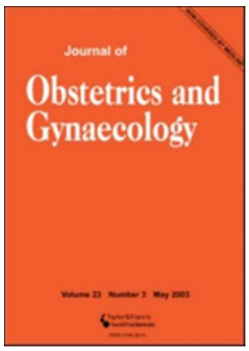

Utility of intrapartum transabdominal ultrasound for the correct placement of a vacuum during delivery

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Utility of intrapartum transabdominal ultrasound for the correct placement of a vacuum during delivery.

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Summary:

The transabdominal ultrasound helps the correct identification of the fetal head position previous to placement the cup of vacuum

Abstract:

We have evaluated the correlation between vaginal digital-examination(DE) and transabdominal ultrasound(TAU) to identify the fetal head position(FHP) previous to a vacuum delivery and how the knowledge of the exact position have an effect on the placement of the cup. We performed a prospective observational study(11/2011-3/2012) in 102 primiparous,≥37w,singleton gestation in full dilation which, previous to vacuum cup placement,DE and TAU was performed to assess FHP.After birth, the distance between the center of the chignon and the flexion point was measured.We have studied 81 cases. TAU identified 100% of FHP and DE 96.3%.The relationship between DE and TAU for the identification of FHP was 71.5%(58/81). The average distance between the center of the chignon and the flexion point was 1.6+/-1.0cm(lateral distance 0.7+/-0.5cm).The center of the chignon was placed at less than 2cm of the flexion point in 92.5% cases(75/81).TAE employing helps reduce vaccum misplacing cup 1/4 to 1/10 cases

Introduction

An operative delivery is a common procedure in obstetrics. It is associated to an increase maternal and neonatal morbid-mortality (Sultan et al 1993; Chadwick, 1996; Towner et al, 1999; Murphy et al, 2001; Johanson & Menon,2010; Contag et al, 2010; Eason et al 2010; Majoko & Garderner,2012). The exact knowledge of the fetal head position is essential to the correct placement of a vacuum or a forceps. An accurate operative delivery associates a decrease maternal and neonatal morbid-mortality (Bird, 1976; Vacca et al, 1989; Mola et al, 2002)

In order to correctly identify the fetal head position it has been proposed that vaginal digital examination can fail in 30-52% of cases and that the employment of transabdominal or transvaginal ultrasound has demonstrated better results.

This study proposes the application of transabdominal ultrasound for the correct identification of the fetal head position previous to a vacuum delivery in primiparous women and, by this, to demonstrate the accurate placement of the vacuum cup.

Method

This prospective observational study included 102 at term pregnant women admitted at the Delivery room in Hospital Valme, Seville, between October 2011 and March 2012. Recruited patients were in active labor and required an operative fetal extraction. A comparative assessment between vaginal digital examination and transabdominal ultrasound was performed with the purpose of identify the fetal head position and estimate the adequate placement of the vacuum cup during operative delivery.

Patients included had the following characteristics: at term singleton gestation (37-42 weeks), with no history of vaginal delivery (primiparous or multiparous with no previous vaginal delivery), active labor, ruptured membranes, longitudinal situation and cephalic presentation, spontaneous or induced labor. Patients excluded were all those with maternal diseases such as severe preeclampsia, uncontrolled gestational diabetes, maternal heart disease level 3-

4, endocrine diseases, severe neurologic diseases, maternal infections (HIV, hepatitis, toxoplasmosis), respiratory diseases, severe orthopedic disease or severe fetal diseases (structural malformation, chromosomal diseases, fetal infection, isoimmunization, intrauterine growth restriction, hydrops) and any intend of vacuum delivery even if its finalization was cesarean section or vaginal delivery

In active phase of labor, full dilated with ruptured membranes, and previous to operative delivery, vaginal digital examination and transabdominal ultrasound are performed in order to assess the fetal head position. Three attending obstetricians with more than ten years of experience in labor assistance and obstetric ultrasound were in charge of the evaluations. Fetal head position assessment by vaginal digital examination, was classified as recommended by the ACOG (ACOG, 2007), in 8 categories: direct occiput anterior (DOA), direct occiput posterior (DOP), left occiput anterior (LOA), right occiput anterior (ROA), left occiput transverse (LOT), right occiput transverse (ROT), left occiput posterior (LOP) and right occiput posterior (ROP). For the ultrasound evaluation of the fetal head position a Toshiba Famio 8 (Tokio, Japan) with convex 3.75 MHz probe was used. The orbital region, the fetal cervical spine, the cerebral midline and the cerebellum were used to determine the head position. The ultrasound probe was placed longitudinally and tangential to the skin to identify the cervical fetal spine and the occipital bone. The ultrasound probe was then placed transversely at the suprapubic region of the maternal abdomen to confirm fetal head position using the midline brain echo and the cerebellum (Sherer et al, 2002; Akmal et al, 2002;Wong et al, 2007) (image 1).

Vacuum extraction was performed using Bird´s cup number 5. Optimal placement was determined to be when the center of the chignon was on the sagittal suture 6 cm posterior to the anterior. We assessed two deviations from optimal cup position: the midline anterior-posterior and the midline lateral, both measured in centimeters (cm) (Wong et al, 2007; Haikin & Mankuta, 2012;). Immediately after delivery of the baby, the distance between the center of the chignon and the flexion point was determined using a transparent plastic sheet by a registered midwife (Wong et al, 2007). We consider the distance between

the center of the chignon and the flexion point of 2 cm or less as the adequate cup placement.

To evaluate the correlation between quantitative parameters we use a student t test. The correlation between two qualitative parameters was tested with X^2 and Mann-Whitney test. A $p< 0.05$ was considered statistically significant.

Results

We have analyzed a total of 102 women in active stage of labor and with no history of vaginal delivery. 20 cases were missed: in 8 of these cases, a cesarean section was decided after digital and ultrasound examination; 7 of the cases required an instrument different than vacuum and in 5 cases the data was incomplete.

Table 1 shows general obstetric and intrapartum parameters of the studied population (81 patients). The mean maternal age was 29.6+/-5.9 years. Mean gestational age at delivery was 39.4+/-1.4 weeks.

9 women had history of a previous cesarean section. In 6 of the cases, the gestation was pathologic. Mean estimated fetal weight was 3360 gr. 78.1% of labors initiated spontaneously. Average duration of the first stage of labor was 7.82 hours. Epidural anesthesia was used in all the cases. 100% of operative deliveries were achieved with vacuum; its main indication was extended second stage (78%).

The neonatal results of the studied population are demonstrated in table 2. 46.9% of newborns were females with a mean weight of 3364 gr. Average Apgar at the first minute was 8.8, and at 5 minutes 9.96. Mean fetal pH, which was obtained from umbilical cord blood, was 7.24. No cases of neonatal morbid-mortality were found. 2 cases required admittance to the neonatal care unit.

The most common fetal head position identified by vaginal digital examination was left occiput anterior (27%) followed by right occiput transverse (23.4%). vaginal digital examination was not able to recognized fetal head position in 3.7% of the cases (**table 3**).

Through transabdominal ultrasound we have identified the fetal head position in 100% of the cases. Most frequent position recognized by transabdominal ultrasound was left occiput anterior (29.6%) followed by right occiput transverse (22%)(**table 3**).

The association between the position identified by vaginal digital examination and transabdominal ultrasound was observed in a 71.5% (58/81). Occiput anterior presentation had the best correlation (100%), followed by right occiput transverse (83.3%) and left occiput anterior (79.1%). Occiput posterior position showed a 60% correlation **(table 3).**

The concordance in the fetal head position identification went from a 75%, when the presenting fetal part in birth canal is at a lower level, to a 50% in a higher level **(table 4).**

The mean distance between the center of the chignon and the flexion point was 1.6+/-1.0 cm and the lateral displacement distance from the flexion point was 0.7+/-0.5. In 92.5% (75/81) of the cases the chignon was found to be at less than 2cm from the flexion point. An occiput posterior presentation was found at 4 of the 6 cases in which the chignon was at more than 2 cm.

Discussion

Fetal extraction with vacuum supposes a 5-20% of total deliveries. When fetal extraction with vacuum fails, maternal and neonatal morbid-mortality increases clearly (Revah et al, 1997; Sadan et al, 2003; Bhide et al, 2007). The latter occurs in 4-23% of the cases, and the clearest reason associated with this is the fetal malposition or the vacuum cup misplaced (Al-Kadri et al, 2003; Ebulue et al, 2008; Wanyonyi et al, 2011). Bhide (Bhide et al, 2007) concluded that failed vacuum delivery associated a fetal malposition and this causes an increased risk of maternal postpartum hemorrhage (OR 3.5). Vacca (Vacca et al, 1989) found suboptimal placement of the cup to be a common factor in 50% of failed deliveries and that neonatal injury rate increased from 5% for flexing median to 45% for deflexing paramedian application. Mola (Mola et al, 2002) demonstrated that when a vacuum delivery fails it determines an increased risk

(4.5) of deflexing application and this results in low Apgar score, serious scalp trauma and admission to the neonatal unit of 3.2 times, 5.2 times and 12 times more likely, respectively. Teng (Teng & Sayre, 1997) established that among the principal facts that cause fetal scalp traumas after vacuum extraction were: duration of vacuum application, duration of second stage of labor and paramedian application of the cup. Chadwick (Chadwick et al, 1996) showed how an incorrect vacuum cup application associates an increased risk of subgaleal hematomas.

The data intends to emphasize the importance of the correct application of the vacuum cup. Multiple studies recognized the rate of failure that a DE has on identifying fetal head position during labor. Sherer (Sherer et al, 2002; Sherer et al 2002) described a 46% failure, Kreiser (Kreiser et al, 2001) a 30% and Souka (Souka et al, 2003) a 61% during first stage and 31% in second stage of labor. Akmal (Akmal et al, 2003) found an error corresponding to 2.6-34% of the cases in which occasion more than 45º was associated to 26.6-34% of the cases. According to Sherer (Sherer et al, 2002; Sherer et al 2002) epidural anesthesia improves the results on improving the fetal head position identification, in the other hand, it does not observes differences among parity, maternal age, body mass index, gestational age, dilation and cervical effacement, ruptured membranes, level of the descent of the presenting part, and fetal head position.

Dupuis (Dupuis et al, 2005) making use of a newly designed birth simulator observed a vaginal digital examination failure between 36-80% of the cases; 34% failure among obstetricians in classifying the level of fetal descent in high, mid-pelvis, low and outlet and a 67% error in identifying high and mid-pelvis. Sherer (Sherer et al, 2002; Sherer et al 2002) showed similar results on failure rate (50%) with ACOG's station 0 and refers to the difficulty of an operative delivery in this situation.

Intrapartum ultrasound has demonstrated its efficacy to identify the proper fetal head position. Results show a low interobserver variability with a difference less than 15º in 90% of the case: It does not require a great study because the reference points (orbits, cerebral middle line and cerebellum) are easy to recognize (Akmal et al, 2005). Mean time to perform the ultrasound examination

was 2 minutes, no differences were found between transabdominal nor transvaginal (Chou et al, 2004; Zahalka et al, 2005).

Our study collected 81 primiparous women in active stage of labor, fully dilated, who required an operative delivery and in which cases the knowledge of the exact fetal head position was essential. Previous to operative maneuvers, performed by experienced attendings, fetal head presentation by vaginal digital examination was not identificated in 3.7% of cases, 28.5% examinations failed reaching a 30% in occiput posterior presentations. Besides, we observed that a higher level of head descent associates a more inaccurate identification of fetal head position. Our data agrees with recent publications. Moreover, our results shows how the vacuum cup will be misplaced in 1 of every 4 operative deliveries if the flexion point is identified using vaginal digital examination.

Wong (Wong et al, 2007), during the first study assessing the intrapartum transabdominal ultrasound for the correct vacuum cup application found no statistical differences in vaginal digital examination, but it did observed a shorter distance between the center of the chignon and flexion point (2.1+/- 1.3 versus 2.8+/- 1.0). Haikin (Haikin & Mankuta, 2012) observes that the vacuum cup application is not influenced by the experience of the obstetrician in contrast, to the correct identification of cranial fetal sutures. Accurate application of vacuum cup was defined as a < 3cm deviation of the anterior-posterior midline and < 2cm from the lateral deviation of the flexion point. In 28.5% of the cases the vacuum cup site was modified after confirming the misplaced with transabdominal ultrasound and in 92.5% we succeed to place the vacuum cup at less than 2cm form flexion point. We have certain difficulty in placing de vacuum cup in occiput posterior presentations. Transabdominal ultrasound helped us to assess the correct presentation in 40% of cases. In 4 of every 10 cases we were unable to place the cup at less than 2cm from the flexion point.

Although our results are challenging, some of our limitations were: small total number of cases and maternal and neonatal complications are not valuable. More studies should be done to assess the deviation distance between vacuum cup and flexion point and to compare vaginal digital examination with transabdominal ultrasound before the vacuum cup placement.

Conclusions

We failed to identify 1 of every 4 cases, making use of transabdominal ultrasound to identify fetal head position this rate decreased to 1 of every 10.

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Declaration of interest statement:

The authors (Carlota Borrero, Pamela Valdivieso, Begoña Rodríguez, Rosa Serrano, José Garcia-Mejido, Jose A Sainz) report no conflicts of interest.

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Image 1. To determine the position of the head use: 1 cerebral midline. 2 cerebellum. 3 orbital region.

Table 1. General and intrapartum obstetric features of the total studied population (N=81).

	N 81	Percentage %
Mean maternal age	29.60	SD 5.901
History of cesarean section	9	11.1 %
Gestational disease	15	14.2%
Gestational Diabetes	2	1.4%
Hypertensive state of pregnancy	2	1.4%
Intrauterine growth restriction	5	5.7%
Others	6	7.4%
Gestational weeks at delivery	39.47	SD 1.452
Mean fetal weight (g)	3,360	SD 338.42
Induced deliveries	23	25.7%
Chronological prolonged pregnancy	5	5.7%
Ruptured membranes	7	10%
Intrauterine growth restriction	5	5.7%
Hypertensive state of pregnancy	2	1.4%
Others	4	2.8%
Epidural analgesia	81	100%
Number of operative deliveries	81	100%
Indication of operative delivery		
Prolonged expulsive phase	56	80%
Altered cardiotochography	9	12.9%
Others	5	7.1%
Vacuum deliveries	81	100%
Cesarean section delivery	14	17.2%
Maternal morbidity	2	2.8%
Tear of Cesarean section scar	2	2.8%
Others	0	0%

The results are show in media and standard deviation (SD).

Table 2. Neonatal outcome of the total studied population (N= 81).

	N 81	Percentage %
Newborn gender (Females)	38	46.9%
Newborn weight in grams	3,364	SD 423.34
APGAR at 1 minute	8.80	SD 1.051
APGAR at 5 minutes	9.96	SD 0.268
Newborn umbilical artery pH	7.24	SD 9.782
Perinatal mortality	0	0%
Perinatal morbidity	3	3.7%
Head laceration	2	66%
Head trauma	1	33%
Others	0	0%

The results are show in media and standard deviation (SD).

Table 3. Fetal head position assessment through digital examination (DE), transabdominal ultrasound (TAU) and its correlation.

POSITION	DE	TAU	DE/TAU correlation
DOA	13 (16%)	7 (8.6%)	**7/7 (100%)**
ROA	8 (9.8%)	12 (14.8%)	**6/11 (54.5%)**
LOA	22 (27.1%)	24 (29.6%)	**19/24 (79.1%)**
ROT	19 (23.4%)	18 (22.2%)	**15/18 (83.3%)**
LOT	9 (11.1%)	9 (11.1%)	**5/8 (62.5%)**
OP	7 (8.6%)	11 (13.5%)	**6/10 (60%)**
Not possible	3 (3.7%)	0 (0%)	**3 (3.7%)**
Total			**58/81 (71.5%)**

Occiput anterior (DOA), right occiput anterior (ROA), left occiput anterior (LOA), right occiput transverse (ROT), left occiput transverse (LOT), occiput posterior (ROP)

Table 4. Evaluation of the association between digital examination (DE) and transabdominal ultrasound (TAU) in the identification of the fetal head position according to the level of descent of the presenting part. Total number of studied cases: 81.

Level of descent of the presenting part	Total cases of DE	DE/TAU association
High	4 (4.9%)	2/4 (50%)
Medium	17 (20.9%)	11/17 (64.7%)
Low	60 (74.0%)	45/60 (75%)
Total	81 (100%)	58/81 (71.5%)