal heart rate and condition of cervix.

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All ultrasonographic examinations were performed by same ultrasonographer who was also responsible for quality control at intervals during the study period. All measurements were made in a vertical plane with transducer face parallel to the floor. The AFI was calculated by dividing the maternal abdomen into four quadrants using the umbilicus and the linea nigra as reference markers. Measurement of the deeper pool in each quadrant was summated. AFI value ≥5 cm was taken as normal.

Collected data was compiled and appropriate statistical analyses were done using SPSS.

Results

Table I shows characteristics of the study patients. None of the parameters, such as, age, occupation, parity, and history of false labour pain showed statistically any significant variation. In control and case group, respectively, 4 (8%) women each belonged to age group <20 years, 39 (78%) and 40 (80%) belonged to age group 20-29 years, and 7 (14%) and 6 (12%) belonged to age group 30-39 years. Occupation showed that 44 (88%) and 46 (72%) women were housewives, 2 (4%) and 3 (6%) were serviceholders, and 4 (8%) and 1 (2%) were engaged in various other occupation, respectively. Parity distribution shows that 25 (50%) and 26 (52%) were nulliparous, 11 (22%) and 10 (20%) were primiparous, and 14 (28%) each were multiparous. History of false labour pain showed that 14 (28%) and 17 (34%) had positive history, and 36 (72%) and 33 (66%) had none.

Table I: Characteristics of the study population

Parameters	Control (n=50)		Case (n=50)		P value
	No.	(%)	No.	(%)	
Age (years)					0.956ns
<20	4	(8.0)	4	(8.0)	
20 29	39	(78.0)	40	(80.0)	
30 39	7	(14.0)	6	(12.0)	
Occupation					0.360ns
Housewife	44	(88.0)	46	(72.0)	
Service	2	(4.0)	3	(6.0)	
Others	4	(8.0)	1	(2.0)	
Parity					0.967ns
Nulliparous	25	(50.0)	26	(52.0)	
Primiparous	11	(22.0)	10	(20.0)	
Multiparous	14	(28.0)	14	(28.0)	
History of false labour pain					0.517ns
Yes	14	(28.0)	17	(34.0)	
No	36	(72.0)	33	(66.0)	

Chi square test, ns = Not significant

Table II shows status of present pregnancy. In control and case group, respectively, ANC showed statistically no significant variation; regular ANC was in 46 (92%) and 42 (84%) instances, and irregular in 4 (8%) and 8 (16%) instances. Fetal movement was normal in 44 (88%) and 40 (80%) cases, and decreased in 6 (12%) and 10 (20%) cases (no significant variation). Labour pain was present in 37 (74%) and 27 (54%), and absent in 13 (26%) and 23 (46%) (P<0.05). Fundal height was <36 cm in 45 (90%) and 38 (76%), and ≥36 cm in 5 (10%) and 12 (24%) cases (no significant variation). Liquor volume (AFI) was decreased (<5 cm) in 2 (4%) and 8 (16%), and normal ≥5 cm) in 48 (96%) and 42 (84%) (P<0.05). Meconium stained liquor was seen present in 3 (6%) and 13 (26%) cases, and absent in 47 (94%) and 37 (74%) cases (P<0.01). Mode of delivery was 33 (66%) and 14 (28%), and Caesarean section in 17 (34%) and 36 (72%) cases (P<0.001). Postdelivery complication was absent in 47 (94%) and 46 (72%), PPH present in 2 (4%) and 3 (6%), and wound infection present in 1 (2%) each (no significant variation).

Table II: Status of present pregnancy

Parameters	Control (n=50)		Case (n=50)		P value
	No.	(%)	No.	(%)	
ANC					0.218ns
Regular	46	(92.0)	42	(84.0)	
Irregular	4	(8.0)	8	(16.0)	
Fetal movement					0.275ns
Normal	44	(88.0)	40	(80.0)	
Decreased	6	(12.0)	10	(20.0)	
Labour pain					0.037*
Present	37	(74.0)	27	(54.0)	
Absent	13	(26.0)	23	(46.0)	
Fundal height					0.062ns
< 36 cm	45	(90.0)	38	(76.0)	
≥36 cm	5	(10.0)	12	(24.0)	
Liquor volume (AFI)					0.046*
< 5 cm (decreased)	2	(4.0)	8	(16.0)	
≥ 5 cm (normal)	48	(96.0)	42	(84.0)	
Meconium stained liquor					0.006**
Yes	3	(6.0)	13	(26.0)	
No	47	(94.0)	37	(74.0)	
Mode of delivery					0.0001***
Vaginal	33	(66.0)	14	(28.0)	
Caesarean section	17	(34.0)	36	(72.0)	
Postdelivery complications					0.900ns
None	47	(94.0)	46	(72.0)	
PPH	2	(4.0)	3	(6.0)	
Wound infection	1	(2.0)	1	(2.0)	

Chi square test, ns = Not significant, * = Significant (P<0.05), ** = Significant (P<0.01), *** = Significant (P<0.001)

Table III shows fetal status. Head circumference was <35 cm in 45 (90%) and 38 (76%) cases, and ≥35 cm in 5 (10%) and 12 (24%) cases (no significant variation. Birth weight was <2.5 kg in 5 (10%) and 1 (2%) cases, 2.5 3.5 kg in 43 (86%) and 42 (84%) cases, and >3.5 kg in 2 (4%) and 7 (14%) cases (no significant variation). Apgar score (1 minute) was <6 in 2 (4%) and 10 (20%), and ≥6 in 48 (96%), and 40 (80%) cases (P<0.05).

Table III: Status of fetus

Parameters	Control (n=50)		Case (n=50)		P value
	No.	(%)	No.	(%)	
Head circumference (cm)					0.062ns
<35	45	(90.0)	38	(76.0)	
≥ 35	5	(10.0)	12	(24.0)	
Birth weight (kg)					0.065ns
<2.5	5	(10.0)	1	(2.0)	
2.5 3.5	43	(86.0)	42	(84.0)	
>3.5	2	(4.0)	7	(14.0)	
Apgar score 1 min					0.014*
<6	2	(4.0)	10	(20.0)	
≥ 6	48	(96.0)	40	(80.0)	

Chi square test, ns = Not significant, * = Significant (P<0.05)

Table IV shows effect of AFI on Apgar score (1 minute) of babies. Apgar score (1 minute) was <6 and ≥6, respectively, in 3 (7.1%) and 39 (92.9%) babies when AFI was normal (≥5 cm), and in 7 (87.5%) and 1 (12.5%) when AFI was decreased (<5 cm) (P<0.001).

Table IV: Effect of liquor volume on Apgar score of cases

Liquor volume (AFI)

Apgar score	Normal (1 minute) (n=42)		Decreased (≥5 cm) (n=8)		P value (<5 cm)
	No.	(%)	No.	(%)	
<6	3	(7.1)	7	(87.5)	0.0001***
≥6	39	(92.9)	1	(12.5)	

Chi square test, *** = Significant (P<0.001)

Discussion

Prolonged pregnancy is a high risk pregnancy, as there is a possibility of fetal distress and death due to progressive fetal hypoxia following placental insufficiency as a result of its aging. It is also accompanied by a reduction in the volume of amniotic fluid. Oligohydramnios detected by ultrasound is an useful test for detecting placental insufficiency. The most common fetal problems associated with prolonged pregnancy are intrapartum fetal distress, meconium aspiration syndrome, fetal trauma, postmaturity syndrome, dysmaturity and also increased incidence of maternal morbidities, including instrumental delivery[15,16].

Ultrasound is probably the most reliable method particularly in women whose menstrual cycle is irregular. The method most commonly used involves measurement of biparietal diameter (BPD), the head circumference (HC), the femur length (FL) and the abdominal circumference (AC). The results obtained by averaging these measurements had a better correlation with the gestational age as determined by neonatal evaluation of the newborn than any of the methods used in the past. Single ultrasound examination for determining gestational age is unreliable after 30 weeks and that the best time to determine the age of the fetus using a single set of ultrasound measurements is between 18-24 weeks of gestation. In majority of cases the gestational age of fetus and the expected date of delivery (EDD) will be clearly established with a single ultrasound examination if it is obtained between 18-24 weeks. If a second set of measurements deviates by more than 1 week from the first, the obstetrician should suspect an abnormality in fetal growth[15].

Previous studies have suggested that the perinatal mortality increases from 40 weeks of gestation to 4.8/1000 at 42 weeks of gestation[17]. Ultrasound assessment of amniotic fluid volume has been widely introduced into clinical practice as a method of fetal surveillance. There is uncertainty, however, about the measure that should be used to indicate oligohydramnios. After publication of a reference range for AFI[18], it has been suggested that an AFI of <5 cm should be considered abnormal compared with a deepest pool <2 cm[11].

In the present study, majority of the case group (prolonged pregnancy) of women, respectively, belonged to age group 20-29 years (80%). Rahima showed that 88% patients belonged to age group 18-29 years[19]. Morris. showed that mean age of cases was 31.9 years[20].

Bergiso showed that prolonged pregnancy occur more commonly in women with sedentary habit[21]. Present study shows that housewives have 10 times more risk of having prolonged pregnancy compared to serviceholders.

Parity distribution shows that in the present study risk of prolonged pregnancy was higher in nulliparous and primiparous women (72%) in comparison to multiparous (28%). However, Rahima showed that the risk was 60% in primiparous and 40% in multiparous[19].

History of false labour pain may be a risk factor for prolonged pregnancy as shown in the present study and in a study by Dutta[16].

Regular antenatal checkup may lower the risk of prolonged pregnancy as has been shown in the present study and a study by Crowley[3]. Fetal movement was normal in most of the women of the present study. Labour pain was present significantly (P<0.5) in less number of women of case (54%) compared to control (74%). Fundal height was ≥36 cm in 24% case group of women compared to 10% in control. Arias opined that if the fundal height is ≥36 cm, the risk of prolonged pregnancy is significantly higher[15].

Morris reported that liquor volume is normally significantly lower in prolonged pregnancy[20]. Arias also reported that amniotic fluid volume gradually decreases with advancement of pregnancy[15]. In the present study, the incidence of oligohydramnios was fourtimes higher in prolonged pregnancy (case group) compared to term pregnancy (control group) (P<0.05). There is an increased chance of meconium stained liquor in prolonged pregnancy as reported by Arias[15]. Morris also showed that there is

increased chance of meconium stained liquor in prolonged pregnancy[20]. In the present significantly higher (P<0.01) number of patients of case group had meconium stained liquor (26% case vs 6% control). Morris showed that patients with prolonged pregnancy had more chance of abdominal delivery[20]. In the present study significantly high (P<0.001) number of women underwent abdominal delivery (72% vs 34%). In the present study, incidence of postdelivery complications were very low among women with prolonged pregnancy, like PPH (6%) and wound infection (2%).

Rahima reported that head circumference of babies of prolonged pregnancy were more (≥35 cm) than term pregnancy[19]. In the present study head circumference (≥35 cm) of case and control group babies was 24% and 10%, respectively. Birth weight did not show any significant variation, although 14% babies of case group weighed >3.5 kg compared to 10% of control group. Rayburn showed that in their study 10 20% babies weighed >3.5 kg[22].

Morris showed that Apgar score of 90% babies were <6 if AFI was reduced (<5 cm)[20]. In the present study Apgar score of 87.5% babies was <6 when AFI was <5 cm (decreased).

Placental insufficiency is postulated to be the cause of adverse outcome in prolonged pregnancy. Ultrasound assessment of AFI is presently an effective screening test for assessing fetal outcome. In the present study, prolonged pregnancy with decreased AFI was associated with increased rate of abdominal delivery, increased occurrence of meconium stained liquor, increased birth weight and increased head circumference, and also increased rate of asphyxia.

Routine use of ultrasound AFI for assessment of fetal risk at or beyond 40 weeks gestation is likely to lead to increased obstetric intervention leading to improved perinatal outcome.

Further large scale studies among various section of population may help in predicting usefulness of ultrasound assessment of amniotic fluid in predicting outcome in prolonged pregnancy.

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