

Intrapartum sonography head transverse and asynclitic diagnosis with and without epidural analgesia initiated early during the first stage of labor

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Abstract. – Purpose: To investigate if early epidural analgesia can influence fetal head engagement into the pelvis and if it can increase the rate of transverse and asynclitic position during labour.

Materials and Methods: 195 women with combined spinal-epidural analgesia (CSE) or without neuraxial analgesia were studied. CSE was performed using a mixture of ropivacaine 0.02% with 0.3 µg/ml of sufentanil administered in the spinal space. Maintenance of analgesia was managed with intermittent epidural administration of 10-15 ml of ropivacaine (0.07%-0.10%) mixed with 0.5 µg/ml of sufentanil, based on the stage of labour and the degree of pain. 2D transabdominal ultrasound (US) was used. Serial transabdominal US examinations were performed at 45-90 min intervals to detect transverse and asynclitic positions, using the following signs: squint sign, sunset thalamus and cerebellum signs that best details the fetal head station. After delivery, the complete set of clinical and US data obtained by each examination were recorded and compared in women with and without labour analgesia. Data were examined by independent reviewers.

Results: There was no difference in obstetric outcome between women in whom CSE had been used and those who did not request analgesia during labour ($p>0.05$).

Conclusions: Epidural analgesia initiated early during labour and using low doses does not increase the rate of dystocic labors. Transverse fetal head positioning with anterior or posterior asynclitism does not seem to be promoted by drug or technique-related mechanisms, but rather should be the consequence of cephalopelvic disproportion.

Key Words:

Intrapartum sonography, Transverse position, Asynclitism, Labour, Neuraxial analgesia, Cesarean section, Anesthesia, Delivery, Complications.

Introduction

Historically, X-Ray studies have demonstrated that the fetal head is typically positioned in transverse diameter late in the third trimester and usually rotates during labor to an occiput anterior or occiput posterior position¹. The fetal head engages the upper pelvis in transverse position in 75% of cases². A persisting occiput-transverse position can cause either obstructed labor in the first stage or a 'deep transverse arrest' in the second stage where delivery cannot be achieved by maternal pushing and requires the use of forceps or vacuum³⁻⁴. With the fetal head in transverse position, engagement is stopped because the limiting factor into the mid-pelvis is the interspinous diameter (accounted between the ischial spines), which is usually the smallest pelvic diameter and should be greater than 10 cm. The occiput transverse position arises when the fetal head fails to rotate to an occipital-anterior position and remains in transverse position. Asynclitism is a particular feature associated with this

malpresentation as the fetal head tilts sideways as it descends and the parietal bone is the presenting part. Asynclitism is the presentation, during labor, of the fetal head at an abnormal angle. Asynclitism occurs when the sagittal suture is not directly central relative to maternal pelvis. If the fetal head is turned such that more parietal bone is present posteriorly, the sagittal suture is more anterior and this is referred to posterior asynclitism. Anterior asynclitism occurs when more parietal bone presents anteriorly.

In the first stage of labor, since the uterine cervix is not still fully dilated, clinical examination is limited and cannot perceive adequately the fontanel and the sagittal suture. Dietz et al⁵⁻⁷ reported the possibility of detecting patients at risk of instrumental delivery using intrapartum ultrasound, while Souka et al⁸ affirmed that the persistent occipital posterior position developed from the failure to rotate from an initial occipital posterior or transverse position. Asynclitism can be diagnosed by placing the ultrasonic beam at right angle to the midline echo, and reading the angle from a scale. The fetal midline echo, which represents the medial aspect of each cerebral hemisphere, is strong when the head is occipital-transverse and becomes progressively less distinct when occiput is rotated anteriorly or posteriorly. Rotation means that the midline structures are being recognized by means of diffuse backscatter. A transverse scan is made with the probe inclined to the angle of tilt of the head, so called angle of asynclitism⁹.

Few studies in the literature have used ultrasound in the delivery room and, currently clinical changes obtained by vaginal examination are the main factor for prediction of how labour will proceed.

Neuraxial labor analgesia is the most complete and effective method of pain relief during childbirth, and the only method that provides complete analgesia without maternal or fetal sedation. Because pain can be severe even in early labour, neuraxial labour analgesia may be necessary¹⁰. However, epidural analgesia has been accused to promote malpresentation during labour and to increase the rate of cesarean section especially when started in the early first stage of labour¹¹.

The Authors of the present study were interested to investigate if early epidural analgesia can influence fetal head engagement into the pelvis and if it can increase the rate of transverse and asynclitic position during labour.

Materials and Methods

The study was conducted in two University affiliated Hospitals, between September 2007 and October 2010. Singleton pregnancies at term gestation (38 weeks or more) with a fetus in vertex presentation, in spontaneous labor and with intact membranes were included.

The non-inclusion criteria were: women with previous gynecologic surgery and any of the following event experienced during pregnancy: macrosomia (defined by US as fetus more than 4500 g of weight); infection; anticoagulation therapy; pre-eclampsia; HELLP syndrome; emergency CS; ruptured membranes for more than 36 hours; placenta praevia, and other placental pathologies.

Women attempting trial of labor after cesarean (TOLAC) could not included too.

The onset of labor was stated with the following criteria¹²: reduction of interval (<10 min) between uterine contractions; abdominal pain of increasing intensity; cervical effacement ($\geq 50\%$); cervical dilation (≥ 2 cm). To all women the choice to delivery under labour neuraxial analgesia was offered. The indications and anaesthesiologic techniques were evaluated taking into consideration the benefits and limitations of labor neuraxial analgesia. The procedures used in the present study were in accordance with the guidelines of the Helsinki Declaration on human experimentation. No specific approval was required by the Ethical Committee because the labour neuraxial analgesia approach is the standard surgical procedure for the pain control during the labor and the delivery.

The protocol purpose was carefully explained to the patients before they entered the study and a part of these accepted to be involved in anaesthetic trial in labour and to delivery under analgesia, while the resting part accepted to be the control group without anesthesia.

Both these group accepting protocol were enrolled with a detailed signed informed consent.

Labour neuraxial analgesia was administered by combined spinal-epidural analgesia (CSE) which included: (1) double needle, single intervertebral space (L3-L4) spinal puncture using a Withacre 27 G needle. A mixture of ropivacaine 0.02% with 0.3 $\mu\text{g/ml}$ of Sufentanil was administered in the spinal space. (2) a mixture of ropivacaine 0.07% with 0.5 $\mu\text{g/ml}$ of sufentanil¹²⁻¹⁵ mls) was administered in epidural space in case of persistence of pain, on patient's request and depending on the stage of labour and the degree of pain.

In the second stage of the labour, if necessary, 10 ml of alkalinised lidocaine 0.5%, could be administered to avoid pain during possible manoeuvres and surgical procedure.

All women were consecutively evaluated by two obstetricians, well trained regarding both intrapartum ultrasonography and expectant management of labour, according to the unit usual protocols. In our Department, the use of US during the first stage of labor is complementary to clinical approach, obtained by obstetric manoeuvres. In our routine approach, digital examination is used first to check fetal head station with respect to the ischial spines and fetal head landmarks: large anterior fontanel, sagittal suture and small posterior fontanel to check the sinciput (or frontal bone) and occiput (or occipital bone). Anterior transverse asynclitism (Figure 1) is diagnosed when there is more parietal bone presenting anteriorly, and when the sagittal suture is more posterior; when parietal bone presenting

posteriorly, with midline positioned anteriorly, this defines transverse posterior asynclitism².

US examination is used as the second step by other examiners, blinded to obstetric evaluation.

The ultrasound examinations were performed with an Aloka® instrument (SSd 2000 MultiView, Tokio, Japan), equipped with a multifrequency convex transabdominal transducer of 3.5 MHz. In the first stage of labor, US image acquisition is conventionally performed with a transabdominal sagittal and transversal approach, placing the transducer below the symphysis, above the pubis and aligning it with the mid-sagittal plane of fetal head. Prior to starting the acquisition, the pubic symphysis and fetal skull contour should be visualized almost entirely on the screen. The patient was asked to remain still during the US acquisition, in a semi-recumbent position with her legs flexed. The US transducer was first placed transversely in the suprapubic region of the maternal abdomen. The second step in the US analysis was to record fetal landmarks: midline of the fetal head, defined as the echogenic midline interposed between the two cerebral hemispheres, fetal orbits in the sinciput, thalamus in the deep brain area and cerebellum in the occipital side (Figure 2).

US asynclitism was said to be anterior when the anterior orbit (“squint sign” or “Malvasi’s 1”), the north thalamus sunset (“thalamus sunset” or “Malvasi’s sign 2”) and the north cerebellum sunset (“cerebellum sunset” or “Malvasi’s sign 3”) were visualised or when the midline was < 21 h and > 3 h. By contrast, US posterior asynclitism was recorded when the

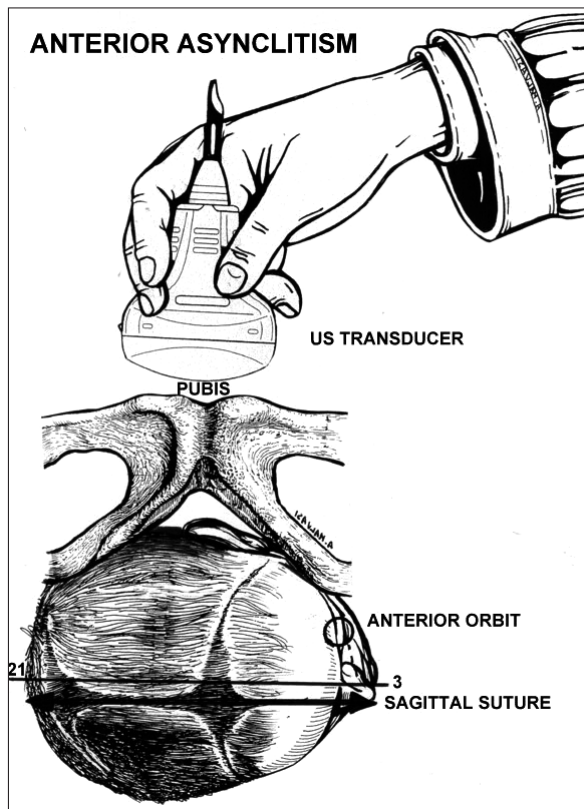


Figure 1. Transabdominal ultrasound in transverse fetal head position: the probe is in transverse suprapubic area and the fetal head shows an anterior asynclitism (the large black line is the sagittal suture, the thinner black line midline). The right anterior orbit (3 h) is called also “squint sign” and the occiput is on the left (21 h).

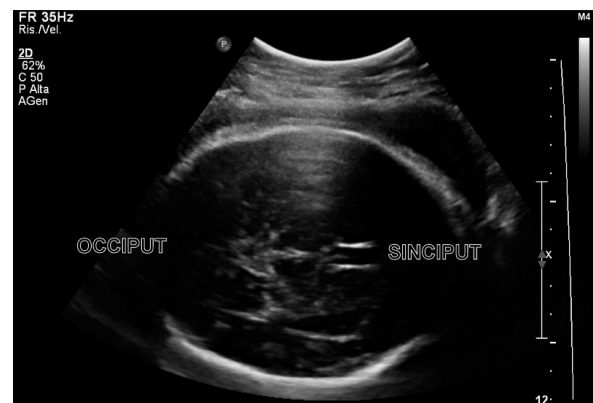


Figure 2. The US transverse plane identifies the midline of the fetal head, defining as the echogenic midline interposed between the two cerebral hemispheres, then they localized the fetal orbits in the sinciput, the thalami in the brain center and finally the cerebellum in the occiput side in right position.

posterior orbit, the south thalamus sunset and the south cerebellum sunset were visualised or when the midline was > 21h and < 3 h.

These findings were recorded on a datasheet depicting a circle, like a clock, with 24 divisions and the position was described as transverse when sagittal suture is at 21 h and 3 h; anterior asynclitism was presented with the sagittal suture < 21 h and > 3h, while posterior asynclitism was present when the sagittal suture was > 21h and < 3 h.

Transverse asynclitism was divided in 4 subgroups: group 1 with patients in anterior-left transverse positioning (ALT); group 2 with women in posterior-left side (PLT); group 3 with women in anterior-right transverse positioning (ART) and group 4 with patients in posterior-right positioning (PRT).

Transvaginal sterile digital examinations were performed and followed immediately by serial intrapartum transabdominal sonography assessments, followed by digital examinations performed at intervals of 45-90 min. Examiners were blinded to each other's findings.

Following acquisition, the US scan dataset was stored and was immediately printed for further obstetric analysis later. After delivery, the complete set of clinical and US data obtained by each examination were recorded and compared in women with and without labour analgesia.

Statistical Analysis

For statistical analysis, an independent reviewer was blinded to exams and the null hypothesis tested was that the proportion of patients with asynclitic fetal head (positive) would be identical in the two populations. The criterion for significance (alpha) was set at 0.050. The test was 2-tailed. With a sample size of 49 in each group, the study would have a power of 80% to yield a significant result. A difference in proportions of

0.28 (specifically, 0.68 versus 0.40) was selected as the smallest effect that would be important to detect, in the sense that any smaller effect would not be of clinical significance. Differences between percentages were assessed using the χ^2 test and with the corresponding 95% confidence intervals (CI). Statistical analysis was performed using STATVIEW 5.1 for Macintosh (Abacus Concepts, Inc., Berkeley, CA, USA 1992).

Results

Over a total of 216 eligible women invited to participate in the study, 195 provided consent and were enrolled for ultrasound and clinical examinations: in 108 of them, the fetal head was in transverse position. Among them, 58 women were in the CSE group and 50 were in no-analgesia group. Patients were mostly (94%) Caucasian nulliparae (183/195) at a median gestational age of 39.4 weeks (range, 38-41). At enrollment, demographic factors were equally distributed, and no difference between groups (i.e. with and without anaesthesia) were recorded regarding the rate of transverse and asynclitic position in the first stage of labor.

There was also no difference between the groups, women in CSE Vs patients without anaesthesia at any stage during labour ($p > 0.05$). All results are described in Tables I and II.

Discussion

This study mainly shows that the use of early neuraxial analgesia, using CSE with a low dose local anaesthetic does not modify the rate of transverse and asynclitic position during labour.

Table I. Comparison, at enrollment, between women receiving CSE analgesia or no analgesia in the first stage of labor: diagnosis of transverse position.

Group	Women in CSE (n = 58) n (%; 95% CI)	Without labour analgesia (n = 50) n (%; 95% CI)	P
Left anterior transverse position (ALT)	19 (32.5; 27-39)	17 (34.0; 27-41)	0.9246 (ns)
Posterior-left transverse position (PLT)	13 (22.4; 17-27)	10 (20.0; 14-26)	0.9860 (ns)
Anterior-right transverse position (ART)	16 (27.6; 22-34)	14 (28.0; 22-34)	0.8298 (ns)
Posterior-right transverse position (PRT)	10 (17.2; 12-22)	9 (18.0; 13-23)	0.9063 (ns)

Abbreviation: ns, not significant.

Table II. Incidence of asynclitic position in the two groups during the first stage.

Group	Women in CSE (n = 58) n (%; 95% CI)	Without labour analgesia (n = 50) n (%; 95% CI)	P
Women in left anterior transverse positioning (ALT)	20 (34.4; 28-40)	19 (38.0; 31-45)	0.8173 (ns)
Women in posterior-left transverse side (PLT)	12 (20.7; 16-26)	9 (18.0; 13-23)	0.8819 (ns)
Women in anterior-right transverse positioning (ART)	17 (29.3; 23-35)	12 (24.0; 18-30)	0.7132 (ns)
Women in posterior-right transverse positioning (PRT)	9 (15.5; 11-21)	10 (20.0; 14-26)	0.7724 (ns)

Abbreviation: ns, not significant.

Trials evaluating the rate of transverse fetal head position and asynclitism in patients with or without epidural analgesia are scarce. Sherer et al.¹⁰ detected by transabdominal sonography 10 fetuses in transverse position during the second stage and stated that early epidural analgesia does not affect this position into the pelvis. Akmal et al¹³ presented similar views.

Whatever the fetal head position at enrollment (occiput transverse, occiput posterior, or occiput anterior), most fetuses were found to be occiput anterior at delivery (enrollment position: occiput transverse 78%, occiput posterior 80%, occiput anterior 83%, $p = .1$) according to Lieberman et al¹⁴.

Final fetal position was established close to delivery. Of fetuses that were occiput posterior late in labour, only 20.7% were occiput posterior at delivery. Changes in fetal head position were common, and 36% of women had an occiput posterior fetus on at least one ultrasound examination¹⁴.

The following study's analysis¹⁵ regarding head position at delivery was performed on 270 women. Of these, 97 (36%) had an OP position on ultrasonography before induction of labor. At delivery, eight (8%) of these 97 were OP, 12 (12%) were OT, and 77 (79%) were OA. Twenty-five babies were in an OP position at delivery. Before induction of labor, eight (32%) of these 25 women were OP, eight (32%) were OT, and nine (36%) were OA. Therefore, 68% of OP positions at delivery occurred due to a mal-rotation from a non-OP position during labor.

Blasi et al¹⁶ evaluated the occiput and spinal column position during the first and second labor stage and reported no difference in posterior occiput and transverse position between women receiving epidural analgesia and those without analgesia.

Previously we have observed that the combined spinal epidural (CSE) analgesia with low

sufentanil and ropivacaine dose increases the duration of the second stage but not the rate of occiput posterior position¹⁷.

In the absence of well-depicted maternal structures (symphysis pubis or sacral promontory), clinical appreciation of asynclitism is limited to a highly subjective assessment. While swelling is usually limited to a thickness of only a few millimeters, it may be sufficiently extensive in prolonged labor to prevent the differentiation of the various sutures and fontanelles¹⁸.

Abnormal fetal head position can be confirmed or quantified sonographically. Unfortunately, US signs for diagnosis of fetal head position are poorly described. A US sign to depict the asynclitism diagnosis has been previously reported¹⁹, i.e. the single orbit sign which is generated by the angle between the fetal head and the pelvis.

Delivery of a "deep transverse arrest" or a posterior arrest is by forceps rotation and extraction using Kielland forceps, by manual rotation and forceps extraction, or by the use of vacuum extractor.

Should rotation or descent not occur despite moderate force, skilfully applied, the attempt should be abandoned and cesarean section carried out. It is imperative in these conditions (especially if subsequently after a prolonged second stage of labor and instrumental delivery is considered), that the determination of fetal head position be accurate. Indeed, established prerequisites of both forceps and vacuum deliveries include a precise knowledge of accurate fetal head position^{20,21}.

Conclusions

Epidural analgesia initiated early and using low drug doses during the first stage of labour

does not increase the rate of dystocic labor. Particularly, the occurrence of transverse fetal head position with anterior or posterior asynclitism is mainly caused by cephalopelvic disproportion and is not strongly influenced by the mode of analgesia. Ultrasound imaging best details the fetal head station and position while the diagnosis of transverse and asynclitic position²² (i.e. visualisation of a squint sign, sunset thalamus and cerebellum) can easily be used during labour.

References

- 1) CALDWELL WE, MOLOY HC, D'ESOPPO DA. A roentgenologic study of the mechanism of engagement of fetal head. *Am J Obstet Gynecol* 1934; 28: 824-841.
- 2) LLEWELLYN-JONES D. The stage of labour. In: *Fundamentals of Obstetric and Gynecology*. 3rd Edition. Faber & Faber Ed, London (GB), 1982; Vol 1, Chapter 12: 113.
- 3) AKMAL S, PATERSON-BROWN S. Malpositions and malpresentations of the fetal head. *Obst Gynaecol Reprod Med* 2009; 19: 240-246.
- 4) LACRETA O. More on the Kielland forceps. *Zentralbl Gynakol* 1986; 108: 104-111.
- 5) DIETZ HP, LANZARONE V. Measuring engagement of the fetal head: validity and reproducibility of a new ultrasound technique. *Ultrasound Obstet Gynecol* 2005; 25: 165-168.
- 6) DIETZ H, LANZARONE V, SIMPSON J. Predicting operative delivery. *Ultrasound Obstet Gynecol* 2006; 27: 409-415.
- 7) DIETZ H, LANZARONE V. Predicting delivery mode. *Ultrasound Obstet Gynecol* 2004; 24: 220.
- 8) SOUKA A, HARITOS T, BASAYIANNIS K, NOIKOKYRI N, ANTSAKLIS A. Intrapartum ultrasound for the examination of the fetal head position in normal and obstructed labor. *J Matern Fetal Neonatal Med* 2003; 13: 59-63.
- 9) CAMPBELL S. FETAL GROWTH. In: Beard RW, Nathanielz WB (eds). *Fetal Physiology and Medicine*. WB Saunders, Philadelphia, USA, 1976.
- 10) CYNTHIA AC. Advances in labor analgesia. *Int J Womens Health* 2009; 1: 139-154.
- 10) SHERER DM, MIODOVNIK M, BRADLEY KS, LANGER O. Intrapartum fetal head position I: comparison between transvaginal digital examination and transabdominal ultrasound assessment during the active stage of labor. *Ultrasound Obstet Gynecol* 2002; 19: 258-263.
- 11) NAGEOTTE M. Timing of conduction analgesia in labor. *Am J Obstet Gynecol* 2006; 194: 598-599.
- 12) GROSS MM, HAUNSCHILD T, STOEXEN T, METHNER V, GUENTER HH. Women's recognition of the spontaneous onset of labor. *Birth* 2003; 30: 267-271.
- 13) AKMAL S, TSOI E, KAMETAS N, HOWARD R, NICOLAIDES K. Investigation of occiput posterior delivery by intrapartum sonography. *Ultrasound Obstet Gynecol* 2004; 24: 425-428.
- 14) LIEBERMAN E, DAVIDSON K, LEE-PARRITZ A, SHEARER E. Changes in fetal position during labor and their association with epidural analgesia. *Obstet Gynecol* 2005; 105(5 Pt 1): 974-982.
- 15) PEREGRINE E, O'BRIEN P, JAUNIAUX E. Impact on delivery outcome of ultrasonographic fetal head position prior to induction of labor. *Obstet Gynecol* 2007; 109: 618-625.
- 16) BLASI I, D'AMICO R, FENU V, VOLPE A, FUCHS I, HENRICH W, MAZZA V. Sonographic assessment of fetal spine and head position during the first and second stages of labor for the diagnosis of persistent occiput posterior position: a pilot study. *Ultrasound Obstet Gynecol* 2010; 35: 210-215.
- 17) MALVASI A, TINELLI A, BRIZZI A, GUIDO M, MARTINO V, CASCIARO S, CELLENO D, FRIGO MG, STARK M, BENGHAMOU D. Intrapartum sonography for occiput posterior detection in early low dose combined spinal epidural analgesia by sufentanil and ropivacaine. *Eur Rev Med Pharmacol Sci* 2010; 14: 799-806.
- 18) CUNNINGHAM FG, MACDONALD PC, GANT NF, LEVENO KJ, GILSTRAP LC, HANKINS GDV, CLARK SL. Mechanisms of normal labor in occiput presentation. In: Cunningham FG, MacDonald PC, Gant NF, Leveno KJ, Gilstrap LC, Hankins GDV, Clark SL, eds. *Williams Obstetrics*, 20th ed. Stamford: Appleton & Lange, 1997: pp. 319-325.
- 19) MALVASI A, TINELLI A, STARK M. Intrapartum sonography for occiput posterior asynclitism diagnosis. *J Matern Fetal Neonatal Med* 2011; 24: 553-554.
- 20) OPERATIVE VAGINAL DELIVERY. ACOG Technical Bulletin, number 196, August 1994. Washington DC: Compendium of selected publications, 2000; pp. 644-649.
- 21) BIRD GC. The use of the vacuum extractor. *Clin Obstet Gynecol* 1982; 9: 641-661.
- 22) GHI T, YOUSSEF A, PILU G, MALVASI A, RAGUSA A. Intrapartum sonographic imaging of fetal head asynclitism. *Ultrasound Obstet Gynecol*. 2011 Apr 26. doi: 10.1002/uog.9034. [Epub ahead of print].