Sonographic knowledge of occiput position to decrease failed operative vaginal delivery: a systematic review and meta-analysis of randomized controlled trials

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 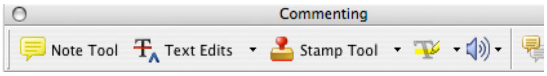

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 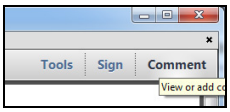

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 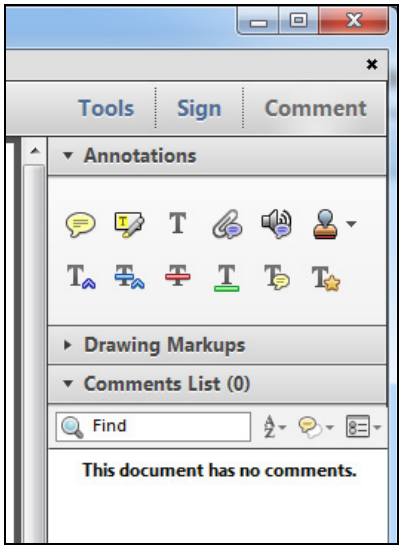
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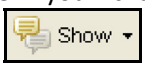
Review	To review your changes, click on the 'Show' button  on the Commenting tool bar. Choose 'Show Comments List'. Navigate by clicking on a correction in the list. Alternatively, double click on any mark-up to open the commenting box.	Your changes will appear automatically in a list below the Comment tool bar. Navigate by clicking on a correction in the list. Alternatively, double click on any mark-up to open the commenting box.
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Sonographic knowledge of occiput position to decrease failed operative vaginal delivery: a systematic review and meta-analysis of randomized controlled trials

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OBJECTIVE: This study aimed to assess the efficacy of sonographic assessment of fetal occiput position before operative vaginal delivery to decrease the number of failed operative vaginal deliveries.

DATA SOURCES: The search was conducted in MEDLINE, Embase, Web of Science, Scopus, ClinicalTrial.gov, Ovid, and Cochrane Library as electronic databases from the inception of each database to April 2021. No restrictions for language or geographic location were applied.

STUDY ELIGIBILITY CRITERIA: Selection criteria included randomized controlled trails of pregnant women randomized to either sonographic or clinical digital diagnosis of fetal occiput position during the second stage of labor before operative vaginal delivery.

METHODS: The primary outcome was failed operative vaginal delivery, defined as a failed fetal operative vaginal delivery (vacuum or forceps) extraction requiring a cesarean delivery or forceps after failed vacuum. The summary measures were reported as relative risks or as mean differences with 95% confidence intervals using the random effects model of DerSimonian and Laird. An I^2 (Higgins I^2) >0% was used to identify heterogeneity.

RESULTS: A total of 4 randomized controlled trials including 1007 women with singleton, term, cephalic fetuses randomized to either the sonographic (n=484) or clinical digital (n=523) diagnosis of occiput position during the second stage of labor before operative vaginal delivery were included. Before operative vaginal delivery, fetal occiput position was diagnosed as anterior in 63.5% of the sonographic diagnosis group vs 69.5% in the clinical digital diagnosis group (*P*=.04). There was no significant difference in the rate of failed operative vaginal deliveries between the sonographic and clinical diagnosis of occiput position groups (9.9% vs 8.2%; relative risk, 1.14; 95% confidence interval, 0.77–1.68). Women randomized to sonographic diagnosis of occiput position had a significantly lower rate of occiput position discordance between the evaluation before operative vaginal delivery and the at birth evaluation when compared with those randomized to the clinical diagnosis group (2.3% vs 17.7%; relative risk, 0.16; 95% confidence interval, 0.04–0.74; *P*=.02). There were no significant differences in any of the other secondary obstetrical and perinatal outcomes assessed.

CONCLUSION: Sonographic knowledge of occiput position before operative vaginal delivery does not seem to have an effect on the incidence of failed operative vaginal deliveries despite better sonographic accuracy in the occiput position diagnosis when compared with clinical assessment. Perhaps future studies should evaluate how a more accurate sonographic diagnosis of occiput position or other parameters can lead to a safer and more effective operative vaginal delivery technique.

Key words: delivery outcome, instrumental vaginal delivery, occiput position, ultrasound in labor

Introduction

Safe, successful operative vaginal delivery (OVD) is an important goal in contemporary obstetrics. Failed OVD, defined as cesarean delivery (CD) or sequential use of different instruments after a trial of OVD, is associated with an increased risk for complications such as neonatal metabolic acidosis, seizures, neonatal encephalopathy, neonatal intracranial hemorrhage and maternal postpartum hemorrhage, prolonged hospitalization, and perineal wound complications.[1–5] Moreover, second stage CD is also associated with risks, and the rate of complications increases

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AJOG at a Glance

Why was this study conducted?

A sonographic diagnosis is more accurate than a clinical digital diagnosis for fetal occiput position. It is unknown if this improved knowledge affects pregnancy outcomes when acquired before an operative vaginal delivery (OVD).

Key findings

This meta-analysis of randomized controlled trials (RCTs) showed that sonographic knowledge of occiput position before OVD does not have an effect on the incidence of failed OVD. There were no significant differences in any other obstetrical and perinatal outcomes assessed.

What does this add to what is known?

In this meta-analysis, recent RCTs on sonographic knowledge vs clinical knowledge of fetal occiput position before OVD were evaluated. Future studies should ~~perhaps~~ evaluate how a more accurate sonographic diagnosis of occiput position or other parameters can lead to a safer and more effective OVD technique.

when the CD is performed after a trial of OVD.[1]

According to the international guidelines,[6,7] an accurate diagnosis of fetal occiput position is necessary for a safe OVD, because an incorrect diagnosis of the occiput position is associated with an increased risk for failed OVD and its consequences. Clinical digital examination is traditionally performed before OVD to diagnose fetal occiput position, but studies in which ultrasound has been used show that the clinical examination alone is unreliable, because it fails to accurately diagnose the correct occiput position in many cases (about 20%), particularly in cases of occiput posterior or transverse position.[8,9] In this scenario, over the past few years, performing an ultrasound before OVD has been proposed[5,10–15] to improve the accuracy of the diagnosis of fetal occiput position.[8,16–18]

Objective

The aim of our meta-analysis was to evaluate the effect of ultrasound diagnosis of fetal occiput position before OVD on the incidence of failed OVD, defined as a CD or sequential use of different instruments after a trial of OVD.

Materials and Methods

Search strategy

This meta-analysis was performed according to a protocol recommended for systematic review.[19] The review protocol was designed by a priori defining methods for collecting, extracting, and analyzing data. The research was conducted using MEDLINE, Embase, Web of Science, Scopus, ClinicalTrial.gov, Ovid, and Cochrane Library as electronic databases from the inception of each database to April 2021. We systematically searched for a combination of the following terms: "ultrasound in labor," intrapartum sonography," "occiput position," "fetal head position," "instrumental vaginal delivery," "operative vaginal delivery," "vacuum delivery," "forceps delivery," and "fetal head presentation." Review of articles also included the abstracts of all references retrieved from the search. No restrictions for language or geographic location were applied.

Study selection

Selection criteria included only randomized controlled trials (RCTs) of pregnant women randomized to either sonographic or clinical digital diagnosis of occiput position during the second stage of labor. Quasi-randomized trials (ie, trials in which the allocation was done based on a pseudorandom sequence, for example odd and even hospital number or date of birth alterations) were excluded.

Risk of bias assessment

The risk of bias in each included study was assessed by using the criteria outlined in the Cochrane Handbook for Systematic Reviews of Interventions.[20] The following 7 domains related to risk of bias were assessed in each included trial because there is evidence that these issues are associated with biased estimates of treatment effect: (1) random sequence generation; (2) allocation concealment; (3) blinding of participants and personnel; (4) blinding of outcome assessment; (5) incomplete outcome data; (6) selective reporting; and (7) other bias. The review authors' judgments were categorized as "low risk," "high risk," or "unclear risk" of bias.[20]

Primary and secondary outcomes

The primary outcome was failed OVD, defined as a failed fetal vacuum or forceps operative extraction requiring a subsequent CD or instrumental delivery with forceps after a failed vacuum extraction attempt.

The secondary obstetrical outcomes were:

1. CD ~~owing to~~ failed OVD;
2. Obstetrical anal sphincter injuries (grade III and IV perineal tears);
3. Shoulder dystocia;
4. Distance between the center of the chignon and the flexion point;
5. Difficult OVD, defined as the number of patients who had >1 of the following: >3 tractions, CD, sequential instrument delivery, obstetrical anal sphincter injuries (OASIS), neonatal trauma;
6. Discordance in occiput position between pre-OVD evaluation and birth.

Secondary perinatal outcomes were:

1. Admission to neonatal intensive care unit (NICU);
2. Apgar score <7 at 5 minutes;
3. Neonatal trauma (skull fractures, subgaleal hemorrhage, cephalohematoma, any other neonatal hemorrhage);
4. Umbilical cord arterial pH <7.0;

5. Composite perinatal outcome defined as the sum of each of the perinatal outcomes;
6. Composite perinatal outcome defined as the number of patients experiencing at least 1 perinatal outcome.

Data extraction

Data extraction was completed by 2 independent authors (F.B. and G.S.). We resolved discrepancies through discussion and by consensus with a third reviewer (V.B.). Before data extraction, the review was registered with the PROSPERO International Prospective Register of Systematic Reviews (registration number, CRD42020136182). In case of missing data in a relevant article, the corresponding and/or the primary authors were contacted for additional information.

Data analysis

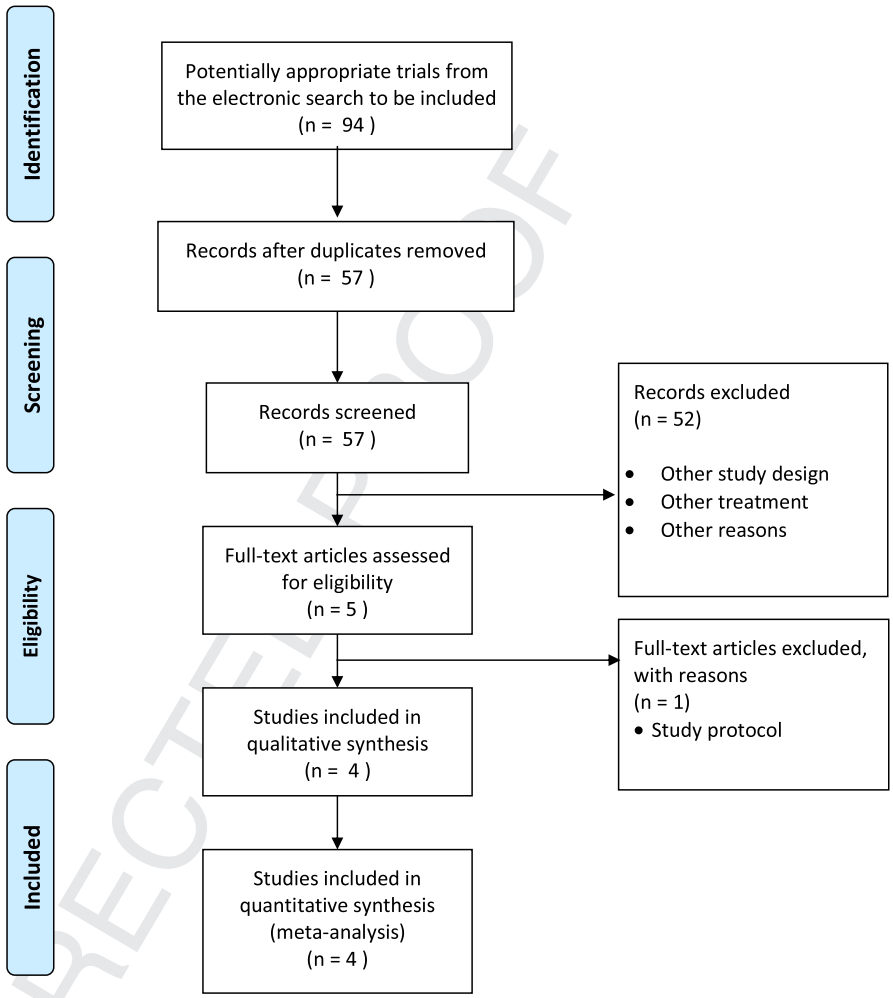
Data analysis was completed using Review Manager 5.4.1 (Copenhagen: The Nordic Cochrane Center, Cochrane Collaboration, 2020). The summary measures were reported as summary relative risks (RRs) or as summary mean differences (MDs) with 95% of confidence intervals (CIs) using the random effects model of DerSimonian and Laird. I^2 (Higgins I^2) >0% was used to identify heterogeneity. Potential publication biases were assessed graphically by using the funnel plot. The meta-analysis was reported according to the Preferred Reporting Item for Systematic Reviews and Meta-analyses (PRISMA) statement.[21]

Results

Study selection

[F1] Figure 1 shows the flow diagram (PRISMA template) of information derived from our review of potentially relevant articles. A total of 4 RCTs that included 1007 women randomized to either sonographic or clinical digital diagnosis of occiput position during the second stage of labor were included.[8,16–18] Of the 1007 women included in the meta-analysis, 484 (48.1%) were randomized to the sonographic arm and 523 (51.9%) to the clinical digital diagnosis of occiput position arm.

FIGURE 1
PRISMA flow diagram summarizing inclusion of RCTs in this review



PRISMA, preferred reporting items for systematic reviews and meta-analysis; *RCTs*, randomized controlled trials.

Bellussi. Sonographic occiput position before operative vaginal delivery. Am J Obstet Gynecol 2021.

Study characteristics

Table 1 shows characteristics of the included studies. Type of participants included women with singleton, term pregnancies and vertex presentation for which an OVD was indicated mainly for a prolonged second stage, failure to progress, fetal distress, or nonreassuring cardiotocography tracings. Only 2 studies were completed after reaching the needed sample size.[8,17] Labor characteristics are described in Table 2. Most women had spontaneous labor and epidural anesthesia; rates of epidural use (P=.80), induction of labor (P=.93), and oxytocin augmentation (P=.06) were similar between the 2 groups. Failure to progress was the most common indication for OVD, occurring in 50.4% of the sonographic examination group and in 60.6% of the clinical digital examination group (P=.03). The occiput posterior or transverse positions before OVD were detected significantly more frequently in the sonographic examination group than in the clinical digital examination group (36.4% vs 30.4%, respectively; P=.04). The frequency of fetal head station at ≥+2 was similar (44.5% vs 48.9%, respectively) for the 2 groups (P=.33). Rates of low birthweight (LBW) neonates were similar for the 2 groups (P=.17).

[T1] [T2]

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TABLE 1
Characteristics of the included studies

Characteristics	Wong et al,[17] 2007	Ramphul et al,[8] 2014	Ghi et al,[xx] 2018	Barros et al,[16] 2020
Location	Hong Kong	Ireland	Italy	Portugal
Type of study	Single center RCT	Multicenter RCT	Multicenter RCT	Multicenter RCT
Sample size	25 vs 25	257 vs 257	89 vs 132	113 vs 109
Intervention	Clinical examination (transabdominal and vaginal assessment of occiput position) followed by US examination (transabdominal US assessment of spine and occiput position)	Abdominal and vaginal examination and US examination (transabdominal US assessment of spine and occiput position)	Vaginal examination followed by transabdominal US assessment of occiput position	Transabdominal US assessment of occiput position and transperineal assessment of the angle of progression
Control	Clinical digital examination ~~of the occiput position~~	Abdominal and vaginal examination	Vaginal examination	Vaginal examination
Inclusion criteria	- Prolonged second stage and indication for OVD	- Singleton	- Singleton	- Singleton
		- Cephalic presentation	- >18 y	- Cephalic presentation
		- Indication for OVD	- Cephalic presentation	- Nonemergent indication for OVD
			- Indication for OVD	
Exclusion criteria	- Multiple pregnancies	- Multiple pregnancies	- Any contraindication to OVD	- <18 y
	- Preterm	- <18 y	- Fetal head station >+3	- Fetal malformations
	- Fetal distress	- Limited understanding of English	- Emergency delivery needed	- Limited understanding of the study
	- Contraindication for OVD	- Contraindication for OVD	- Sonographic evaluation of fetal head position performed before randomization	
GA at randomization	≥37 wk	≥37 wk	≥37 wk	≥ 37 wk
Study primary outcome	Distance between the center of the chignon and the flexion point	Incorrect diagnosis of the fetal head position (diagnosis of incorrect position diagnosis was not done by US but by discrepancy between pre-OVD diagnosis and birth diagnosis or postnatal examination of instrument's markings on the neonatal face after delivery)	Incidence of failed vacuum extraction and need to perform emergency cesarean delivery	Composite of maternal and neonatal morbidity (severe PPH, severe perineal trauma, >48 h of postnatal hospital stay, low 5-min Apgar score, umbilical artery metabolic acidosis, birth trauma, and NICU admission)
Intention to treat analysis	Not reported	Yes	Not reported	Yes

Bellussi. Sonographic occiput position before operative vaginal delivery. Am J Obstet Gynecol 2021.

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TABLE 1
Characteristics of the included studies *(continued)*

Characteristics	Wong et al,[17] 2007	Ramphul et al,[8] 2014	Ghi et al,[xx] 2018	Barros et al,[16] 2020
Randomization technique	Randomization was done by computer-generated random numbers in a ratio of 1:1 using sealed envelopes, which were opened after recruitment at the time of decision for vacuum extraction	Randomization in a 1:1 ratio using a secure, web-based central randomization service, ensuring concealment of allocation. The allocation sequence was computer generated, stratified by center, and used random permuted blocks of 4, 8, and 12 women	Online randomization program	Randomization in a 1:1 ratio to 1 of the 2 study groups. The allocation group was determined by opening a previously prepared opaque, sealed envelope. These envelopes contained the results of an allocation sequence, created by a computer random-number generator, according to a permuted block method
Study completed after reaching sample size	Yes	Yes	No	No

GA, gestational age; *NICU*, neonatal intensive care unit; *OVD*, operative vaginal delivery; *PPH*, postpartum hemorrhage; *RCT*, randomized controlled trial; *US*, ultrasound.

Bellussi. Sonographic occiput position before operative vaginal delivery. Am J Obstet Gynecol 2021.

Table 3 shows details of OVD. Two studies only used vacuum devices,[17,18] whereas the other 2 used both vacuum and forceps.[8,16] The rate of vacuum delivery (only vacuum used), forceps delivery (only forceps use), and sequential use of instruments (vacuum or forceps first) was similar for the 2 groups. Similarly, the number of cup applications and cup detachments and the rate of >3 tractions were also similar for both groups. [T3]

Risk of bias of the included studies

The quality of the RCTs included in our meta-analysis was assessed using the Cochrane Collaboration's Risk of Bias Tool.[21] All the included studies used a computer-generated table of random numbers and had a low risk of bias for "incomplete outcome data" category (Figure 2). No method of blinding of either the participants or the outcome assessment was reported. [F2] [F3]

Synthesis of results

Table 4 shows the primary and secondary obstetrical outcomes. There was no significant difference in the rate of failed OVDs between the sonographic and clinical digital diagnosis of occiput position groups (9.9% vs 8.2%; RR, 1.14; 95% CI, 0.77−1.68). Similarly, no significant difference was found when considering the CD rate performed because of a failed OVD (2.9% vs 2.5%; RR, 1.1; 95% CI, 0.49−2.49). [T4]

No significant difference was also found in the rate of OASIS (9.3% vs 9.7%; *P*=.59), shoulder dystocia (4.6% vs 4.6%; *P*=.91), distance between the center of the chignon and the flexion point, and difficult OVD (20.8% vs 18.3%; *P*=.82). Finally, women randomized to the sonographic group had a significantly lower rate of discordance in the diagnosis of occiput position before OVD and in the evaluation after birth than those randomized to the clinical digital diagnosis group (2.3% vs 17.7%; RR, 0.16; 95% CI, 0.04−0.74; *P*=.02).

Table 5 shows the secondary perinatal outcomes. No significant differences were found in the rate of admission to the NICU (9.4% vs 8.6%; *P*=.79), Apgar score <7 at 5 minutes (0.6% vs 0.9%; [T5]

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TABLE 2
Labor characteristics

Characteristics	Wong et al,[17] 2007	Ramphul et al,[8] 2014	Ghi et al, 2018	Barros et al,[16] 2020	Totals	*P* value
Rate of epidural use	2/25 (8) vs 3/25 (12)	228/257 (88.7) vs 228/257 (88.7)	53/89 (59.6) vs 91/132 (68.9)	112/113 (99.1) vs 108/109 (99.1)	395/484 (81.6) vs 430/523 (82.2)	.8
Induction of labor	9/25 (7.4) vs 8/25 (9.7)	129/257 (50.2) vs 129/257 (50.2)	NR	NR	138/282 (48.9) vs 137/282 (48.5)	.93
Augmentation	4/25 (9) vs 10/25 (11.8)	NR	NR	NR	4/25 (9) vs 10/25 (11.8)	.06
Indication for OVD	Prolonged second stage	General indications for instrumental delivery, including fetal distress	Failure to progress 44/89 (49.4) vs 81/132 (61.4)	Failure to progress 58/113 (51.3) vs 65/109 (59.6)	Failure to progress 102/202 (50.4) vs 146/241 (60.6)	.03
			Fetal distress 28/89 (31.4) vs 38/132 (28.7)	Nonreassuring CTG: 41/113 (36.3) vs 37/109 (33.9)		
			Failure to progress and distress: 17/89 (19) vs 13/132 (9.8)	Prophylactic/maternal indication: 5/113 (4.4) vs 2/109 (1.8)		
				Lack of maternal collaboration: 9/113 (8) vs 5/109 (4.6)		
OP position before OVD[a]	6/24[b] (25) vs 4/25 (16)	48/257 (18.7) vs 39/257 (15.2)	NR	19/113 (16.8) vs 24/109 (22.0)	73/394 (18.5) vs 67/391 (17.13)	.61
OT position before OVD[a]	5/24[b] (21) vs 2/25 (8)	66/257 (25.7) vs 70/257 (27.2)	NR	18/113 (15.9) vs 16/109 (14.7)	89/394 (22.5) vs 88/391 (22.5)	.98
OP or OT position before OVD[a]	11/ 24[b] (45.8) vs 6/25 (24)	114/257 (44.4) vs 109/257 (42.4)	14/89 (15.7) vs 4/132 (3.0)	37/113 (32.7) vs 40/109 (36.7)	176/483 (36.4) vs 159/523 (30.4)	.04
OA position before OVD[a]	13/24[b] (54.2) vs 19/25 (76)	143/257 (55.6) vs 148/257 (57.6)	75/89 (84.3) vs 128/132 (97.0)	76/113 (67.3) vs 69/109 (63.3)	307/483 (63.5) vs 364/523 (69.5)	.04
Station >+2	6/25 (24) vs 6/25 (24)	NR	31/89 (34.8) vs 56/132 (42.4)	64/113 (56.6) vs 68/109 62.4)	101/227 (44.5) vs 130/266 (48.9)	.33
Rates of low birthweight	NR	3/257 (1.2) vs 2/257 (0.8)	4/89 (4.5) vs 3/132 (2.3)	6/113 (5.3) vs 3/109 (2.8)	13/459 (2.8) vs 8/498 (1.6)	.17

Numbers show comparison between data on patients in which ultrasound has been used in the diagnoses of occiput position before operative vaginal delivery and patients in which ultrasound was not used.

CTG, cardiotocography tracings; *NR*, not reported; *OA*, occiput anterior; *OP*, occiput posterior; *OT*, occiput tranverse; *OVD*, operative vaginal delivery.

[a] Position was ascertained by ultrasound in the intervention group and by clinical digital exam only in the control group; [b] Data available only for 24 of 25 patients (Wong et al,[17] 2007).

Bellussi. Sonographic occiput position before operative vaginal delivery. Am J Obstet Gynecol 2021.

TABLE 3
Operative vaginal delivery details

Delivery details	Wong et al,[17] 2007	Ramphul et al,[8] 2014	Ghi et al, 2018	Barros et al,[16] 2020	Totals	*P* value
Instrument used	Only vacuum (Bird's cup number 5)	Vacuum and forceps	Only vacuum	Vacuum and forceps (Simpson and Kielland)	NA	
Vacuum delivery (only vacuum used)	25/25 vs 25/25	168/257 (65.4) vs 162/257 (63.0)	89/89 (100) vs 132/132 (100)	67/113 (59.3) vs 71 (65.1)	349/484 (72) vs 390/523 (74.6)	.94
Forceps delivery (only forceps used)	0/25 (0) vs 0/25 (0)	7/257 (29.6) vs 77/257 (30.0)	0/89 (0) vs 0/132 (0)[a]	32/113 (28.3) vs 29/109 (26.6)	39/484 (8.05) vs 106/523 (20.2)	.37
Sequential use of instruments (vacuum or forceps first)	0/25 (0) vs 1/25 (4)	24/257 (9.3) vs 21/257 (8.2)	NA (only vacuum performed)	11/113 (9.7) vs 8/109 (7.3)	35/395 (8.86) vs 30/391 (7.67)	.53
Number of cup applications	NR	NR	1 application: 50/89 (56.1) vs 82/132 (62.1)	1 application: 47/80 vs 45/81[b]	1 application 97/169 (57) vs 127/213 (59.6)	.69
			2 applications: 20/89 (22.5) vs 37/132 (28)		2 applications 20/89 (22.5) vs 37/132 (28)	.36
			3 applications: 19/89 vs 13/132		3 applications 19/89 (21.3) vs 13/132 (9.85)	.02
Number of cup detachments	NR	NR	NR	No cup detachment: 47/80 (59) vs 45/81 (56)	47/80 (59) vs 45/81 (56)	.68
				1 cup detachment: 18/80 (22) vs 20/81 (25)	18/80 (22) vs 20/81 (25)	.74
				2 cup detachments: 6/80 (7.5) vs 6/81 (7.4)	6/80 (7.5) vs 6/81 (7.4)	.98
				3 cup detachments: 8/80[b] (10) vs 8/81[b] (9.9)	8/80[b] (10) vs 8/81[b] (9.9)	.98
>3 tractions	1/25 (4) vs 0/25 (0)	34/257 (13.2) vs 23/257 (8.9)	NR	20/113 (17.7)[b] vs 18/109 (16.5)[b]	55/395 (13.9) vs 41/391(10.55)	.15
Senior obstetrician as primary operator	NR	78/257 (30.4) vs 87/257 (33.9)	NR	NR[c]	78/257 (30.4) vs 87/257 (33.9)	.4

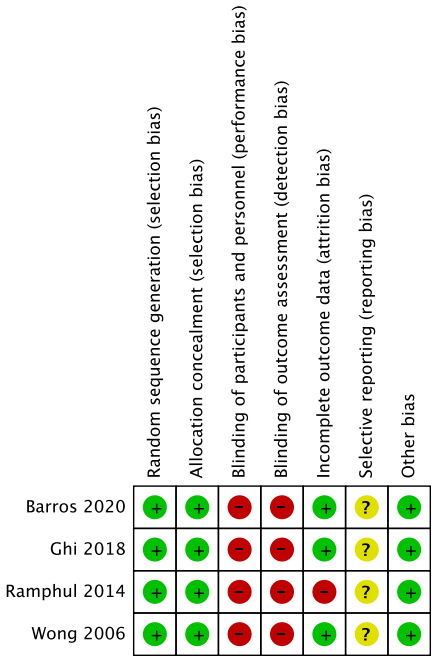
Numbers show comparison between data on patients in which ultrasound has been used in the diagnoses of occiput position before operative vaginal delivery vs patients in which ultrasound was not used.

NR, not reported.

[a] Data with regards to NICU admission, umbilical cord pH, Apgar score <7 (the authors wrote that all the newborns did well) not available; [b] Data missing for 33 patients in the VE+US group and 28 patients in the VE group; [c] A senior obstetrician was present in every delivery and was responsible for the delivery procedure.

Bellussi. Sonographic occiput position before operative vaginal delivery. Am J Obstet Gynecol 2021.

FIGURE 2
Risk of bias according to the Cochrane Handbook in Randomized Controlled Trials included in this meta-analysis



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P=.75), neonatal trauma (4.9% vs 4.8%; P=.93), umbilical cord arterial pH <7 (2.7% vs 2.5%; P=.89), and composite perinatal outcomes defined either as the mathematical sum of each perinatal outcome (22.5% vs 21.6%; P=.87) or the number of patients experiencing at least 1 of the perinatal outcomes (13.9% vs 14.5%; P=.66).

Comment

Main findings

In this meta-analysis of 4 RCTs, which included 1007 women with singleton, term pregnancies with vertex presentation and most commonly epidural anesthesia and for which OVD was most often indicated for failure to progress, the sonographic examination group did not show a reduction in the number of failed OVDs, defined as a failed fetal vacuum or forceps operative extraction requiring a subsequent CD or instrumental delivery with forceps after a failed vacuum extraction, when compared with the clinical digital diagnosis of occiput position before ~~an~~ OVD group. This occurred despite the fact that the operator was aware that the occiput posterior or transverse positions before an OVD were detected significantly more frequently in the sonographic examination group than in the clinical digital examination group (36.4% vs 30.4%, respectively; P=.04).

Strengths and limitations

This meta-analysis of RCTs evaluated the effect of sonographic knowledge vs clinical knowledge of the fetal occiput position before an OVD on the outcome of an OVD. Only RCTs were included and for some criteria (with the notable exception of no blinding), these studies were of high quality and included >1000 women.

A limitation of this meta-analysis was the relatively small sample size (n=1007). To detect a 30% decrease in the 8.2% incidence of failed OVDs in our control group with an alpha of 0.05 and 80% power, about 3246 women would need to be randomized. Only 2 studies[D4] were completed after reaching the needed sample size. About half of the OVDs were done at stations ~~>+2~~, which may not be applicable in some countries such as the United States. Because an ultrasound was not done in the clinical digital examination group, the true occiput position before OVD in this group is unknown; perhaps future studies should have a "blind ultrasound" performed in the clinical digital diagnosis group. In the study by Ramphul et al[8] (Instrumental delivery & ultrasound Irish trial), the physicians who performed the OVD did not always ~~accepted~~ the sonographic diagnosis if discordant from their clinical digital examination assessment.[8] Another limitation is that the exact experience and technique of each provider for each OVD was not well described in the RCTs. Another limitation is that the definition of fetal head station was different in the 3 RCTs that provided these data[16–18]; Wong et al[17] in their RCT used a range of fetal head stations between −3 and +3 and Ghi et al[18] and Barros et al[16] used a range of fetal head station between −5 and +5.

Comparison with existing literature

The results from this meta-analysis show a slightly lower rate of failed OVDs (9.9% for patients with ultrasound examinations vs 8.2% for patients without ultrasound examinations) when compared with previous literature. For

FIGURE 3
Forest plot of the primary outcome, failed operative vaginal delivery

Study or Subgroup	Intrapartum US Events	Intrapartum US Total	Vaginal delivery Events	Vaginal delivery Total	Weight	Risk Ratio M-H, Random, 95% CI
Barros 2020	14	113	9	109	23.9%	1.50 [0.68, 3.32]
Ghi 2018	0	89	2	132	1.7%	0.30 [0.01, 6.08]
Ramphul 2014	34	257	31	257	72.9%	1.10 [0.70, 1.73]
Wong 2006	0	25	1	25	1.5%	0.33 [0.01, 7.81]
Total (95% CI)		**484**		**523**	**100.0%**	**1.14 [0.77, 1.68]**
Total events	48		43			

Heterogeneity: Tau² = 0.00; Chi² = 1.84, df = 3 (P = 0.61); I² = 0%
Test for overall effect: Z = 0.64 (P = 0.52)

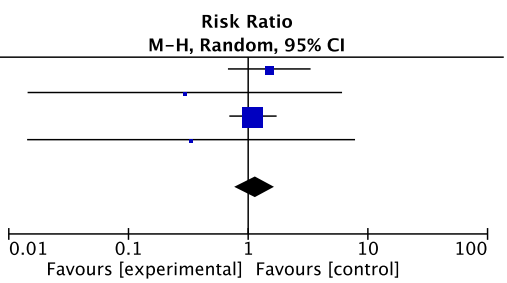

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TABLE 4
Primary and secondary obstetrical outcomes

Outcome	Wong et al,[17] 2007	Ramphul et al,[8] 2014	Ghi et al,[illegible] 2018	Barros et al,[16] 2020	Totals	RR or MD (95% CI)	*P* value	I2
Failed OVD (CD or sequential)	0/25 (0) vs 1/25 (4)	34/257 (13.2) vs 31/257 (12)	0/89 (0) vs 2/132 (1.5)	14/113 (3.5) vs 9/109 (0.9)	48/484 (9.9) vs 43/523 (8.2)	1.14 (0.77—1.68)	.52	0
CD owing to failed OVD	0/25 (0) vs 0/25 (0)	10/257 (3.9) vs 10/257 (3.9)	0/89 (0) vs 2/132 (1.5)	4/113 (3.5) vs 1/109 (0.9)	14/484 (2.9) vs 13/523 (2.5)	1.1 (0.49—2.49)	.81	3
OASIS (third- and fourth-degree perineal tears)	0/25 (0) vs 0/25 (0)	10/257 (3.9) vs 7/257 (2.7)	5/89 (5.6) vs 7/132 (5.3)	11/113 (9.7) vs 17/109 (15.6)	45/484 (9.3) vs 51/523 (9.7)	0.9 (0.62—1.31)	.59	0
Shoulder dystocia	NR	9 (3.5) vs 13 (5.1)	4/89 (4.5) vs 2/132 (1.5)	8/113 (7.1) vs 8/109 (7.3)	21/459 (4.6) vs 23/498 (4.6)	0.96 (0.5—1.84)	.91	14
Distance between the center of the chignon and the flexion point	2.1±1.3 vs 2.8±1.0	NR	1.57±0.99 vs 1.64±1.55	NR	NR	−0.32 (−0.93 to 0.28)	.3	66
Difficult OVD (number of patients who has had >1 of the following: >3 tractions, CD, sequential instrument delivery, OASIS, neonatal trauma[a])	NR	NR	10/89 (11.2) vs 15/132 (11.4)	32/113 (28.3) vs 29/109 (26.6)	42/202 (20.8) vs 44/241 (18.3)	1.05 (0.72—1.52)	.82	0
Discordance of occiput position between pre-OVD evaluation and birth	NR	4/257 (1.6) vs 52/257 (20.2)	4/89 (4.5) vs 17/132 (12.9)	NR	8/346 (2.3) vs 69/389 (17.7)	0.16 (0.04—0.74)	.02	77

Numbers show comparison between data on patients in which ultrasound has been used in the diagnoses of occiput position before operative vaginal delivery vs patients in which ultrasound was not used.

CD, cesarean delivery; *CI*, confidence interval; *MD*, mean difference; *NR*, not reported; *OASIS*, obstetrical anal sphincter injuries; *OVD*, operative vaginal delivery; *RR*, relative risk.

[a] Neonatal trauma include skull fractures, subgaleal hemorrhage, cephalohematoma, or any other neonatal hemorrhage.

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TABLE 5
Secondary perinatal outcomes Outcome

Outcome	Wong et al,[17] 2007	Ramphul et al,[8] 2014	Ghi et al,[XX] 2018	Barros et al,[16] 2020	Totals	RR (95% CI)	*P* value	I²
Admission to NICU	NR	31/257 (12.1) vs 30/257 (11.7)	5/89 (5.6) vs 9/132 (6.8)	7/113 (6.2) vs 4/109 (3.7)	43/459 (9.4) vs 43/498 (8.6)	1.06 (0.7–1.59)	.79	0
Apgar score <7 at 5 min	0/25 (0) vs 0/25 (0)	0/257 (0) vs 2/257 (0.8)	1/89 (1.1) vs 2/132 (1.5)	2/113 (1.8) vs 1/109 (0.9)	3/484 (0.6) vs 5/532 (0.9)	0.78 (0.18–3.42)	.75	0
Neonatal trauma[a]	0/25 (0) vs 0/25 (0)	20/257 (7.8) vs 17/257 (6.6)	2/89 (2.2) vs 5/132 (3.8)	2/113 (1.8) vs 3/109 (1.8)	24/484 (4.9) vs 25/523 (4.8)	1.02 (0.59–1.78)	.93	0
Umbilical cord arterial pH <7	NR	8/203 (3.9) vs 9/191 (4.7)	1/89 (1.1) vs 2/132 (1.5)	2/113 (1.8) vs 0/109 (0)	11/405 (2.7) vs 11/432 (2.5)	0.94 (0.41–2.17)	.89	0
Composite mathematical perinatal outcome (sum of OASIS, neonatal trauma, arterial pH <7, admission to NICU and Apgar score <7)	0/25 (0) vs 0/25 (0)	72/257 (28) vs 67/257 (23.7)	13/89 (14.6) vs 21/132 (15.9)	24/113 (21.2) vs 25/109 (22.9)	109/484 (22.5) vs 113/523 (21.6)	1.02 (0.81–1.28)	.87	0
Composite perinatal outcome[b]	NR	NR	10/89 (11.2) vs 14/132 (10.6)	18/113 (15.9) vs 21/109 (19.3)	28/202 (13.9) vs 35/241 (14.5)	0.90 (0.57–1.43)	.66	0

Numbers show comparison between data on patients in which ultrasound has been used in the diagnoses of occiput position before operative vaginal delivery vs patients in which ultrasound was not used.

CI, confidence interval; NICU, neonatal intensive care unit; *NR*, not reported; *OASIS*, obstetrical anal sphincter injuries; *RR*, relative risk.

[a] Neonatal trauma; [b] Composite perinatal outcome is the number of patients who sustained ≥1 of the followings: OASIS or neonatal trauma (skull fractures, subgaleal hemorrhage, cephalohematoma, or any other neonatal hemorrhage), arterial umbilical cord pH <7, admission to NICU, or Apgar score <7 at 5 minutes.

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example, in the Cochrane meta-analysis in which forceps and vacuum extractions were compared, a failed OVD rate of 9% with forceps extraction and 14% with vacuum extraction was reported.[22] Almost three-quarters of the OVDs in our meta-analysis used vacuum extraction as the primary OVD instrument and thus perhaps an OVD failure rate closer to 14% could have been expected. The lower than expected incidence of failed OVDs could be because of the selection of easier cases for inclusion in the RCT (which is unlikely given that >50% had a station ≥+2) (Table 2); because of the research settings within which the RCTs were completed that perhaps allowed a more accurate selection of women eligible for OVD or engagement with better operators; or because with time, operators are getting better at OVDs (the RCTs in the Cochrane database are all much older than those in our meta-analysis).

Conclusions and implications

These data have several clinical implications. The more accurate diagnosis of the correct occiput positions (98% correct in the sonographic group vs 82% correct in the clinical digital groups; *P*=.02) (Table 4), and the fact that in more cases in the sonographic group, the operator knew that the fetus was in occiput posterior or transverse and not, erroneously if done by clinical digital exam, in the occiput anterior position, did not help to achieve a greater number of safe and successful OVDs or to achieve any significant differences in the maternal or neonatal outcomes. This might be secondary to the fact that the operator did not change or know how to change his or her OVD technique between different occiput positions. In fact, the rates of vacuum delivery (only vacuum used), forceps delivery (only forceps use), and sequential use of instruments (vacuum or forceps first) were similar for the 2 groups. Similarly, the number of cup applications and cup detachments and the rate of more than 3 tractions were also similar for both groups.

Knowledge of the correct position does not necessarily translate into a measurable outcome benefit.[23] It is also

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possible that knowledge of the occiput position may affect the operator who is performing the OVD in different ways. For example, the operator may be more confident to perform an OVD if he or she thinks the position is occiput anterior. Or the operator may be more fearful and cautious if he or she thinks the position is occiput posterior or transverse. Further research is necessary to assess the possible usefulness of other parameters (eg, station, angle of progression, head to perineum distance, deflexion, asynclitism, and others) before OVD in addition to the knowledge of occiput position.

Sonographic knowledge of the correct occiput position pre-OVD was not associated with a significant effect on failed OVDs or maternal or perinatal outcomes in women with singleton, term pregnancies with vertex presentation and usually epidural anesthesia when compared with clinical digital knowledge of the occiput position. Although a more accurate diagnosis of occiput position using ultrasound does not necessarily translate into a measurable outcome benefit as studied so far, further research is needed on possible clinical management modifications and OVD technique changes based on this more accurate sonographic knowledge of the correct occiput position.

Uncited Figure

Figure 3

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000 Sonographic knowledge of occiput position to decrease failed operative vaginal delivery: a systematic review and meta-analysis of randomized controlled trials

Federica Bellussi; Daniele Di Mascio; Ginevra Salsi; Tullio Ghi; Andrea Dall'Asta; Fabrizio Zullo; Gianluigi Pilu; Joana G. Barros; Diogo Ayres-de-Campos; Vincenzo Berghella

Sonographic knowledge of occiput position does not decrease the incidence of failed operative vaginal deliveries.