SONOGRAPHIC ASSESSMENT OF FETAL HEAD AND SPINE POSITION BEFORE INDUCTION OF LABOUR (IOL) AND OBSTETRIC OUTCOMES: PROSPECTIVE STUDY

DR. NOR AZLINA BINTI CHE YAACOB

Dissertation submitted in partial fulfilment of the requirement for the degree of Master of Medicine

(OBSTETRIC & GYNAECOLOGY)

UNIVERSITI SAINS MALAYSIA

2019

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

ACKNOWLEDGEMENT

In the Name of Allah, Most Gracious, Most Merciful

All praises to Allah S.W.T, the lord of Al-Mighty, the most merciful and beneficial and peace be upon our best teacher, Prophet Muhammad S.A.W for giving me the strength and courage throughout the entire completion of this dissertation.

First and foremost, I would like to convey my deepest gratitude and the great appreciation to my supervisor, Assoc. Professor Dr. Nik Ahmad Zuky Nik Lah, the most respective Lecturer and Senior Consultant in the Department of Obstetrics and Gynaecology, Hospital Universiti Sains Malaysia for his kind assistance, invaluable guidance, contribution and constructive criticism to make this dissertation possible. Next, many thanks to Assoc. Professor Dr. Pazudin Ismail, Head of Department of Obstetrics and Gynaecology, HUSM and all the lecturers who had contributed during my master training. Not to forget my personal statistician, Nurul Mawaddah bt Mohamed and also to Dr Siti Azrin Abdul Hamid, Lecturer from Department of Biostastics and Research Methodology, Universiti Sains Malaysia for her assistance in my statistical data analysis.

I would also like to extend my thank you to the most important person, my beloved husband, Wan Mohd Nasir bin Wan Omar for his support, understanding, encouragement, patience and endless pray. Also to my beloved mother, Che Bidah bt Che Well for her endless prayer and support. To the most wonderful presents I ever had, Wan Nur Ellysa Eqia, Wan Nur Ellya

Eryna, Wan Nur Ellyza Ezzalea and Wan Ahmad Ezzat Izz who always make my life happy and cheerful.

Last but not least, I would like to thank all my colleagues and all the staffs in Obstetrics and Gynecology, for their cooperation and assistance in carrying out this study.

Thank you.

Dr Nor Azlina binti Che Yaacob

Mei 2019

LIST OF ABBREVIATIONS

BMI Body Mass Index

CI Confidence Intervals

CS Caesarean Section

DOA Direct Occipito-Anterior

DOP Direct Occipito-Posterior

DspADirect spine Anterior

DspP Direct spine Posterior

FD Forceps Delivery

Hrs Hours

IVD Instrumental Vaginal Delivery

IOL Induction of Labour

GmGram

Kg Kilograms

LOA Left Occipito-Anterior

LOL Left Occipito-Lateral

LOP Left Occipito-Posterior

LspA Left spine Anterior

LspL Left spine Lateral

LspP Left spine Posterior

Min Minutes

Mls millimetres

NICE National Institute for Health and Clinical Excellence

NICU Neonatal Intensive Care Unit

OA Occipito-Anterior

OFP Optimal Fetal Positioning

OL Occipito-Lateral

OP Occipito-Posterior

OR Odds Ratio

OTOccipito-Transverse

POPPersistent Occipito-Posterior

R/LOT Right/Left Occipito-Transverse

ROA Right Occipito-Anterior

ROL Right Occipito-Lateral

ROPRight Occipito-Posterior

RR Relative Risk

RspARight spine Anterior

RspL Right spine Lateral

RspP Right spine Posterior

SD (*sd)*Standard Deviation

SVD Spontaneous Vaginal Delivery

VD Ventouse Delivery

$V_{ag}D$ Vaginal Delivery

ABSTRAK

(Bahasa Malaysia)

OBJEKTIF: Untuk mengkaji tentang kedudukan janin iaitu posisi kepala janin dan kedudukan tulang belakang (khususnya bahagian belakang kepala dan tulang belakang janin di bahagian belakang) dengan ultrasonografi sebelum merangsang proses bersalin dan kesan semasa dan selepas proses bersalin.

KAEDAH KAJIAN: Ini adalah kajian prospektif di mana ultrasonografi dilakukan untuk menentukan kedudukan kepala dan tulang belakang janin pada 350 wanita hamil sebelum merangsang proses bersalin untuk indikasi yang berbeza. Semasa proses awal kelahiran, kedudukan kepala dan tulang belakang janin ditentukan melalui ultrasonografi dan proses kelahiran dipantau seperti biasa. Hasil dan kesan kelahiran telah dicatat.

KEPUTUSAN: 350 kehamilan dikenal pasti sebelum induksi kelahiran dan dipantau dari peringkat pertamasehingga selesai proses kelahiran. 329 wanita dinilai pada peringkat pertama kelahiran dan 304 wanita dinilai pada peringkat kedua. 24.3% janin didapati berada dalam kedudukan OP dan 16.3% janin pada kedudukan tulang belakang di belakang sebelum proses induksi. Walau bagaimanapun, majoriti OP dan tulang belakang di bahagian belakang kemudian berputar ke bahagian hadapan sebelum lahir. Terdapat 13 (3.7%) kes OP dan 11 (3.1%) kedudukan tulang belakang di belakang pada penilaian ultrasonografi semasa peringkat kedua kelahiran. 296 kes berjaya bersalin secara normal termasuk vakum (4.0%) dan forcep (0.9%). 54 (15.4%) wanita bersalin secara pembedahan kecemasan. Daripada 54 kes, 15 (17.6%) kes adalah mempunyai kedudukan OP sebelum proses induksi, diikuti oleh 8 (15.1%) kes semasa tahap pertama kelahiran dan hanya 3 (23.1%) pada peringkat kedua

proses kelahiran. 9 (15.8%) sebelum proses induksi, 10 (29.4%) pada peringkat pertama dan 4 (36.4%) pada peringkat kedua proses kelahiran dengan kedudukan tulang belakang di bahagian belakang telah menjalani proses bersalin secara pembedahan. Tiada data yang dilaporkan tentang kedudukan kepala dan tulang belakang janin semasa proses kelahiran. Analisis menunjukkan bahawa hubungan antara kedudukan kepala janin dan tulang belakang di bahagian belakang sebelum proses induksidengan hasil kelahiran sebagai p-nilai ($p => 0.05$) adalah tidak signifikan tetapi kedudukan kepala janin semasa peringkat pertama kelahiran ($p = <0.001$) dan pada peringkat kedua ($p = <0.001$) dan hasil proses kelahiran adalah berkait rapat di antara satu dengan yang lain. Dari analisis Chi-square, daripada 10 faktor yang berkaitan dengan hasil kelahiran (VD / Non-VD), hanya 7 faktor (pariti, berat lahir, penggunaan oxitocin semasa proses kelahiran, jangka waktu fasa pertama proses kelahiran, daripada proses induksi ke proses kelahiran, kedudukan kepala janin dan tulang belakang di bahagian belakang semasa peringkat pertama dan kedua proses kelahiran) dengan p-nilai yang signifikan ($p<0.05$) mempunyai kaitan antara satu sama lain.

KESIMPULAN: Ultrasonografi adalah kaedah mudah dan prosedur biasa untuk menilai kedudukan kepala dan tulang belakang sebelum merangsang proses kelahiran. Setakat ini, tiada hasil kajian yang menunjukkan hubungan antara kedudukan kepala janin sebelum proses induksi kelahiran. Walau bagaimanapun, kajian ini menunjukkan bukti statistik yang kukuh bahawa kedudukan kepala dan tulang belakang janin yang terletak di bahagian belakang semasa peringkat pertama dan kedua proses kelahiran berkait dengan kadar peningkatan kelahiran secara pembedahan dan kelahiran dengan bantuan.

ABSTRACT

(English)

OBJECTIVES:To study regarding the position of fetus by the position of the fetal head and the spine position (specifically fetal occiput posterior (OP) and spine posterior position) by ultrasonographyprior to induction of labour and during intrapartum and their adverse delivery outcomes.

METHOD:This was a prospective study in which ultrasonographic fetal head and spine position were determined in350 women with singleton pregnancy immediately before induction of labour for various reasons at term. During early intrapartum, transabdominal sonography for fetal head and spine positionwere determinedand the progress of labour was monitored as usual. The outcomes of labour were measured.

RESULTS: 350 pregnancies were evaluated before induction of labour and were followed up for first and second stages of labour until delivery. 329 women were then evaluated during the first stage and with 304 of them were evaluated during second stage. 24.3% of fetuses were found to be in an OP position and 16.3% of fetuses in the spine posterior position prior to induction of labour. However, the majority of OP and spine posterior then were rotated to an anterior position before delivery. There were 13 (3.7%) cases of OP and 11 (3.1%) cases of spine posterior position on ultrasound evaluation during second stage of labour. 296 (79.7%) cases delivered via vaginal delivery included ventouse (4.0%) and Forceps (0.9%). The incidence of EMLSCS was 54 (15.4%) amongst pregnant women. Out of 54 cases had EMLSCS, 15(17.6%) cases with occiput posterior position had undergone EMLSCS before

induction of labour, followed by 8(15.1%) cases during first stage of labour and only 3(23.1%) cases during second stage of labour (Table 7). 9(15.8%) cases before induction of labour, 10 (29.4%) cases during first stage of labour and 4 (36.4%) cases during second stage of labour in relationship to spine posterior position had undergone EMLSCS (Table 8). There was no reported data regarding the position of occiput and spine position at delivery. Analysis failed to provide evidence of significant association between fetal occiput and fetal spine positions prior induction of labour with birth outcome as the p-values (p=>0.05) were not significant but fetal occiput and spine positions during first stage of labour (p=<0.001) and during second stage of labour (p=<0.001) and mode of delivery are dependent on one another. From Chi-square analysis, 12 of association or predictorsfactors that associated with birth outcome (V_{ag}D/Non-V_{ag}D), only 9 association factors (parity, birth weight, use of oxytocin during labour, duration of first stage of labour, time from start of IOL to delivery,fetal occiput position during first and second stage of labour and in fetal spine posterior during first and second stage of labour) with significant p-values (p=<0.05) correlated each other.

CONCLUSION:There was no evidence of an association between any occiput positionsprior to induction labour with obstetric outcome (V_{ag}D/Non-V_{ag}D). However, this study showed statistically significant evidence that fetal occiput and spine posterior position during first and second stage of labour andincreased rate of caesarean section.

INTRODUCTION

In normal mechanism of labour, a well flexed fetal head engaged into maternal pelvis in transverse position so that the occiput comes to lie near one of the lateral aspects of maternal pelvis at the onset of labour. As labour advanced, progressive flexion and descent of fetal head cause the occiput to rotate anteriorly when the head reaches the pelvis floor. When this sequence of changes in the position of the fetal is altered, a malposition or malpresentation occurs. This malposition and malpresentation of fetal head are usually diagnosed during labour and while in many cases vaginal delivery is possible, they are associated with more difficult labour and associated with increased operative interventions with attendant risks to both the mother and the baby.

In malposition, fetal occiput is directed towards the posterior quadrant of the maternal pelvis[1]. The most frequently encountered mal-position is the Persistent Occipito-Posterior (POP) fetal position and is thought to be the most common complication encountered during labour and delivery[2]. POP position is considered to occur in 10-20% of labours at onset and 5% at delivery[3-5].Studies that distinguished between nulliparous and multiparous women reported there were increased incidences at both labour onset and delivery in nulliparous women[4]. Study reported that the incidence of Occipito-Posterior (OP) deliveries in nulliparous women (7.2%) were almost double compared to multiparous women (4.0%).

The cause of fetal mal-position remains unclear with the most plausible explanations being physical inhibitors and mechanistic deviation. It is thought that pelvic types may predispose fetuses to adopt a posterior fetal position, particularly those that have a narrowed fore-pelvis or a flat sacrum such as the android and anthropoid pelvises[6]. It is also argued that a de-flexed fetal head may cause mal-position[2]. Some studies have shown that an anterior positioned placenta may contribute towards a posterior fetal position, although other studies have not reported similar findings[7]. The most common rationale is that of mechanical deviation, where mal-rotation is thought to be the primary cause of mal-position or a POP fetal position [8]. The reasons as to why some fetuses adopt the posterior position remains unclear and it maybe that no single cause can explains the reason for mal-position with varying characteristics predisposing fetuses to the posterior position.

The posterior fetal position is understood to be the less favoured position as the process of labour and delivery is often challenged with varying clinical complications. Once engagement has taken place in the posterior rather than the OA position, labour mechanism is altered from the point of labour onset [5]. For the posterior fetus to engage it must do so with a deflexed head, unlike the OA position which engages in the flexed position. In the OP position the maternal spine acts as an inhibitor preventing the head from flexing sufficiently to allow the chin to rest on the chest [9]. The OA position achieves this with ease and ensures that the smallest diameter of the fetal head becomes the leading part. In the OP position the lack of flexion encourages the largest diameter of the fetal head to present and descend as the presenting part[10]. The deflexed head with the larger diameter does not fit the pelvis well or position itself centrally over the cervix [11]. Since the deflexed head of the OP fetus rests anteriorly over the cervix rather than resting centrally, contractions are not effectively

stimulated. In turn, this causes poor uterine activity that leads to both delayed descent and uneven and slow cervical dilatation [8, 9].

Eventually, when cervical dilation is achieved the increased diameter of the presenting part is 2.5cm larger and to achieve vaginal delivery the fetal head must mould significantly and the perineum must stretch more than is necessary with an OA positioned [12]. This then increases the need for operative delivery and causes greater perineal trauma[13].

The mechanism of the OP fetus is based on theory as to what ‘may’ happen when the anatomy and physiology of the OP fetus is considered. No scientific evidence exists on the posterior mechanism of labour. Scientific evidence does however exist in relation to both the maternal and fetal morbidity associated with a posterior fetal mal-position compared to the favoured OA fetal position. It is thought that morbidity is associated with the interventions that become necessary in order to salvage the process and achieve a safe delivery when the fetus persists in the OP position [14].

The obstetric outcomes in fetal malpositions are associated with the following:

- Prolonged pregnancy
- Prolonged latent phase of labour
- Primary dysfunctional labour/dystocia (slow progress)
- Secondary arrest of cervical dilatation in labour
- Prolonged second stage of labour

- Obstructed labour
- Operative interventions- dystocia or obstructed labour leads to increase operative interventions either in the form of instrumental delivery or caesarean section depending upon the stage of labour and findings on clinical examination.

Regarding induction of labour, it is a method of artificially stimulating the onset of labour prior to the onset of spontaneous labour. The incidence of induction of labour has increased over recent decades, mainly due to an accumulating body of evidence highlighting the risks to the fetus of pregnancy lasting beyond 41 completed weeks of gestation. It has also been suggested that practioners may have adopted a decreased to recommend intervention of induction of labour for variety of indications. Without intervention, approximately 5-10% of pregnancies continue beyond 294 days or completed 42 weeks. These pregnancies are a major contributor to the high incidence of induction of labour.

The Royal College of Obstetricians and Gynaecologists recommend a policy of induction of labour at 41 completed weeks of pregnancy rather than awaiting spontaneous onset of labour. The NICE guidelines recommend that women with uncomplicated pregnancy should be offered induction of labour between 41 + 0 and 42 + 0 week's gestation. This appears to result in fewer perinatal deaths and lower incidence of meconium aspiration syndrome. However, the absolute risk of perinatal mortality remains very small following 41 weeks' gestation.

Induction of labour may be one of the most common interventions in the obstetrics, but it is not without risks and should not be undertaken lightly. Of all women who are induced, less than two-thirds will give birth without further intervention; approximately 15% will have an instrumental delivery and over 20% will deliver by emergency caesarean section. Therefore, the appropriate counselling of the patient with documentation of provision of information regarding indications, risks, benefits and alternatives to induction of labour is advocated.

LITERATURE REVIEW

The fetal malposition during labour occurredwhen the occiput persists in a lateral or posterior position. Typically, head engages in the transverse diameter late in the third trimester and usually rotates to an occipitoanterior (OAP) or occipitoposterior (OPP) position. About 15-20% of OPP occurs in women before labour at term. [15].

As labour progress, progressive flexion and descent of fetal head cause the occiput to rotate anteriorly when the head reaches the pelvic floor occurs approximately 90-95% [15].When this sequence of changes in the positon of fetal head is altered, a malposition occurs. The Occiput Posterior and Occiput Transverse positionsare represents most common in cephalic malposition during labour.

The incidences of Occiput Posterior Position in the first stage vary between 6-41%, whereas the incidence of occiput transverse position in first stage varies between 33% and 44.5%[16].When this sequence of changes in the position of fetal head is altered, a malposition occurs.

Clinicians traditionally use clinical abdominal palpation (Leopold's manoeuvers) and palpation of sagittal suture and fontanelles to determine the foetal head position. There are several problems with these methods. What little data there is on clinical palpation assesses

the position of the foetal spine, but this does not always correspond to the foetal head position [17].

Recently, ultrasound has been used to examine ocipitoposterior position. Blasi et al, showed that diagnostic sonographic accuracy of foetal occiput position at the second stage of labour had sensitivity of 100%, specificity of 78%, positive predictive value (PPV) of 26% and negative predictive value (NPV) of 100% to predict the same position at birth. Considering the foetal spinal position, ultrasound showed a sensitivity of 100%, specificity of 98%, PPV of 85% and NPV of 100% [18].

The observational prospective study by Cheng et al in 148 women in active labor regarding the feasibility of transabdominal ultrasound for determining fetal head position in laboring women and compare it to digital examination, and to study ultrasonographically the rotation of the fetal head in normal and obstructed labour. Assessment of the fetal head position by digital examination was not possible in 60.7% (122/201) of cases in the first stage and 30.8% (41/133) in the second stage of labour[19]. Difficulty in assessing the position was more likely if the occiput was posterior in comparison to anterior and in the maternal right in comparison to the left side. In the second stage, it was three times more likely for the assessment not to be possible digitally if the occiput was posterior. In the cases when assessment by vaginal examination was possible, the correlation with ultrasound was average in the first stage (kappa = 0.59) and good in the second stage (kappa = 0.77). Overall fetal head position assessment by digital examination was accurate in 31.28% of the cases in the first stage and 65.7% of the cases in the second stage of labor. Rotation of the fetal head is highly unlikely when labor begins in the occipital anterior position. Persistent occipital posterior position developed through failure to rotate from an initial occipital posterior or

transverse position. Duration of the first stage of labor was independently related to parity and position of the fetal spine at presentation, and duration of the second stage of labor was independently related to parity, birth weight, position of the fetal head at the beginning of the second stage, rotation and position of the head at delivery. Souka et al. concluded thatultrasound assessment of the fetal head position in labour is feasible in a busy labour ward. Digital examination is less accurate than ultrasound, in particular in cases of obstructed labour when medical intervention is more likely to be needed. Ultrasound assessment may prove useful in the prediction and diagnosis of difficult and prolonged labour.

Sherer et al. studied intrapartum fetal head position in the first stage of labour and also second stage of labour by comparing digital vaginal examinations with transabdominal suprapubic ultrasound. They reported and concluded that an overall rate of error occurred in 76% in digital vaginal examination during first stage of labour and 65% in digital vaginal examinations in the second stage of labour[20].

Intrapartum assessment using ultrasound was also researched in the assessment of the fetal spine in combination with fetal head position. Akmal *et al.* and Blasi *et al.* assessed the fetal head position with fetal spine position in first and second stages of labour in 918 and 100 pregnant women, respectively. Both of studies conclude that occiput posterior position at delivery in the second stage of labour results from failure of rotation during the first stage of labour rather than a malrotation from the occipito-anterior position. They found that all cases that were occiput posterior position in the second stage of labour had the fetal spine in posterior position[18, 21].

The fetal spine and occiput were often not concordant before induction of labour but the posterior positioned spine was detected in nearly 14.5% of deliveries frequently associated with ocipitoposterior position (OPP)[15]. Another study showed there was higher OPP prevalence during the first and second stages of labour than expected and it's important inpredicting OPP at birth by intrapartum ultrasound assessment of fetal spine positions during second stage of labour[18].These recent studies suggest that intrapartum sonography can provide an accurate way of determining the foetal head position not only in the second stage but also throughout the first stage of labour [18].

Akmal et al found that atearly stages of labour in 209 (35%) cases had fetal occiput posterior position and in this group the incidence of caesarean section was 19% (40 cases) compared with 11% (47 of 392) in the non-occiput posterior group [22]. That study concluded the risk of caesarean section can be estimated during the early stage of active labour by ultrasound determined occiput position, in addition to traditional maternal, fetal and labour related characteristics.

Double-blinded prospective cohort study by Carseldine et al determined occiput-posterior position by ultrasound during the second stage of labour compared with occiput-anterior position. The primary outcome was operative (caesarean section, forceps or vacuum) delivery[23]. A total of 68% (13/19) women in the occiput-posterior group, and 27% (39/141) in the occiput-anterior group had an operative delivery (unadjusted: $P < 0.001$). Caesarean section was performed in 37% and 5%, respectively ($P < 0.001$). The

occiput-posterior group had a longer second stage (mean 2 h 59 minutes vs 1 h 54 minutes; $P = 0.001$) and larger infants (mean 3723 g vs 3480 g, $P = 0.024$). In the logistic regression, occiput-posterior position, nulliparity, abnormal second stage cardiotocograph and epidural analgesia were independent predictors for operative delivery.Occiput-posterior position early in the second stage of labour is strongly associated with operative delivery.

The role of fetal spine position in the first and second stages of labour to determine the probability of OPP detection at birth and the related obstetrical implications were investigated by Gizzo et al. The study conducted using an observational-longitudinal cohort study on uncomplicated cephalic single fetus pregnant women at term. They evaluated the accuracy of ultrasound in predicting occiput position at birth, influence of fetal spine in occiput position during labour, labour trend, analgesia request, type of delivery and indication to CS. The accuracy of fetal spine position to predict the occiput position at birth was high at the first labour stage. At the second stage of labour, CS (40.3%) and operative vaginal deliveries (23.9%) occurred more frequently in OPP than occiput anterior position (7% and 15.2%, resp), especially in cases of posterior spine. They concluded the assessment fetal spine position could be useful in obstetrical management and counselling both, before and during labour. The detection of spinal position, more than OPP is predictive of successful delivery[24].

Many data concluded occipito-posterior position at delivery has been associated with many factors and outcomes measures in the pregnancy and delivery. Short maternal stature, nulliparity, anterior placenta, induction of labour, variable FHR decelerations, use of

epidural, used of oxytocin augmentation, increased instrumental delivery rate, increased caesarean section rate, increased episiotomy rate, perineal trauma, larger birth weights and lower 1-minute Apgar scores.

Pearl et al conducted a study in the United States (US) for investigated the association between OP delivery and maternal and fetal morbidity using a larger number of neonatal outcomes than the previous study. The study was retrospective and compared 564 vaginal OP deliveries with 1068 OA controls matched for race, parity, delivery method and neonatal birth weight. The OP position at delivery was found to be associated with a longer second stage of labour despite fetuses being matched for equivalent birth weight ($p<0.05$) and an increased incidence of episiotomy and severe perineal lacerations that extended to include third- and fourth-degree perineal lacerations ($p<0.05$). Blood loss following delivery was also increased, and women who had OP deliveries had longer hospital stays compared to women who had OA deliveries ($p<0.05$). Neonates who had operative deliveries in the OP position were more likely to suffer from facial nerve and Erb's palsy ($p<0.05$). The overall rates of facial nerve and Erb's palsy were 1.3 and 0.3 per 1000 live births, but OP fetuses were examined 12.4 and 5.3 per 1,000 live births. Despite this and the OP fetuses having a higher frequency of fetal distress, Apgar scores, cord gas pH and neonatal intensive care admissions were no different from the OA group. The study concluded that delivery of the OP position per se was associated with increased maternal morbidity. Increased fetal morbidity for the OP position was associated with operative OP delivery[25].

Sizer et al conducted a study of 16,781 in nulliparous women at term gestation, with singleton cephalic fetuses during the period of 1990-1998. The study was a retrospective

review of health records to determine if there were differences in obstetric outcomes between the OP and the OA deliveries, the main outcomes being mode of delivery and Apgar scores at 5 minutes. Secondary outcomes were maternal age, induction, epidural use, augmentation by oxytocic drugs and neonatal birth weight. OP was defined as delivery of 'face-to-pubes' and delivery where rotation of an OP to an OA position was undertaken prior to delivery. The frequency of the OP position at delivery was 4.7%. Mode of delivery associated with fetal position was significantly different, the rate of SVD for women who delivered an OA fetus was 61.8% and 14.6% for those who delivered an OP fetus (p=0.001). The instrumental delivery rate was 24.4% for the OA group and 43.7% for the OP group (p=0.001) and the emergency CS rate for the OA group was 13.7% compared to 41.7% for the OP group (p=0.001). This study also found an increased association between the use of epidural analgesia in labour and oxytocic augmentation of the OP fetus, apgar scores at 5 minutes (<8) were not significantly different and nor were increasing maternal age, induction of labour and gestational age[3]. The study suggested that delivery in the OP position was associated with increased morbidity for the mother although not for the neonate.

An observational study in Ireland by Senecal et al was compared the outcomes of 246 women with OP positions at delivery and found 13,543 vaginal deliveries were in OA positioned fetuses. They found that the incidence of the OP position at delivery was 1.8% overall, 2.4% in nulliparous and 1.3% in multiparous women[26]. Position was defined as that observed at delivery or that diagnosed on vaginal examination prior to delivery by the attending clinician. The study found that significantly more women in the OP group had a prolonged pregnancy ($p<0.01$) and were more likely to be induced compared to the OA group ($p<0.001$). They also found that the use of oxytocic drugs to augment labour was significantly higher in the OP group than the OA group (52% vs. 32%, $p<0.001$) and prolonged labour of greater than 12

hours was more common amongst the OP group (12% vs. 1.7%, p=0.001). The rates of both instrumental delivery and operative delivery were significantly higher in the OP group than the OA group (p<0.001). The SVD rate for the OA fetuses was 84% overall (inclusive of nulliparous and multiparous women) whilst the SVD rate for the OP fetuses was 29% in nulliparous and 55% in multiparous women (p<0.001). The study also suggested a significant increase in maternal morbidity associated with the OP position at delivery. Maternal perineal trauma was significantly more common in the OP group than the OA group in both the nulliparous and multiparous women (p<0.001). Although the incidence of episiotomy was similar in both OA and OP groups, the OP group had significantly greater risk of anal sphincter injury following instrumental delivery (p<0.001). Neonatal condition at delivery was similar in both the OA and the OP groups, showing no difference in the Apgar scores.

Ponkey et al. in 2003 reported that the persistent occiput posterior position is associated with higher rate of complications during labour and delivery such as. higher rate of induction, prolonged first and second stage of labour, oxytocin augmentation, use of epidural, assisted vaginal delivery, caesarean delivery and third of fourth degree laceration, excessive blood loss and 1 minute low Apgar scores [4].

Senecal et al. in 2005 found no association between fetal position and gestational age and duration of first stage of labour or the use of episiotomy but did find an association between OP position at delivery and increased incidence of the following compared to the OA and OT position. They also reported that there is noassociated between OP position and adverse neonatal outcomes i.elow Apgar, abnormal umbilical cord gasses, admission to intensive care[27].

In the large study by Fitzpatrick et al in 2006, it is reported that the prevalence of OP at delivery was 8.2% and OP position significantly associated with Apgar score <7 at 5 minutes, meconium stained liquor, meconium aspiration and admission to neonatal intensive care unit[26].

Martino V et al, 2007, summarize the available evidence on occipito-posterior fetal head position and maternal and neonatal outcome. The occipito-posterior fetal head position is the most common malposition, but there are not so many data about it in literature. Its incidence is ranging from 1.8% by Fitzpatrick, to 4.6% and 5.5% by Yancey and Sizer, to 6% by Ponkey. Only two trials studied the occipito-posterior associated factors. There is lower incidence of premature rupture of membrane, arterial hypertension pregnancy-induced, induced labour, increased of episiotomy, instrumental delivery and a decreased of vaginal birth without a difference in neonatal Apgar, and with a neonatal bigger weight. The occipito-posterior fetal head position persistence compared to anterior position, has a statistically significant association with short maternal stature, previous caesarean section, longer first and second stage of labour, oxytocin augmentation, epidural analgesia, instrumental vaginal delivery, chorion-amnionitis, vaginal perineal injures, loss of blood and post- partum infections[19]. A highest incidence of occipito-posterior fetal head position may depend by nulliparity, malnutrition with pelvic deformity, pelvic immaturity in the teenager and anterior placenta. Epidural analgesia is a risk factor for fetal head malposition. The majority of occipito-posterior fetal head positions is not due to a malrotation, but to a persistence in this position of the fetal head. In fact, this persistence leads to a failure of the fetal head rotation.

The prolonged second stage is often the result of occipito-posterior fetal head position and instrumental delivery is required. The traditional vaginal examination is not useful for the determination of fetal head position, so instrumental method is needed, such as ultrasound, for a correct evaluation of fetal head position, particularly if a vaginal instrumental delivery is necessary. This is recommended by the Canadian Society of Obstetrics and Gynaecology. The evaluation of fetal head position is important in the prediction of labour induction.

In a prospective cohort study by Choi et al, involved primiparous women, there is significant association between OP position during first stage of labour with rate of caesarean section (37.5% versus 8.5%, $p < 0.0001$) and significant association between OP position during second stage of labour with duration of second stage of labour and neonatal complications as compared to non-OP position (77.9 ± 33.4 min versus 52.2 ± 26.6 min, $p = 0.0104$; 50.0% versus 17.2%, $p = 0.0118$)[28].

Gardberg et al. (1998)[5] conducted a prospective study of 408 women with singleton, cephalic fetuses at term gestation. Each woman underwent an ultrasound on admission to hospital for induction of labour or for spontaneous onset of labour. Fetal position for the purpose of the study was categorised as either anterior or posterior. A posterior position was categorised as the observation on ultrasound of both orbits facing the symphysis pubis and with the spine seen posteriorly. All other observations on ultrasound were classed as anterior fetal positions. Interestingly no further sub-division of position was noted; instead the transverse position of the fetus was also classed as an anterior fetal position. From the study, they found that of the total study population 61 (15%) of fetuses were posterior at the onset of labour, and 21 (5.1%) were posterior at delivery. Of the posterior fetuses that were found to

be OP on admission 53 (87.5%) rotated and were in an anterior position at delivery. This supposed that only 8 cases of posterior fetal position persisted throughout labour and delivery. However, the study found that a total of 21 fetuses were posterior at delivery, concluding that the additional 13 (62%) were as a result of fetal mal-rotation from an initial anterior fetal position rather than a persistent OP position from labour onset. They found that the OP position was not associated with labour induction, epidural use, maternal BMI, duration of first and second stage or mode of delivery.

OBJECTIVES OF THE STUDY

General Objectives

To study regarding the position of fetus; fetal spine position in relation to the uterus and the fetal head position at the pelvic brim prior to induction of labour and during intrapartum with adverse delivery outcomes.

Specific Objectives

1. To describe the proportion of fetal head and spine positions prior to the induction of labour by ultrasound.

2.To determine the association between fetal head position at the onset of labour and mode of delivery amongst pregnant women undergone induction of labour.

- Vaginal delivery rates

- The caesarean delivery rates

- The instrumental delivery rates

- Type of analgesia during labour

- Duration of time of labour till delivery

- Use of oxytocin to augment labour

- Maternal and fetal outcomes

3.To determine the association between fetal spine position at the first stage of labour and the mode of delivery amongst pregnant women undergone induction of labour.

- Vaginal delivery rates

- The caesarean delivery rates

- The instrumental delivery rates

- Type of analgesia during labour

- Duration of time of labour till delivery

- Use of oxytocin to augment labour

- Maternal and fetal outcomes

METHODOLOGY

This was a prospective study, which was conducted in Hospital Universiti Sains Malaysia. 350 patients who were admitted for induction of labourto Antenatal Ward were involved in the study.The rigorous planning and piloting of the study aimed to minimise weaknesses and enhance scientific strengths. During the planning of the study the use of a prospective design was deemed mandatory if the associative relationship between fetal position and labour outcomes was to provide best available evidence. The ability to determine the eligibility criteria minimised confounding variables that would otherwise generate arguments relating to validity. The prospective approach allowed controls to be imposed in order to standardise processes of assessment of fetal position. Once such controls were applied it allowed study participants to be followed until the outcome of delivery was observed and recorded. The birth outcome measure of mode of delivery was an objective measure and did not give rise to issues of subjectivity. Moreover it was routinely collected so not influenced at all by study purposes. The ability to design a study and impose controls increased the validity of the study and eliminated potential bias, particularly relating to possible confounding variables that may otherwise result in competing explanations.

Selection of women was based on the study inclusion and exclusion criteria. Those whoagreed to participate were recruited into the study and had an ultrasound scan to determine head position and fetal spine position prior to induction of labour. In the labour room, they had another ultrasound examination to determine the fetal head position and fetal spine position at the first stage of labour. The labour was then followed up until delivery of the baby. The mode of delivery and outcomes were determined. The duration of the study was 12 months from 25th September 2017 until 24th September 2018.

The null hypothesis of this study is the Occipitoposterior position (OPP) and fetal spine position is associated with less successful induction of labour. They either end up with unfavourable cervix or poor progress of labour.

The outcome measures in this study were time interval from start of induction to delivery, vaginal delivery rates, the caesarean delivery rates, the instrumental delivery rates, the need for analgesic or epidural requirementduring labour, the need for oxytocin augmentation, time interval during first and second stages of labour, types of perineal tear, estimated blood loss post-delivery, maternal complications such as postpartum haemorrhage, third or fourth degree tear, retained placenta and neonatal outcomes such as birth weight, Apgar score at 5 minutes of life and the need for Neonatal Unit admission.

All data analysis and data entry done using **Social Science and Statistical Packaged (SPSS)** version 24.0 software licensed to Universiti Sains Malaysia. Descriptive statistic procedures

applied for analysed data. Descriptive statistics using Mean with SD (Standard deviation) for distribution of variables of maternal characteristics of pregnant women prior the induction of labour. Median and interquartile range (IQR) are used for analysed data of maternal and neonatal outcomes. The length of labour and time from start of induction of labour to delivery was compared with fetal occiput and spine positions using an analysis of variance (ANOVA) test. Chi-Square was used with each mode of delivery as the outcome, firstly to see whether there were any differences between fetal occiput posterior and fetal spine posterior with all other positions. The Chi-Square also was used to predict the factors that associated with the birth outcome amongst pregnant women during induction and eachstages of labour in Hospital USM. The predictor factors that were included in the analysis were the age of patients, BMI, parity, birth weight, duration of first and second stage of labour, time from IOL till delivery, occiput position and spine position.

4.1: SAMPLE SIZE

Objective 1 = the proportion of all foetal spine and occiput positions before the induction of labour

The sample size was calculated using single proportion formula as below:

1) Fetal spine position

$$n = \left(\frac{Z\alpha}{\Delta}\right)^2 P(1-P)$$

Anticipated population proportion (P) = 14.5 % (Peregrine et al, 2007)

Absolute precision (Δ) = 0.05

Z = 1.96

P = 14.5% = 0.145

n = $(\frac{\mathbf{1.96}}{\mathbf{0.05}})^2$ 0.145 x (1- 0.145) = 246.93 »247 (sample) + 16 (dropout) = 263 each case

2.Fetal head position

n = $\left(\frac{Z\alpha}{\Delta}\right)^2 P(1-P)$

Anticipated population proportion (P) = 35 % (Peregrine at al ,2007))

Absolute precision (Δ) = 0.05

Z = 1.96

P =35% = 0.35

n = $(\frac{\mathbf{1.96}}{\mathbf{0.05}})^2$ 0.35 x (1-0.35) =349.58 »349 (sample) + 16 (dropout) = 365 each case

Objective 2 = association between foetal occiput position at the onset of labour with birth outcomes amongst pregnant women undergone induction of labour.

For the birth outcomes, sample size is calculated using Power and sample size

Calculation program version 3.1.2 as below, using Chi- Square for numerical variable and dichotomous for categorical variable

Po is probability of exposure among control group

Power = 0.8

α = 0.05

m ratio = 1

Po: control group (Non OP)

A: Obstetric outcomes according to fetal head position on ultrasonography before induction of labour amongst pregnant women. (Peregrine, 2007)

Variable	Po	P1	α	1-β/power	n	n+ 20% dropout
Delivery within 24h - SVD - LSCS - Operative	0.54	0.34	0.05	0.8	96	115
Vaginal delivery	0.69	0.55	0.05	0.8	188	226
Vaginal delivery within 24h	0.43	0.23	0.05	0.8	183	220
Instrumental delivery	0.20	0.40	0.05	0.8	81	97

Abnormal CTG during labor or delivery	0.33	0.52	0.05	0.8	105	126
Use of oxytocin to augment labor	0.50	0.75	0.05	0.8	58	70

Objective 3: The association between foetal spine position at the onset of labour with the mode of delivery amongst pregnant women undergone induction of labour.

For the mode of delivery, sample size is calculated using Power and sample size calculation program version 3.1.2 as below, using Chi- Square for numerical variable and dichotomous for categorical variable (S.Gizzo,2014)

Po is probability of exposure among control group

Power = 0.8

$\alpha = 0.05$

m ratio = 1

P0= control group (persistent spine anterior position)

Variable	Po	P1	α	1-β/power	n	n+ 20% dropout
Caesarean (LSCS)	0.08	0.65	0.05	0.8	10	12
Operative delivery	0.163	0.30	0.05	0.8	141	170