SURABAYA BIOMEDICAL JOURNAL
2025, VOL. 4, NO. 2

REVIEW ARTICLE

CEPHALIC DISTOCIA (JOURNAL REVIEW)

I Ketut Edy Sudiarta [1]
Departement of Obstetric dan Gynecology, Medical Faculty of Hang Tuah University / dr. Ramelan Naval Hospital, Surabaya
Correspondence: I Ketut Edy Sudiarta, drketutjournal@gmail.com, +628123071699

Naskah Masuk 23 November 2024, Revisi 10 Desember 2024, Layak Terbit 31 Januari 2025

Abstrak
Proses persalinan normal ditentukan oleh 3 faktor utama yaitu tenaga ibu, ukuran panggul, dan janin. Persalinan normal adalah persalinan pervaginam dengan janin presentasi belakang kepala yang bejalan secara alami tanpa bantuan alat. Apabila tidak presentasi belakang kepala maka kemungkinan persalinan akan terhambat walaupun bentuk dan uluran bayi dalam batas normal. Dengan demikian harus dilakukan pemeriksaan yang cermat untuk mengetahui posisi kepala dalam rongga panggul. Disini akan dijelaskan beberapa posisi kepala yang sering menyebabkan distosia.

Kata kunci: malposisi, malpresentasi, oksiput posterior, oksiput transversal, presentasi dahi, presentasi muka.

Abstract
The normal birth process is determined by 3 main factors, namely maternal power, pelvic size and fetus. Normal delivery is vaginal delivery with a fetus in occiput posterior presentation that proceeds naturally without the help of tools. If there is no occiput posterior presentation, there is a possibility that labor will be obstructed even though the shape and extension of the baby are within normal limits. Thus, a careful examination must be carried out to determine the position of the head in the pelvic cavity. Here we will explain several head positions that often cause dystocia.

Keyword: *malposisition, malpresentation, oksiput posterior, oksiput transversal, brow presentation, face presentation.*

INTRODUCTION

The mechanism of normal delivery involves proper flexion of the head so that the fetal head can be fixed with the mother's pelvic cavity. As labor progresses, continued flexion and descent of the fetal head into the pelvic cavity causes the occiput to rotate anteriorly as the head touches the pelvic floor. Failure to change this position results in malposition of the fetal head[1].

In normal vaginal birth, the fetal head must enter the cavity of the mother's pelvic bones. The widest parts of the fetal body are the fetal head and fetal shoulders. In vaginal delivery, it is generally seen that the vertex position represents 95% of vaginal delivery positions. The vertex is a diamond-like formation described as having two parietal protrusions, namely the anterior fontanel and the posterior fontanel. The occiput anterior position is the best head position for vaginal delivery. This position involves a relatively smaller suboccipitobregmatic diameter than the obstetric diameter. Thus, the fetal head will be born more easily in this position.

Malposition of the fetal head is a presentation of the fetal head other than the vertex. Normal vaginal delivery has a vertex or occiput anterior presentation. Fetal malposition is associated with extension of the fetal head so that the fetal head enters the pelvic inlet other than the vertex. This scientific article contains a review of the literature on pelvic anatomy, fetal head and the mechanism of normal delivery along with definitions, malposition and management of malposition of the fetal head.

PROBLEMS

How does the fetal head malpresentation cause dystocia?

PURPOSE

The aim of this research is to determine the malpresentation of the fetal head which causes distosia.

METHOD

Literature review.

RESULT AND DISCUSSIONS

Pelvic Bone and Pelvic Cavity.

The birth canal consists of the bony and the soft part of the birth canal. The bony part of the birth canal are consists: pelvic bones and their joints, while the soft part consists of muscles, tissues and ligaments. In vaginal delivery, the fetus must pass through this birth canal. If the birth canal and the fetus in normal shape and size, then with normal strength vaginal delivery will take place without difficulty[1,2].

The hip bone is composed of three bones, namely os. coxae, os. sacrum and os. coccygeus. Os. coxae is a fusion of os. ileum, os. ischium and os. pubis. These bones fuse into one hip joint. The relationship between os. the right and left pubic are connected by the symphysis. The symphysis is composed of fibrocartilage and the superior pubic ligament above and the inferior pubic ligament below[1,2].

Conceptually, the pelvic cavity is divided into two main parts, namely the true/major and false/minor pelvic cavities. The division of the two pelvic regions is limited by the linea terminalis

structure. Pelvis major lies on the upper terminal line, while the pelvis minor lies on the lower terminal line. Planum pelvic slices are divided into four parts, namely: pelvic inlet plane, pelvic outlet plane, midpelvic plane and greatest pelvic dimension plane.

The pelvic minor is bounded by the pelvic inlet and pelvic outlet. Pelvis minor forms a canal which has an axis of forward curvature (axis carus). The pelvic inlet is a plane bounded posteriorly by the promontory, laterally by the linea terminalis and anteriorly by the upper border of the symphysis. The pelvic cavity has several diagonals which are essential in obstetric examination, such as: anteroposterior diameter, conjugate diagonal, conjugate vera, transverse diameter and oblique diameter[2].

The anteroposterior diameter extends from the promontory to the posterior surface of the symphysis. The anteroposterior diameter is also called the obstetrical conjugate. The diagonal conjugates extend from the base of the symphysis to the promontory. This can be measured by inserting the middle finger and trying to feel the promontory[1,2].

Conjugata vera, namely the distance from the upper edge of the symphysis to the promontory, is obtained by reducing the conjugate diagonal by 1.5 cm. The transverse diameter is the farthest latitudinal inlet, usually about 12.5 - 13 cm. The line drawn between the conjugate junction vera and the transverse diameter to the sacroiliac joint is called the oblique diameter. Has a length of about 13 cm[1,2].

The female pelvis has a variety of shapes. The Caldwell-Moloy classification divides the female pelvis into four main parts: gynecoid, android, anthropoid and platipeloid. 1). Gynecoid type, found in 45% of women with the anteroposterior diameter equal to the transverse diameter. 2). Android type, found in 15% of women with an anteroposterior diameter almost the same length as the transverse diameter. The dorsal part of the pelvic inlet is flat, the ventral part narrows to the face. 3). Anthropoid type, found in 35% of women with an anteroposterior diameter greater than the transverse diameter. 4). Platypelloid type, found in 5% with an anteroposterior diameter smaller than the transverse diameter[1,2].

Anatomy of Fetal Head

Scull Bones.

The baby's skull bones still consist of separate cartilages and will unite when brain growth has complete parts of the skull as follows:

Frontal bone (forehead bone). The frontal bone is an unpaired bowl-shaped bone located in the forehead area, which plays a role in the formation of the cranium. The frontal bone is located above the nasal bone and anterior to the parietal bone[1,2,4,5].

Parietal bones (fontanel bone). The Parietal bones are located on each side of the skull just behind the frontal bone. The two parietal bones together form most of the roof of the skull and the sides of the skull[1,2,4,5].

Temporal bones. The temporals are

paired bones located on the lateral sides and base of the skull. The temporal bone contains important structures of the vestibulocochlear apparatus, including the external acoustic meatus, tympanic cavity, and structures of the inner ear[1,2,4,5].

Occipital bone. The occipital bone is a single bone and consists of four sections that surround the foramen magnum[1,2,4,5] .

Sutures.

Sutures are strong and flexible tissues that hold the cranial bones together. The two sutures that make up the membrane are called the weak points or fontanels, where they meet. Sutures are useful in protecting the baby's brain and providing opportunities for the brain to grow. Sutures are divided into several, namely:

Lambdoidea suture. The lambdoidal suture is a network that lies between the occipital and parietal bones. Serves to unite the occipital and parietal bones[1,2,4,5].

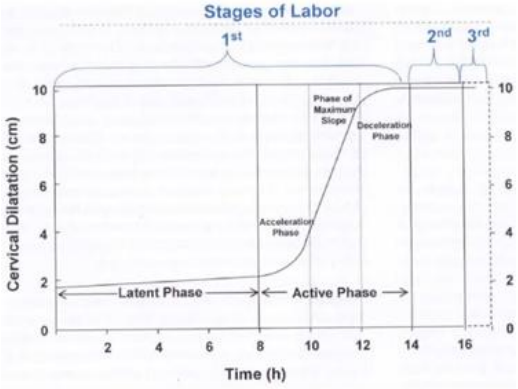
Sagittal suture. The sagittal suture is a tissue that lies in the middle of the parietal bone. Serves to unite the two parietal bones in the midline[1,2,4,5].

Coronary sutures (between the crown). Coronary suture is a tissue that is between the frontal bone and the parietal bone. Serves to unite the parietale and frontal bones[1,2,4,5].

Frontal Suture. The frontal suture is the network between the frontal bones. Serves to unite the two frontal bones[1,2,4,5].

Mechanism of normal delivery

Normal maternal childbirth is divided into four main phases, namely stages I, II, III and IV. The first stage of pregnancy is characterized by adequate uterine contractions and cervical dilatation. Cervical dilatation is divided into two main phases, namely the latent and active phases. The latent phase occurs between the opening of the cervix from 0 cm to 3 cm, while the active phase occurs between 4 cm to 10 cm. The progress of cervical dilatation is monitored via a Friedman curve[1,4,5].



Friedman's curve in the progress of labor in stages I, II and III.[1]

The second stage is the time between the complete dilation of the cervix and the birth of the baby. The second stage involves six cardinal movements in expelling the fetus. The six cardinal movements include engagement, flexion, descending, internal rotation, extension, external rotation and expulsion. The engagement process is the descent of the head into the PAP. After this process ends, the head is flexed normally so that the position of the head relative to the pelvis forms the submentobregmatic diameter. The

head begins to descend (descending) down the pelvic cavity through the pelvic cavity, and simultaneously interna rotation and the occiput moves anteriorly below the pubic symphysis. After the head looks out between the vulva (crowning) the fetal head is extended. Then, as the head descends, external rotation of the fetal head is followed by delivery of the shoulders. After the fetal shoulders are delivered, successive births of the trunk, abdomen and lower extremities [1,4,5].

The third stage is the phase of the birth of the placenta out of the mother's womb. Normally the birth of the placenta occurs in less than 30 minutes. If it exceeds this time, further diagnostic intervention is needed to evaluate the delivery of the placenta. The fourth phase is the phase of monitoring the mother after the birth of the child in the first two hours, the evaluation is carried out by looking at signs and symptoms, bleeding, amniotic fluid leakage, signs of dehydration and vital signs[1,6].

Cephalic Malposition and Malpresentation.

Labour is a complex interaction of the three Ps; **P**ower, **P**assage and the **P**assenger. Abnormalities in any of these factors may account for poor progress of labour, but frequently, it is a combination of factors that results in poor progress of labour. The presenting part may be too large, or more commonly, the relative diameters of the presenting part may be increased due to a **malposition** of the vertex (anterior, transverse, posterior position), attitude of the head (flexion, extention), or asynclitism (anterior asynclitism, posterior asynclitism), and a cephalic **malpresentation** (face, brow, compound)[27].

The fetal head attitude is the degree of flexion or extension at the upper cervical spine. Different longitudinal diameters are presented to the pelvis depending on the fetal attitude. In a well- flexed head, the anterior fontanelle is not easily felt, and the presenting diameter is the suboccipito- bregmatic, which measures about 9.5 cm at term. In OP (occipitoposterior) and occipitotransverse (OT) positions, which are often associated with deflexion of the fetal head, the anterior fontanelle is felt at a lower plane and assumes a more medial position compared to the posterior fontanelle, and the presenting diameter is the occipito-frontal which measures about 10.5 cm at term. The extension of the fetal head leads to brow and face presentations[27].

1. Cephalic malpresentation.

a. Face presentarion.

When facial presentation is diagnosed during labour, the woman should have been made aware that there may be facial swelling and bruising noted in the baby soon after delivery, however, this will likely resolve without permanent damage over the next few days. Regular gentle abdominal and vaginal examinations should be performed to monitor progress while avoiding injury to the fetal orbit/face. If occurred a good progress and the position is mentoanterior (or rotated mentoanterior) then vaginal delivery can be anticipated. If progress is slow or stagnant, or if the position remains mentoposterior, caesarean section is

indicated[1,8,20,23].

The etiology and predisposing factor of face presentation are a conditions that neck extention or prevent flexion. Preterm fetuses, multifetal gestation, high parity. Fetal malformation, hydramnion, anencephalic fetuses, contracted pelvis, macrosomia, anencephalic, pelvic inlet contracted[2.]

Face presentation diagnosis was made during labour. On palpation of the abdomen, most of the head can be palpated on the same side as the back without the head protruding on the same extremity. Abdominal examination it is not enough to make a diagnosis, an internal examination must be carried out to feel the orbital part of the nose, mouth, and jawbone, you can also find the examiner's finger being sucked by the baby. It is important to differentiate from breech presentation given that the jawbones and mouth form an imaginary triangular line whereas the ischial tuberosity and anus form a straight line. .[1,8,9,21] The denominator of face presentation chin in anterior or posterior position[7–9].

With the mentum anterior, internal rotation of the face brings the mentum under the symphysis pubis. After anterior internal rotation and descent, the chin and mouth appear at the vulva. Once the mentum clears the symphysis, the neck can flex. The eyers, nurse, brow, and occiput then appear in succession over the anterior margin of the perineum. After birth of the head, the occiput sags backward toward the anus. Next, the chin rotates externally to the side toward which it was originally directed, and the shoulders are born as in cephalic presentations. If the chin persists posteriorly, the relatively short neck cannot span the anterior surface of the sacrum and the fetal brow is pressed against the mathernal symphysis pubis. So, vaginal birth from a mentum posterior posistion in impossible, unless the shoulder enter the pelvis at the same time[2].

b. Brow Presentation.

Brow presentation mirror those for face presentation. A brow presentation is commonly unstable and converts to a face or an occiput presentation. The presentation may be recognized by abdominal palpation when both the occiput and chin can be palpated easily, but vaginal examination is usually necessary. The frontal sutures, large anterior fontanel, orbital ridges, eyes, and root of the nose are felt during vaginal examination, but neither the mouth nor the chin is palpable[2].

Brow presentation occurs when the fetal head is semi-deflexed so that a forehead presentation with a sinciput denominator is obtained. Mechanism of delivery in forehead presentation is difficult to do vaginally, because: The position of the fetal head in full flexion and extension forms a mentovertical diameter = 13 cm[7–9,22].

This presentation is diagnosed when palpable the base of the nose, the upper edge of the orbit, the frontal suture and the fontanel. Brow presentation is usually only diagnosed once labor is established. Although on abdominal examination many fetal heads may be palpated, this finding alone is not reliable for making the diagnosis. On vaginal examination, the head did not

descend below the ischial spine and root of the nose, a supraorbital bulge and palpable anterior fontanel [1,8,9,21].

Brow presentation is diagnosed when the porsion of the fetal head between the orbital ridge and the anterior fontanel presents at the pelvic inlet, the fetal head thus occupies a position midway between full flexion (occiput) and full extension (face). Engagement of the fetal head and subsequent delivery cannot take place along as the brow presentation persist[2].

Most brow presentations require assisted cesarean delivery to avoid vaginal manipulation which greatly increases perinatal mortality. When compared with posterior cephalic presentation, vaginal delivery in forehead presentation increases cord prolapse, uterine rupture, postnatal infection, and perinatal death. If forehead presentation is diagnosed in early labor with intact membranes, close observation can be undertaken. This observation is meant to await the possibility of spontaneous presentation changes. Giving oxytocin stimulation to weak uterine contractions must be done with extreme caution and should not be done if there is no descent of the head or a cephalic disproportion is suspected. Persistent forehead presentations or with ruptured membranes should be performed by cesarean delivery. Do not deliver using vacuum extraction, forceps, or symphysiotomy as this will only increase morbidity and mortality[1,8,9].

c. Compound Presentations.

The most frequent combination is the hand with the head. Usually, the head will descend below the hand, and the outcome is generally good unless it is associated with cord prolapse. If the descent of the head or the breech appears to be hampered by a limb, then the limb should be pushed up, and the woman should be instructed to bear down if the cervix is fully dilated[27].

The possibility of a multiple presentation can be considered if there is a delay in the progress of labor in the active phase of labour, the lowest part of the fetus (head or buttocks) cannot enter the pelvis, especially after rupture of the membranes. The diagnosis of multiple presentation can also be made by vaginal examination. The difficulty of making the diagnosis is because spontaneous correction often occurs, especially mild degrees of limb prolapse[8,9,22].

Treatment of multiple presentations begins with determining whether there is prolapse of the umbilical cord or not. The presence of umbilical cord prolapse creates an emergency situation for the fetus, and treatment by performing a cesarean section is aimed at overcoming the consequences of cord prolapse rather than its multiple presentations. If there is no umbilical cord prolapse, then the progress of labor is monitored carefully. In cases of multiple presentations with good progress of labor (in the active phase of cervical dilatation of at least 1 cm/hour, or in the 2nd stage there is a descent of the head), spontaneous repositioning will generally occur. After complete dilation, as the head descends further, the prolapsed extremity is left behind and does not enter the pelvis. Furthermore,

delivery assistance is carried out as usual. In the event that the progress of labor is slow or obstructed (usually at practically complete dilatation of the cervix), efforts are made to reposition the prolapsed extremities. The pressure on the extremity that is prolapsed by the lowest part of the fetus (head or buttocks) is relaxed first by placing the mother in the knee-chest position. If the amniotic fluid is still intact, do an amniotomy first. Push the prolapsed limb toward to cranial, holding it until there is a hiss that will press the head or buttocks into the pelvis. As the lowest part of the fetus descends, the helping finger is slowly removed. The success of this effort is demonstrated by no longer being able to feel the prolapsed extremity. If the repositioning action fails, then a cesarean section is performed to deliver it[1,7,8].

2. Cephalic malpositions

a. Posterior occiput

Majority rotate spontaneously to direct occipitoanterior (DOA) position and deliver. A few may persist as occipitoposterior (OP) position[27].

Inspection of the abdomen may reveal feeling below the level of the umbilicus. On palpation, the leg is easily palpable in front and indeed it is difficult to feel the back of the fetus. The anterior shoulder is palpable some distance from the midline. The prominence of the sinciput and occiput can both be felt at the same level above the pubic symphysis indicating deflection. Fetal heart sounds are often heard on the far flanks of the midline. Vaginal examination reveals the anterior fontanel and posterior fontanel near the sacrum[1,7–10].

If a normal delivery does not happen, then the mode of delivery will depend on a multitude of factors such as the progress of labour, the position and station of the vertex and the clinical skills and experience of the operator. The available options are a vacuum delivery, a face to pubes delivery with or without the application of a long- bladed forceps, rotational forceps delivery using Kielland forceps, digital or manual rotation to occipitoanterior (OA) position followed by a normal or instrumental vaginal delivery (IVD) or a caesarean delivery[27].

b. Transverse occiput

Majority rotate spontaneously to direct occipitoanterior (DOA) position and deliver. A few may arrest in occipitotransverse position (deep transverse arrest) or deliver in direct occipitoposterior position (face to pubes)[27].

Occurs when the baby's head fails to rotate to the occipito anterior side and remains in the transverse position. The infant's head may descend to the upper edge of the pelvic inlet but fails to rotate and remains in a transverse position. This malposition is called asynclitism. This position can cause obstructed labor in the old 1st and 2nd stages. If at stage 2 the head can enter hodge 3, the baby's head can be corrected manually or with a vacuum / Kielland's forceps. Reposition using a tool, it must be done in the operating room, so that if there is a failure a SC can be done immediately[1,7–9,11–13 7–9,13,14].

c. Posterior occiput presentation

The occiput posterior to the fetal head is deflected and therefore presents a larger anteroposterior (occipitofrontal - 11.5 cm) diameter to the maternal pelvis[6–9].

Labor can occur spontaneously in the OP position, but if instrumental delivery is required, careful abdominal and vaginal examination is necessary to ascertain whether this is safe. In difficult cases, use of ultrasound to confirm position as well as senior assistance should be sought. If instrumental delivery is appropriate, delivery can be assisted by rotating to the OA position or delivery in the OP position. A rotational delivery can be accomplished manually or using tools. Manual rotation involves flexing the fetal head to allow rotation followed by the delivery of traction (using forceps or a ventouse). An instrumental delivery rotation is most often attempted using vacuum extraction which brings about autorotation of the vertices with descent. The vacuum cup should be placed over the vertex flexion point (3 cm anterior to the posterior fontanel in the midline above the sagittal suture) and traction applied along the pelvic axis in sync with uterine contractions and the mother's labor efforts. Forceps can be achieved rotation prior to traction and delivery but should only be used by those who have adequate training and experience in the use of rotational forceps. Forceps can be used in the OP position when the head is very low but it must be remembered that there is a significantly higher chance of perineal trauma with such a delivery. Caesarean section delivery may be required either in the first stage of labor for failure to thrive or cardiotocographic abnormalities, or in the second stage if vaginal delivery is considered difficult. To avoid difficult delivery in caesarean section, the fetal head should be flexed and rotated before delivery with the occiput facing anterior[1,15,16].

3. Asynclitism.

Asynclitism (lateral flexion of the head), which is a physiological phenomenon that can occur during labour when the head enters the sacral hollow with its anteroposterior diameter in the transverse plane of the pelvic inlet, leads to dysfunctional labour if it is not spontaneously corrected in the mid-cavity of the pelvis. In anterior asynclitism, the anterior parietal bone is more prominently felt than the posterior one and the sagittal suture is felt towards the posterior half of the pelvis, while in posterior asynclitism, the posterior parietal bone is more prominently felt than the anterior one and the sagittal suture is felt towards the anterior half of the pelvis[27].

CONCLUSION

In direct mentoanterior position of a face presentation, vaginal delivery is possible. Vaginal delivery is not possible in direct mentoposterior position.

Persistent brow presentation during labour, with an average-sized fetus, requires a caesarean delivery, as vaginal delivery is not possible.

Mayority causes of primary face and brow presentation ia idiopatix, the other causes are fetal anomalies (anencephaly, cystic hygroma, goitre), prematurity, multiparity.

The most frequent combination of compound presentation is the hand with the head and the vagina birth outcome is generally good unless it is associated with cord prolapse.

Asynclitism (lateral flexion of the head), which is a physiological phenomenon that can occur during labour when the head enters the sacral hollow with its anteroposterior diameter in the transverse plane of the pelvic inlet, leads to dysfunctional labour if it is not spontaneously corrected in the mid-cavity of the pelvis.

REFERENCES

1. Prawirohardjo, S. *Ilmu Kebidanan*. (PT Bina Pustaka Sarwono Prawirohardjo, 2008).
2. Cunningham, F. G. *et al.* Editors. in *Williams Obstetrics, 26e* (McGraw Hill, 2022).
3. Cunningham, F. G. *et al.* William's Obstetric. in *Williams Obstetrics, 26e* (McGraw Hill, 2022).
4. Eickmeyer, S. M. Anatomy and Physiology of the Pelvic Floor. *Phys. Med. Rehabil. Clin.* **28**, 455–460 (2017).
5. Louis, L. S. & Warren, R. Pelvic and fetal cranial anatomy and mechanism of labour. in *Best Practice in Labour and Delivery* (eds. Warren, R. & Arulkumaran, S.) 1–13 (Cambridge University Press, 2009). doi:DOI: 10.1017/CBO9780511635489.002.
6. Parente, M. P. L., Jorge, R. M. N., Mascarenhas, T., Fernandes, A. A. & Martins, J. A. C. The influence of an occipito-posterior malposition on the biomechanical behavior of the pelvic floor. *Eur. J. Obstet. Gynecol. Reprod. Biol.* **144**, S166–S169 (2009).
7. Caughey, A. B., Sharshiner, R. & Cheng, Y. W. Fetal malposition: impact and management. *Clin. Obstet. Gynecol.* **58**, 241–245 (2015).
8. Pilliod, R. A. & Caughey, A. B. Fetal Malpresentation and Malposition: Diagnosis and Management. *Obstet. Gynecol. Clin. North Am.* **44**, 631–643 (2017).
9. Sinha, S., Talaulikar, V. S. & Arulkumaran, S. Malpositions and malpresentations of the fetal head. *Obstet. Gynaecol. Reprod. Med.* **28**, 83–91 (2018).
10. Ridley, R. T. Diagnosis and Intervention for Occiput Posterior Malposition. *J. Obstet. Gynecol. Neonatal Nurs.* **36**, 135–143 (2007).
11. Cheng, Y. W., Shaffer, B. L. & Caughey, A. B. The association between persistent occiput posterior position and neonatal outcomes. *Obstet. Gynecol.* **107**, 837–844 (2006).
12. Bellussi, F. *et al.* The use of intrapartum ultrasound to diagnose malpositions and cephalic malpresentations. *Am. J. Obstet. Gynecol.* **217**, 633–641 (2017).
13. Malvasi, A. *et al.* Asynclitism: a literature review of an often forgotten clinical condition. *J. Matern. Neonatal Med.* **28**, 1890–1894 (2015).
14. Ghi, T., Bellussi, F. & Pilu, G. Sonographic diagnosis of lateral asynclitism: a new subtype of fetal head malposition as a main determinant of early labor arrest. *Ultrasound Obstet. Gynecol.* **45**, 229–231 (2015).
15. Akmal, S. & Paterson–Brown, S. Malpositions and malpresentations of the foetal head. *Obstet. Gynaecol. Reprod. Med.* **19**, 240–246 (2009).
16. WHO. *Managing Complications in*

Pregnancy and Childbirth: A guide for midwives and doctors. (2017).

17. Benavides, L., Wu, J. M., Hundley, A. F., Ivester, T. S. & Visco, A. G. The impact of occiput posterior fetal head position on the risk of anal sphincter injury in forceps-assisted vaginal deliveries. *Am. J. Obstet. Gynecol.* **192**, 1702–1706 (2005).
18. Cheng, Y. W., Hubbard, A., Caughey, A. B. & Tager, I. B. The association between persistent fetal occiput posterior position and perinatal outcomes: an example of propensity score and covariate distance matching. *Am. J. Epidemiol.* **171**, 656–663 (2010).
19. Sizer, A. & Nirmal, D. M. Occipitoposterior Position: Associated Factors and Obstetric Outcome in Nulliparas. *Obstet. \& Gynecol.* **96**, 749–752 (2000).
20. Yancey, M. K., Zhang, J., Schweitzer, D. L., Schwarz, J. & Klebanoff, M. A. Epidural analgesia and fetal head malposition at vaginal delivery11The opinions and assertions contained herein are the expressed views of the authors and are not to be construed as official or reflecting the opinions of the Department of Defense or the D. *Obstet. Gynecol.* **97**, 608–612 (2001).
21. Talaulikar, V. S. & Arulkumaran, S. Malpositions and malpresentations of the fetal head. *Obstet. Gynaecol. Reprod. Med.* **22**, 155–161 (2012).
22. Wasson, C., Kelly, A., Ninan, D. & Tran, Q. Dystocia, Malposition, and Malpresentation (Breech, Transverse Lie) BT - Absolute Obstetric Anesthesia Review: The Complete Study Guide for Certification and Recertification. in (eds. Wasson, C., Kelly, A., Ninan, D. & Tran, Q.) 161–162 (Springer International Publishing, 2019). doi:10.1007/978-3-319-96980-0_53.
23. Gaur, L., Talemal, L., Bulas, D. & Donofrio, M. T. Utility of fetal magnetic resonance imaging in assessing the fetus with cardiac malposition. *Prenat. Diagn.* **36**, 752–759 (2016).
24. Gimovsky, A. C. Intrapartum ultrasound for the diagnosis of cephalic malpositions and malpresentations. *Am. J. Obstet. Gynecol. MFM* **3**, 100438 (2021).
25. Gustapane, S., Malvasi, A. & Tinelli, A. The use of intrapartum ultrasound to diagnose malpositions and cephalic malpresentations. *Am. J. Obstet. Gynecol.* **218**, 540–541 (2018).
26. Malvasi, A. *et al.* Semeiotics of Intrapartum Ultrasonography: New Diagnostic Sonographic Sign of Fetal Malpositions and Malrotations BT - Intrapartum Ultrasonography for Labor Management: Labor, Delivery and Puerperium. in (ed. Malvasi, A.) 251–273 (Springer International Publishing, 2021). doi:10.1007/978-3-030-57595-3_22.
27. 27. Sanjeewa Pandumadasa and Melik Goonewardene. Obstetric Emenrgencies. A Practocal Manual. First Edition (2021)