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Meta-Analysis

Meta-Analysis: The Effect of Waterbirth Delivery Method on the Risk of Perineal Rupture

Mayriyana Kartikasari[1)], Lukman Aktovianta[2)]

[1)]Vocational School, Universitas Gadjah Mada
[2)]Faculty of Dentistry, Universitas Muhammadiyah Surakarta

ABSTRACT

Background: Waterbirth is the process of giving birth in a tub or pool of warm water which starts from a baby born in water and is brought to the surface. Waterbith has an effect on reducing maternal morbidity because it can have a relaxing effect and relieve pain during labor. However, the practice is still controversial in several countries. This study aimed to determine the effect of water birth method delivery with the risk of perineal rupture with a meta-analysis of primary studies linked through previous researchers.
Subjects and Method: This study was a systematic review and meta-analysis study following the PICO, population: Women in labor. Intervention: Waterbirth. Comparison: other delivery methods besides water birth. Results: Perineal rupture articles used in this study were obtained from 4 databases such as Google Schoolar, Semantic Schoolar, Pubmed, and Science Direct. Keywords to search for articles including: waterbirth" OR "water birth" OR "water-birth" OR "water" OR "birth in water" OR "birth underwater" OR "underwater birth" OR "birthing pool" AND ("labour" OR "labor") AND "delivery") AND ("women" OR "woman" OR "mother" OR "mothers" OR "motherhood" OR "maternal") AND ("midwifery" OR "midwife" OR "midwives" OR "maternity" OR "maternity care") AND "Perineal Tears" OR "Perineal Trauma" OR “Perineal Injury” OR “Perineal Rupture”. The articles included were complete articles in English with a cohort study design from 2013 to 2021 and report the adjusted Odds Ratio (aOR) in multivariate analysis. The selection of articles was completed by using a prism flow diagram. Articles were analyzed using the Review Manager 5.3 application.
Results: A total of 9 retrospective articles from the Americas (United States of America) and Europe (Ireland, Sweden, Norway, Iceland, Denmark, and the United Kingdom) involving 124,090 women who gave birth were selected for a systematic review and meta-analysis. The data collected showed that the water birth method reduced the risk of perineal rupture 1.09 times compared to other methods of delivery (without water birth), but it was not statistically significant (aOR= 1.09; 95% CI= 0.92 to 1.29; p= 0.30).
Conclusion: Waterbirth reduced the risk of perineal rupture.

Keywords: Waterbirth, Perineal Rupture, OASI, Perineal Laceration

Correspondence:
Mayriyana Kartikasari. Midwifery, Vocational School, Universitas Gadjah Mada, Daerah Istimewa Yogyakarta, Indonesia. Jl. Persatuan, Blimbing Sari, Caturtunggal, Depok Sub-District, Sleman District, Daerah Istimewa Yogyakarta 55281. Email: mayriyana8@gmail.com. Mobile: 085740514436.

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BACKGROUND

Management of labor around the world is now considering to avoid risks with the main focus on preventing perinatal and maternal morbidity and mortality (Bryers and Teijlingen, 2010). To avoid maternal morbidity and mortality, water birth is one of the methods that can be used as an option nowadays. Water born is increasingly popular among maternity clients, especially in midwifery care. Waterbirth is the process of giving birth in a tub or pool of warm water which starts from a baby who is born in water and is brought to the surface.

Waterbirth can have positive effects for women such as relaxation, pain relief and buoyancy effects facilitating mobility and a sense of control that lead to a positive birth experience (Cluett et al., 2018). However, delivery with the water birth method is still a controversy in some countries such as in the United States. In some countries with high resources, the water birth method is acceptable. According to the American College of Obstetrics and Gynecologists (ACOG), the controversy over this method of delivery is still lacking in evidence for randomized trials. However, large, randomized, definitive trials are difficult to conduct because there is no desire to participate for various reasons (ACOG, 2014).

Delivery by the water birth method in Australia is an option for women to give birth in most maternity centers in the country. However, water birth policies and the design of facilities to allow water birth methods are slow in the process in labor wards in Australia. In the UK, there is an increasing trend for women to give birth in water in hospitals with an increase from 3% in 2007 to 9% in 2015. Mothers about to give birth are given the option of giving birth in water (Care Quality Commission and NHS, 2015). This practice is available in all maternity settings in the UK with guidance from professional agencies that support the use of waterbirth (Top, 2018).

In Sweden, almost all deliveries occur in hospitals, most of which are provided by midwives. Waterbirth is provided to low-risk mothers worldwide but was not an option in Swedish hospitals for the past few decades until the establishment of a new maternity clinic in Stockholm in 2014 (Ulfsdottir et al., 2018). In Ireland, in 2016 Waterbirth stopped completely after there were reports of infant deaths following a water birth method. However, in 2019, the Health Service Implementer issued a memorandum that removed the prohibition on Waterbirth but Waterbirth was slow to be reestablished nationally (Health Service Executive, 2017).

Giving birth in water can provide benefits for the mother such as relieving pain and reducing stress (Torkamani et al., 2010). Not only beneficial for mothers, water birth is also beneficial for neonates because they are born in an environment similar to amniotic fluid (Daniels, 1989). From the results of a cohort study in Europe, it shows that water birth does not increase the risk of morbidity in newborns such as low APGAR scores, the possibility of receiving neonatal intensive care (NICU), neonatal injury or death (Nutter et al., 2014). For the results in the mother, it showed no increase in perineal trauma, infection or bleeding (Nutter et al, 2014). Findings from other literature suggest that water birth can increase perineal elasticity, reducing the incidence and severity of perineal trauma (Cluett and Burns, 2013).

Water birth had little effect on the rate of spontaneous vaginal birth (water immersion in stage I: RR= 1.01; 95% CI= 0.97 to 1.04, water immersion in stage II: RR= 1.02; 95% CI= 0.96 to 1.08) or in the event of severe perineal trauma (RR= 1.36; 95% CI= 0.85 to 2.18). The incidence of pe-

rineal tears in the water birth method is a contradiction and protection of the perineum using hands can be done in the water (Garland, 2017). In several studies, it was concluded that the water birth method of delivery is associated with the incidence of perineal integrity and if there is a laceration in the water, the severity is lower than conventional delivery methods (Nutter et al, 2014).

The results of a retrospective cohort study, including 6,521 water birth deliveries with 10,290 conventional deliveries by comparing perineal lacerations and without lacerations, found an increase in water birth lacerations. According to Barry et al, the incidence of obstetric anal sphincter (OASI) injury was higher than expected after the waterbirth method (8.1%), compared to the hospital OASI rate of 2.2%. For women who choose to give birth in water, there is mixed evidence about the risks of maintaining OASI, with some suggesting that giving birth in water results in a higher incidence of OASI (Preston et al., 2019; Cortes et al., 2011). The results of another study found that delivery by the water birth method reduced the risk of OASI (Dahlen et al., 2013; Henderson et al., 2014).

Based on this background, a comprehensive study is needed of various primary studies of the risk of perineal rupture in pregnant women who give birth by the water birth method of delivery. This study aimed to conduct a systematic review with a meta-analysis to collect evidence on the effect of the water birth delivery method on the risk of perineal rupture with a meta-analysis of the main study conducted by the previous authors.

SUBJECTS AND METHOD

1. Study Design

This study is a systematic and meta-analysis study. The articles used in this study were obtained from several databases, Google Scholar, Semantic Scholar, PubMed, and Science Direct without time frame or language restrictions. The selection of articles was carried out using the PRISMA flow chart. The keywords used to search for articles are as follows "waterbirth" OR "water birth" OR "water-birth" OR "water" OR "birth in water" OR "birth underwater" OR "underwater birth" OR "birthing pool" AND ("labour" OR "labor") AND "delivery") AND ("women" OR "woman" OR "mother" OR "mothers" OR "motherhood" OR "maternal") AND ("midwifery" OR "midwife" OR "midwives" OR "maternity" OR "maternity care") AND "Perineal Tears" OR "Perineal Trauma" OR “Perineal Injury” OR “Perineal Rupture” and other terms combined with the Boolean operators of AND and OR.

2. Inclusion Criteria

The inclusion criteria in this study were: full-text articles that used experimental study designs and observational studies that did not perform multivariate analysis, study subjects were pregnant women, the results of the study were the risk of perineal rupture, multivariate analysis with adjusted odds ratio to estimate effect size.

3. Exclusion Criteria

The exclusion criteria for this study were articles published in languages other than English, statistical results reported in the form of bivariate analysis, articles published before 2012 and incomplete articles.

4. Definition of Operational Variable

The search for articles was carried out by considering the feasibility determined using the PICO model. Population= Women giving birth. Intervention= Waterbirth. Comparison= other delivery methods other than water birth. Outcome= Perineal Rupture.

Waterbirth defined as a method of delivering a baby under water, categorized as a water birth or non water birth method

(other birth methods). The instruments used are medical record documents and data inputted by midwives and doctors through applications/e-medical records as well as maternal delivery experience data. It is measured by using a categorical scale.

Perineal Rupture is damage to the genitals during childbirth that occurs spontaneously or intentionally through an incision or surgery (episiotomy). Classified according to the severity of the lacerations into grades 1 and 2. The instruments used are medical record documents or data inputted by midwives or doctors through the e-medical record application. It is measured by using a categorical scale.

5. Study Instrument

The study was guided using the PRISMA flow chart and the quality of the articles was tested with the Critical Appraisal Skills Program (CASP, 2018).

6. Data Analysis

The data were analyzed using the Review Manager application (RevMan 5.3). Forest plots and funnel plots were used to compare the size of the relationship and the heterogeneity of the data. The fixed effects model was used for homogeneous data, while the random effects model was used for heterogeneity between studies. Because the study model found is cross-sectional and cohort, it is analyzed by conducting subgroups first.

RESULTS

The article search process was carried out through several journal databases including Google Scholar, Semantic Scholar, PubMed, and Science Direct. The review process for linking articles can be seen in the PRISMA flow chart chart 1. Research related to the risk of perineal rupture with the water birth delivery method obtained 9 articles from the initial search process which resulted in 217 articles, after the deletion process of published articles, 9 of those found previously for text review further details. From a total of 9 articles, it was found that the quality of the research included in the quantitative data was combined using meta-analysis and there was 1 article that produced 2 research variables that could be included because they were included in the exclusion criteria.

It can be seen in chart 2 that the research articles were obtained from 2 continents, including America (United States) and Europe (Ireland, Sweden, Norway, Iceland, Denmark, and England). Table 1 showed an assessment of the quality of the study. Table 2 showed that 9 articles from a cohort study design that provide evidence of the association of the risk of perineal rupture with the water birth method of delivery.

Based on the results from the forest plot, the cohort study showed that the water birth method of delivery reduced the risk of perineal rupture by 1.09 times compared to other methods of delivery/without water birth (aOR= 1.09; 95% CI= 0.92 to 1.29) but it was not statistically significant (p= 0.300). The heterogeneity of the research data showed I^2 = 75% so that the distribution of the data is said to be heterogeneous (random effect model).

The funnel plot showed publication bias results with an overestimate effect which was indicated by the asymmetry between the right and left plots. There are 5 plots on the right side, 4 plots on the left side, and 1 point touching the vertical line. The point on the right side of the graph has a standard error (SE) between 0.1 and 1. The point on the left side of the graph has a standard error (SE) between 0 and 0.6.

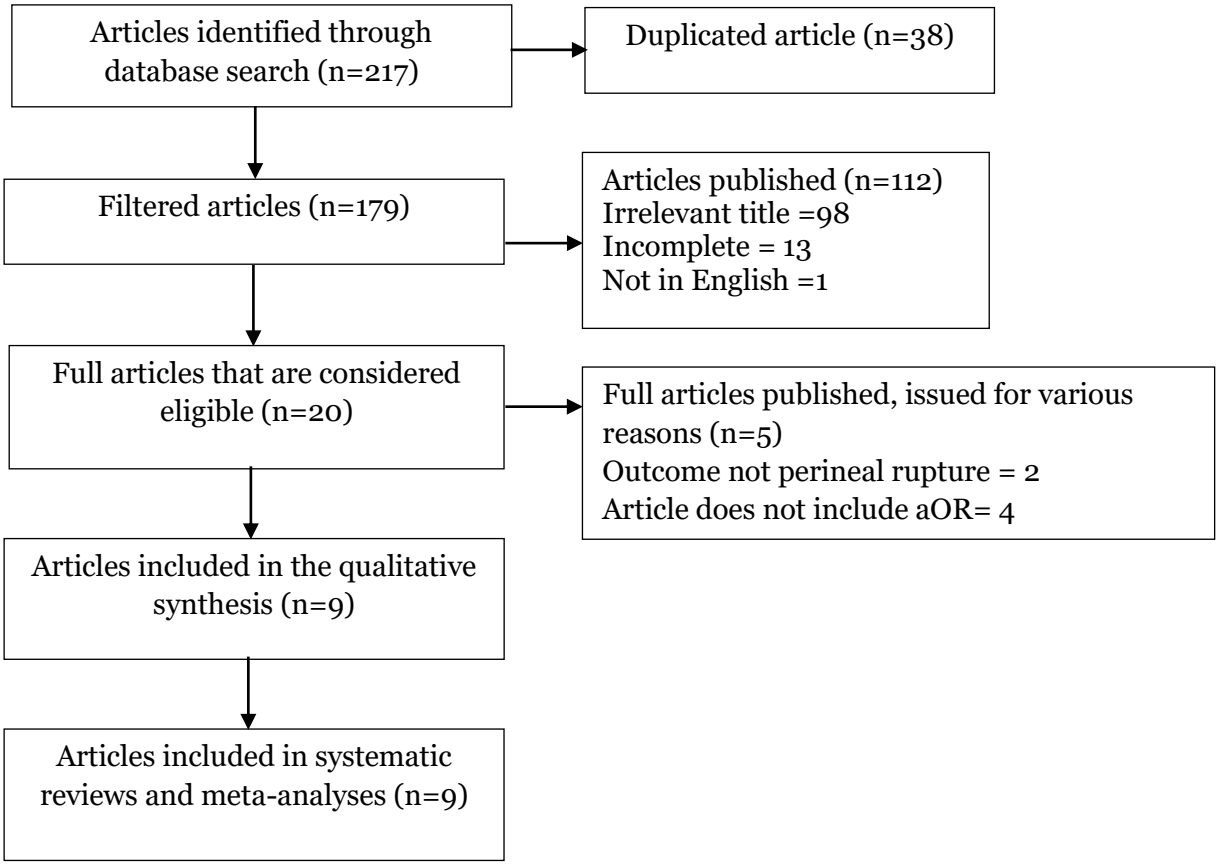

Figure 1. PRISMA Flow Diagram

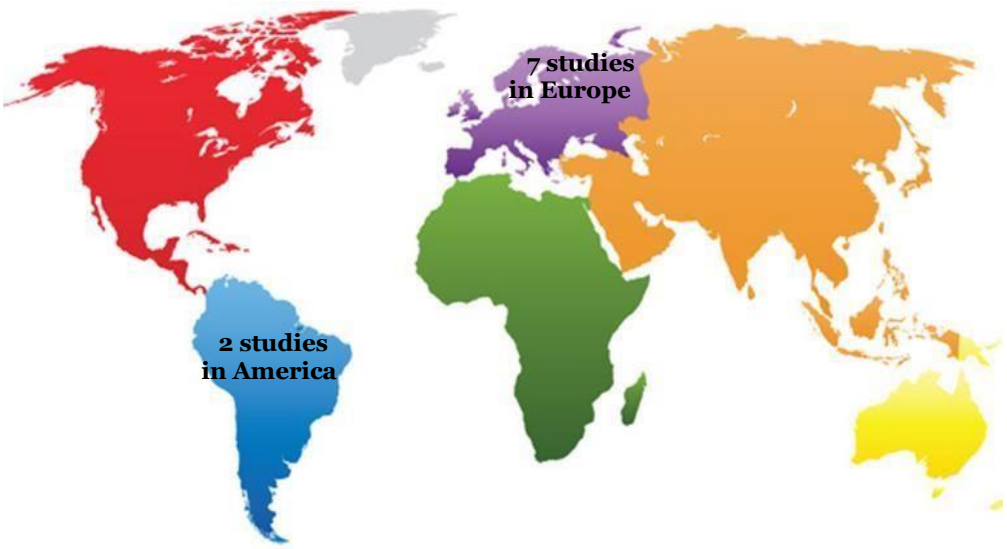

Figure 2. Map of the Research Area for the Effect of Childbirth with Waterbirth Method on the Risk of Perineal Rupture

Table 1. Assessment of Study Quality published by Critical Appraisal Skills Program (CASP)

No	Indicator	Journal (Author and Year)				
		Barry et al. (2020)	Bovbjerg et al. (2021)	Bovbjerg et al. (2016)	Smith et al. (2013)	Aughey et al. (2021)
1	Does the cohort study clearly address the clinical problem?	2	2	2	2	2
2	Was the group recruited in an acceptable way?	2	2	2	2	2
3	Is exposure measured accurately (correctly) to prevent/minimize bias?	2	2	2	2	2
4	Are outcomes measured accurately (correctly) to minimize bias?	2	2	2	2	2
5	Does the researcher identify all the important confounding factors? Does the researcher control for important confounding factors in the design and/or analysis phase of the data?	2	2	2	2	2
6	Does the study subject complete the full time of the study? Are the study subjects followed (follow-up) for a long time?	2	2	2	2	2
7	What are the results of this study?	2	2	2	2	2
8	How precise are the results?	2	2	2	2	0
9	Do you believe the results?					
10	Can the results be applied to the local population?	2	2	2	2	2
11	Are the results of this study consistent with other available evidence?	2	2	2	2	2
12	What are the implications of this research for practice?	0	2	0	0	0
	Total	**22**	**24**	**22**	**22**	**20**

Note: 2: Yes; 1: Can't Tell; 0: No

Table 2. Next

No	Indicator	Journal (Author and Year)			
		Ulfsdottir et al. (2018)	**Edqvist et al. (2016)**	**Preston et al. (2019)**	**Suto et al. (2015)**
1	Does the cohort study clearly address the clinical problem?	2	2	2	2
2	Was the group recruited in an acceptable way?	2	2	2	2
3	Is exposure measured accurately (correctly) to prevent/minimize bias?	2	2	2	2
4	Are outcomes measured accurately (correctly) to minimize bias?	2	2	2	2
5	Does the researcher identify all the important confounding factors? Does the researcher control for important confounding factors in the design and/or analysis phase of the data?	2	2	2	2
6	Does the study subject complete the full time of the study? Are the study subjects followed (follow-up) for a long time?	2	2	2	2
7	What are the results of this study?	2	2	2	2
8	How precise are the results?	2	2	2	2
9	Do you believe the results?	2	2	2	2
10	Can the results be applied to the local population?	2	2	2	2
11	Are the results of this study consistent with other available evidence?	2	2	2	2
12	What are the implications of this research for practice?	0	2	0	0
Total		**22**	**24**	**22**	**22**

Note: 2: Yes; 1: Can't Tell; 0: No

Table 3. Description of the primary studies included in the meta-analysis primary studies

Author (Year)	Country	Study Design	Sample		P (Population)	I (Intervention)	C (Comparison)	O (Outcome)	aOR (95%CI)
			Total	Water-birth					
Barry *et al.* (2020)	Ireland	Retrospective Cohort	380	100	Women giving birth with low risk	Waterimmersion Waterbirth Water Labour	Standard delivery	Perineal suture, OASI 3/4, postpartum hemorrhage, APGAR Score, Admission to HDU, Neonate to NICU, IMD, exclusive breastfeeding	1.41 (0.23 to 8.79)
Bovbjerg *et al.* (2021)	USA	Retrospective Cohort	35,060	17,530	Women who give birth who are assisted by midwives at home or birth centers	Waterbirth	Land delivery	Maternal (postpartum within 6 hours of transfer to hospital, PPH, genital trauma, 3rd and 4th degree perineal lacerations, hospitalization for the first 6 weeks of infection), Neonatal	0.90 (0.81 to 0.99)

Table 4. Description of the primary studies included in the meta-analysis primary studies

Author (Year)	Country	Study Design	Sample		P (Population)	I (Intervention)	C (Comparison)	O (Outcome)	aOR (95%CI)
			Total	Water-birth					
Bovbjerg *et al.* (2016)	USA	Retrospective Cohort	18.343	6521	Mothers who received care from the pre-natal period, childbirth, until 6 weeks post-partum	Waterbirth	Without waterbirth	Neonatal (APGAR score, hospital transfer for neonatal indications, hospitalization for the first 6 weeks, early neonatal death, late neonatal death) Maternal (Genital tract trauma, postpartum transfer, first 6 weeks hospitalization, Postpartum maternal reproductive tract infection)	1.11 (1.04 to 1.18)
Smith *et al.* (2013)	England	Retrospective	3,000	2,754	All women who give birth expected to have a single vaginal delivery	Waterbirth	Without waterbirth	OASIS	1.28 (0.50 to 2.11)

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Table 5. Description of the primary studies included in the meta-analysis primary studies

Author (Year)	Country	Study Design	Sample		P (Population)	I (Intervention)	C (Comparison)	O (Outcome)	aOR (95%CI)
			Total	Water-birth					
Aughey *et al.* (2021)	England	Retrospective Cohort	46,088	6,264	Eligible women to give birth in water	Waterbirth	Without waterbirth	Maternal (OASI and PPH), Neonatal (APGAR score, neonatal acceptance)	1.00 (0.86 to 1.16)
Ulfsdottir *et al* (2021)	Sweden	Retrospective Cohort	612	306	Women who will give birth with the majo-rity of low-risk pregnancies and do not enter high-risk pregnancies	Waterbirth	Without waterbirth	Perineal rupture 2nd degree and above	0.60 (0.40 to 0.90)
Edqvist *et al.* (2016)	Norwegian, Danish, Swedish and Iceland	Retrospective Cohort	2992	952	Women planning to give birth in house	Waterbirth	Without waterbirth	Perineal Trauma	0.99 (0.36 to 2.73)

Table 6. Description of the primary studies included in the meta-analysis primary studies

Author (Year)	Country	Study Design	Sample		P (Population)	I (Intervention)	C (Comparison)	O (Outcome)	aOR (95%CI)
			Total	Water-birth					
Preston *et al.* (2019)	England	Retrospective Cohort	15,734	1,244	Low risk women who giving birth in a midwifery-led unit (MLU) in the major education hospital in England	Waterbirth	Land delivery	OASI	1.77 (1.25 to 2.51)
Suto *et al.* (2015)	Japan	Retrospective	1,881	94	All pregnant women who received the subject's initial ante-natal care were classified between nulliparous and multipara	Waterbirth Labor position	Without waterbirth Lateral position Hands-and-knees Kneeling/standing Maternity chair	Intact perineum Perineal laceration	Nullipara 1.39 (0.55 to 3.55) Multipara 2.35 (1.31 to 4.20)

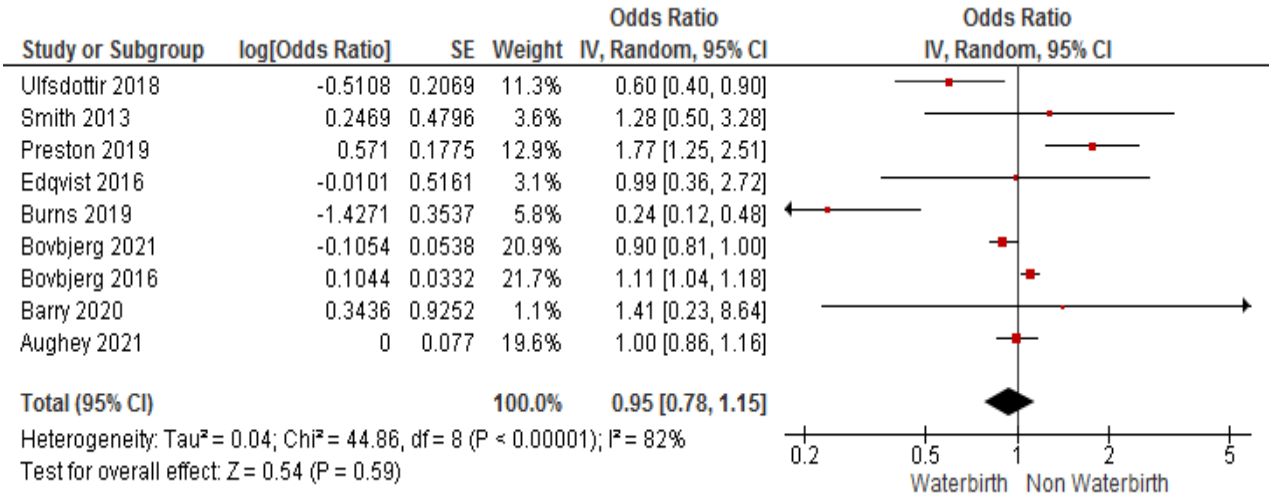

Figure 3. Forest Plot of the Effect of Waterbirth on the Risk of Perineal Rupture

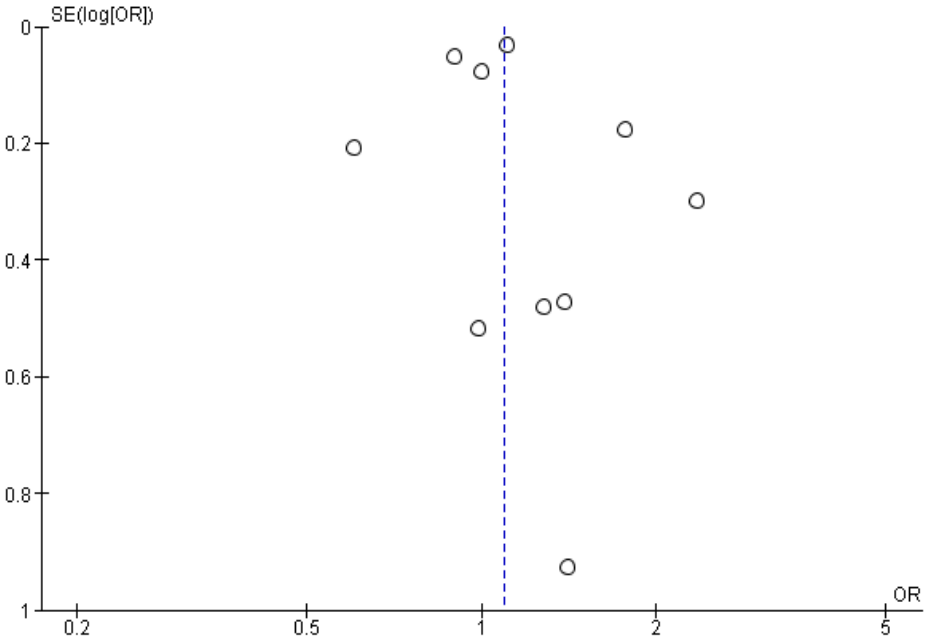

Figure 4. Funnel Plot of the Effect of Waterbirth on the Risk of Perineal Rupture

DISCUSSION

Systematic studies and meta-analyses of studies have shown that water birth can reduce the risk of perineal rupture. This study discussed perineal rupture that can increase maternal morbidity. Perineal rupture may be reduced by the Waterbirth method of delivery. This is in accordance with the results of research from Bailey et al. (2019) which showed that the group of women who delivered water births was more likely to have an intact perineum (65.5%) compared to women who delivered on land (61.8%), the rate of first and second degree

lacerations also showed the same results where water births had a greater chance of 34.5% compared to land delivery of 38.2%. Meanwhile, for third and fourth degree perineal lacerations, there is a 2.8% probability compared to delivery on land at 2.9%. The results of another study using a peer-reviewed integrative analysis showed that water birth may be associated with a reduced risk of severe lacerations and an increased incidence of perineal integrity (Nutter et al., 2014). According to Garland and Jones (2000) who controlled for parity when assessing severe perineal lacerations found that primiparous women may have the same experience of third-degree lacerations where water births were less likely to experience 3rd degree lacerations (0.8%), whereas multiparous women who had had experience with water birth, some of whom had 3rd degree perineal laceration (0.2%) compared to those with conventional delivery (0.6%) although there was no reported p-value.

Case-control studies that have been conducted reported an association between water birth and a reduced incidence of second-degree lacerations compared to conventional delivery methods (Baxter, 2013). Several studies have added that the age and weight of the baby certainly have an effect on the incidence of perineal rupture during delivery. A comparative study conducted in Singapore showed that women in the waterbirth intervention group had significantly intact perineum and 1-2 degree perineal tears (p<0.001) (Lim et al., 2016). Several studies have reported a reduction in episiotomy rates and an increase in perineal integrity in women who gave birth using the water birth method. It can be suggested that delivery with the water birth method can protect the perineal tear (Menakaya et al., 2013).

Another study in Canada also showed differences in the non-waterbirth group in terms of prevalence for grade 3 or 4 perineal tears (OR= 0.34; 95%CI= 0.20 to 0.58; P<0.001), bleeding during delivery (OR 0.48; 95% CI=0.38 to 0.61; p<0.001), and postpartum hemorrhage up to 24 hours after delivery (OR=0.05; 95%CI=0.02 to 0.10; p<0.001). Whereas for outcomes in neonates compared with the no group, the odds were greater for infants with low APGAR scores (OR=0.04; 95%CI= 0.01 to 0.25; p< 0.001). This was in contrast to water births which allowed for fewer grades 3 or 4 perineal tears (OR= 0.34; 95%CI= 0.20 to 0.58; p<0.001), despite having a greater prevalence of macrosomia in infants (OR=3.04; 95% CI 2.15 to 4.31; p< 0.001). The watebirth cohort also had a lower probability of receiving NICU care (OR=0.04; 95% CI= 0.01 to 0.25; p< 0.001).

In accordance with the results of the study above, it showed that water birth can contribute to reducing the risk of perineal rupture and maintaining the integrity of the perineum. Delivery with the water birth method allows a decrease in perineal rupture in maternity, especially for grade 3 and grade 4 perineal rupture. This delivery method can be recommended to maintain the integrity of the perineum and reduce maternal morbidity resulting from perineal tears during childbirth. The drawback of this study was the bias in terms of language because the articles used are in English. The publication bias was shown by the funnel plot results and the search bias was due to using only four databases.

AUTHORS CONTRIBUTION

Mayriyana Kartikasari, Lukman Aktovianta are the main researchers who choose the topic, search for, collect and process the data.

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CONFLICT OF INTEREST

There was no conflict of interest in this study.

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