Narrative Review

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An Evidence-Based Approach to Vaginal Birth

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This is a review of evidence-based management of vaginal birth, which is critical to optimizing the outcomes of birthing people and neonates. The current literature supports the use of immediate pushing in the second stage of labor, neuraxial anesthesia administration for vaginal birth for adequate pain control, use of warm compresses in labor to prevent obstetric lacerations, delayed cord clamping for term and preterm neonates, the utility of umbilical cord milking in neonates who require immediate resuscitation, and active management of the third stage of labor with oxytocin administration. In addition, the routine use of episiotomy is shown to increase morbidity without clear evidence of benefit in the setting of spontaneous vaginal delivery or operative vaginal delivery.

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In 2021, there were 2,486,856 vaginal births in the United States according to the Centers for Disease Control and Prevention.[1] Overall, 68% of all births in the United States were vaginal births.[1] The objective of this narrative review is to summarize the existing literature on aspects of vaginal birth so that evidence-based practice can be applied. The topics reviewed here are those with a significant body of evidence to guide practice.

IMMEDIATE COMPARED WITH DELAYED PUSHING DURING THE SECOND STAGE OF LABOR

The effect of immediate pushing (soon after complete dilation is identified) compared with delayed pushing (waiting at least 1 hour from complete dilation) for term nulliparous women with neuraxial analgesia has been analyzed in multiple randomized controlled trials (RCTs), systematic reviews, and meta-analyses.[2–5] Currently, the World Health Organization supports delayed pushing, whereas the American College of Obstetricians and Gynecologists (ACOG) supports immediate pushing.[6–8]

In an RCT published in 2018, there was no difference in the rates of vaginal, cesarean, or operative vaginal delivery between those in the immediate and those in the delayed pushing groups. However, the immediate pushing group had a significantly shorter mean duration of the second stage compared with the delayed group, despite a significantly longer mean duration of active pushing. The immediate pushing group also had lower rates of chorioamnionitis and postpartum hemorrhage.[2] There were no differences in a composite of neonatal morbidity outcome or perineal laceration rates.[2] A secondary analysis of these data, specifically looking at occult injury of the levator ani, showed no difference between the immediate and delayed pushing groups.[9]

A 2020 systematic review and meta-analysis compiled data from RCTs published from 1979 to 2018 and found no statistically significant differences

in rates of vaginal, cesarean, or operative vaginal delivery between immediate and delayed pushing. The study also showed no difference in postpartum hemorrhage rates between delayed and immediate pushing. Despite the delayed pushing group having lower umbilical cord pH values, there was no significant difference in other neonatal morbidity, including Apgar scores at 5 minutes and neonatal intensive care unit (NICU) admissions.[3]

According to the available evidence, there is no difference in vaginal delivery rates between immediate and delayed pushing. However, there is a possible increased risk of chorioamnionitis and postpartum hemorrhage with delayed pushing. Thus, ACOG recommends immediate pushing when complete cervical dilation is achieved.[10]

EFFECTS OF NEURAXIAL ANALGESIA ON VAGINAL BIRTH

Seventy percent of pregnant people in the United States give birth using neuraxial analgesia.[11] A narrative review from 2010 to 2023 on the topic examined the association of neuraxial anesthesia with several outcomes. All studies (six observational cohorts and two systematic reviews) that evaluated the length of the second stage found that it was longer for patients with epidurals.[11–18] Of the studies that evaluated secondary outcomes, none found an association between epidural anesthesia and adverse effects such as abnormal maternal vital signs, changes in fetal heart rate, differences in 5-minute Apgar score, or NICU admissions. All studies (two retrospective cohorts, two systematic reviews) that evaluated cesarean delivery also found no difference in the rate of cesarean between individuals with and those without epidural analgesia.[11,17,19,20] Finally, the data on operative vaginal delivery were mixed. Generally, it was found that having an epidural increased the need for operative vaginal delivery.[19,21–23] However, a post hoc subgroup analysis of trials conducted after 2005 demonstrated no difference, suggesting that more modern approaches to anesthesia do not have an effect on the rate of vaginal birth.[11–13]

Regarding the effects of neuraxial analgesia on the first stage of labor, two systematic reviews demonstrated an association between epidural use and longer first stage of labor.[14,17] When a meta-analysis was performed, the first stage was 32.28 minutes (95% CI, 18.34–46.22) longer with an epidural, according to a Cochrane Review that included more than 11,000 participants. Findings from a different meta-analysis of 35,146 participants found that epidural anesthesia increased the first stage of labor by 6 minutes per every 1 cm of cervical dilation that the patient had an epidural. Finally, one study evaluated epidural compared with combined spinal–epidural and found no difference in duration of first or second stage of labor or mode of delivery between the two options of analgesia.[24]

In conclusion, the evidence suggests that neuraxial analgesia increases the duration of the first and second stages of labor, although this prolongation does not appear to be clinically significant. Epidural analgesia does not appear to increase a patient's risk of cesarean delivery. There is insufficient evidence to demonstrate any effect of epidural analgesia on the need for operative vaginal delivery. Thus, decision making regarding neuraxial anesthesia should be based on patient preferences.

LACERATION PREVENTION

Perineal trauma after vaginal delivery is common and associated with severe morbidity, including incontinence, pelvic pain, and sexual dysfunction.[25] Various strategies have been studied to prevent lacerations such as perineal massage, perineal support, warm compresses, use and type of episiotomy, delayed pushing, and different birthing positions.

Intrapartum perineal massage has been shown to be effective in preventing perineal lacerations. A meta-analysis including nine trials with a total of 3,374 women demonstrated that participants randomized to receive perineal massage during labor had a significantly lower incidence of severe perineal trauma compared with those who did not (relative risk [RR] 0.49, 95% CI, 0.25–0.94). *Perineal massage* was defined as massage of the posterior perineum by the clinician's fingers (with or without lubricant).[26] A systematic review of three trials with 2,434 participants showed an association with a reduction in the incidence of vaginal laceration requiring sutures and episiotomies with antenatal perineal massage after 34 weeks of gestation in patients with singleton pregnancies.[27] However, given the heterogeneity of technique of perineal massage, it is difficult to make a specific evidence-based recommendation.

Warm compresses continuously held to the perineum during and between pushes may also reduce severe perineal trauma.[8] Warm compresses were evaluated in a meta-analysis of four RCTs including 1,799 participants that showed a decreased rate of third- or fourth-degree perineal tears in the warm compress group compared with the expectant management group (average RR 0.46, 95% CI, 0.27–0.79).[28]

Delayed pushing does not appear to prevent lacerations. A recent RCT with 2,414 participants with neuraxial anesthesia showed that there was no significant difference in rates of second-degree or higher perineal lacerations between the delayed pushing group and the immediate pushing group.[29]

Regarding perineal support (ie, hands-off vs hands-on method), evidence is lacking. A meta-analysis of three RCTs including 6,647 participants did not find a statistically significant reduction in obstetric anal sphincter injury tears with a hands-on method (RR 1.03, 95% CI, 0.32–3.36). The same meta-analysis reviewed three observational cohorts including 74,744 participants and found an association between the hands-on method and a reduction in obstetric anal sphincter injury tears (RR 0.45, 95% CI, 0.40–0.50). Because of the conflicting results and varying descriptions of techniques, the authors concluded that there was not enough evidence to recommend a specific practice.[30]

Specific birthing positions for laceration prevention have also been debated. Two separate meta-analyses including 879 and 1,840 participants did not find an association between different birthing positions and obstetric lacerations.[31,32] In one RCT, lateral birthing position was found to yield a higher probability of maintaining an intact perineum (40.3% vs 12.2%, $P<.001$), although this group also delayed pushing, whereas the dorsal supine group pushed immediately.[33] A retrospective case–control study with 645 participants had similar findings regarding lateral positioning compared with dorsal positioning, with 46.8% compared with 20.2% probability of maintaining an intact perineum ($P=.004$). The authors concluded that lateral birthing position could be associated with a lower likelihood of lacerations.[34]

The available evidence suggests that warm compresses in labor may reduce the incidence of higher-order obstetric lacerations. Differences in technique for other methods of laceration prevention, including perineal massage and hands-on delivery, make it difficult to suggest a specific technique for use in practice.

EPISIOTOMY

There are no well-supported indications for an episiotomy in the setting of a spontaneous vaginal birth. In a meta-analysis of RCTs comparing selective with routine use of episiotomy among patients who had spontaneous vaginal deliveries, investigators found that performing selective episiotomy may result in 30% fewer women experiencing severe perineal or vaginal trauma (RR 0.70, 95% CI, 0.52–0.94).[35] Episiotomies may be performed to expedite delivery of the fetus in the setting of nonreassuring fetal status or to create more space for clinician maneuvers to alleviate a shoulder dystocia.[36] There is conflicting evidence for the routine use of episiotomy in the setting of operative vaginal delivery. In a meta-analysis of 703,977 patients undergoing operative vaginal delivery who received an episiotomy compared with those who did not receive an episiotomy, it was demonstrated that episiotomy may be associated with a reduction in the incidence of obstetric anal sphincter injury lacerations.

Midline episiotomy carries a higher risk of third- and fourth-degree lacerations compared with mediolateral episiotomy.[37] Mediolateral episiotomy may decrease the risk of obstetric anal sphincter injury compared with midline episiotomy; however, it is associated with an increased risk of dyspareunia.[38] Both midline and mediolateral episiotomies are also associated with longer laceration repair times and increased quantitative blood loss.[39,40] Episiotomy may be associated with increased perineal pain and stress urinary incontinence in the postpartum period.[41]

The role of episiotomy in managing shoulder dystocia has been incompletely studied. In a systematic literature review examining the effectiveness of episiotomy in the prevention of shoulder dystocia, no benefit of episiotomy was identified.[42] In a study comparing shoulder dystocia relieved by fetal manipulation with episiotomy, it was found that fetal manipulation is preferred.[43] Evidence remains based mostly on retrospective observational data given the difficulty in performing high-quality, prospective studies in this area. Of note, none of these studies evaluated episiotomy as a mechanism to facilitate performance of the recommended maneuvers to manage shoulder dystocia.

In summary, episiotomy should not be incorporated into routine practice. The role of episiotomy on a selective or restrictive basis and at the clinician's discretion for the management of shoulder dystocia needs further study.

DELAYED CORD CLAMPING

For more than a decade, delayed cord clamping has been performed at the time of birth. *Delayed cord clamping* is traditionally defined as clamping the umbilical cord between 30 and 60 seconds from time of birth.[44] Many trials have demonstrated the safety of delayed cord clamping, in addition to its benefits.[45] In preterm neonates, delayed cord clamping has been

shown to improve fetal neurodevelopment, reduce the incidence of intraventricular hemorrhage, and decrease blood transfusions.[46] In addition, two systematic reviews have noted a statistically significant decrease in mortality before discharge in preterm neonates who received delayed cord clamping compared with immediate cord clamping, with the most benefit conferred when delayed cord clamping was more than 120 seconds (odds ratio 0.31, 95% CI, 0.11–0.80).[47,48] In healthy, term, and preterm neonates at low risk, there is a significant increase in hemoglobin levels, blood volume, and iron levels at the time of birth. Moreover, delayed cord clamping is not associated with a clinically significant difference in risk of postpartum hemorrhage, neonatal hyperbilirubinemia or phototherapy, or symptomatic polycythemia compared with immediate cord clamping.[44,45,49,50]

Despite being widely endorsed, uptake of delayed cord clamping in hospitals within the United States has been limited. About 52% of U.S. hospitals report using delayed cord clamping for newborns, with variation in practice by region and patient comorbidities.[49,51] The hesitation may partially stem from uncertainty about its benefit among special populations or in unique circumstances. More recent studies have focused on delayed cord clamping in special populations. In a study of delayed cord clamping comparing small-for-gestational-age preterm neonates with appropriate-for-gestational-age neonates, the benefits of delayed cord clamping were similar.[52,53]

Notably, in nonvigorous neonates, *umbilical cord milking*, defined as the manual expression of umbilical cord blood by milking blood three to four times down the umbilical cord segment at a rate of about 10 cm/second, has been studied in place of delayed cord clamping because many clinicians do not want to delay neonatal resuscitation in these cases. In a multicenter, cluster, randomized crossover trial, umbilical cord milking resulted in higher hemoglobin, less delivery room cardiorespiratory support, and a lower incidence of hypoxic-ischemic encephalopathy and hypothermia among nonvigorous preterm neonates who received the intervention compared with immediate cord clamping, although NICU admission was not reduced.[54] With respect to vigorous preterm neonates, a systematic review found no difference in mortality before discharge with preterm neonates receiving umbilical cord milking compared with either delayed cord clamping or immediate cord clamping.[47] Of note, a higher incidence of intraventricular hemorrhage was associated with umbilical cord milking in a separate study involving vigorous, extremely preterm neonates (before 28 weeks of gestation) compared with delayed cord clamping.[55]

Currently, delayed cord clamping is endorsed by multiple organizations, including ACOG, the World Health Organization, the International Liaison Committee on Resuscitation, and the American Academy of Pediatrics.[45,46,49] Delayed cord clamping, ideally between 30 and 60 seconds, should be performed after vaginal birth for both term and preterm neonates. Recent data indicate that delayed cord clamping for more than 120 seconds may confer a decrease in mortality in preterm neonates. For nonvigorous neonates who have a need for immediate resuscitation, cord milking is an acceptable alternative, except in extremely preterm neonates (before 28 weeks of gestation).

MANAGEMENT OF THE THIRD STAGE OF LABOR

The *third stage of labor* is defined as the period from the complete delivery of the fetus through delivery of the placenta.[56] Delaying the delivery of the placenta is associated with increased patient complications, including obstetric hemorrhage.[57–59] Various time limits have been proposed for the third stage. In a prospective study of 6,588 patients at a single tertiary center, expectant management longer than 18 minutes was associated with a significantly increased rate of postpartum hemorrhage. In the same study, the classic time limit of 30 minutes was evaluated, and expectant management longer than 30 minutes was associated with a significantly increased risk of postpartum hemorrhage (odds ratio 6.2, 95% CI, 4.6–8.2).[59]

Delivery of Placenta

Delivery of the placenta can occur after expectant or active management. With expectant management, the approach is to wait for the placenta to be delivered with no clinician intervention. Active management occurs when interventions such as the use of uterotonics, controlled cord traction, fundal massage, and maternal Valsalva are used to expedite placental delivery.[56,60] Active management was studied in a meta-analysis involving eight studies with 8,892 patients at low risk.[56] Active management with uterine massage and controlled cord traction was not associated with a statistically significant reduction in the risk of postpartum anemia, mean blood loss, blood transfusion, need for additional uterotonics, and manual removal.[61,62] Severe postpartum hemorrhage, breastfeeding rates, and total length of the third stage were not changed by active management.[56]

Oxytocin Administration in the Third Stage

The current recommendation is that oxytocin be given during the third stage prophylactically because studies have demonstrated a reduction in the risk of severe postpartum hemorrhage and need for blood transfusion.[63–65] An RCT that included 1,035 patients found oxytocin is best administered intravenously (IV) because it is more effective in decreasing the rate of severe postpartum hemorrhage and blood transfusion than when administered through the intramuscular (IM) route.[66]

There is no standard dosage of oxytocin to administer in the third stage. In a systematic review examining the dose of prophylactic oxytocin for the third stage of labor, studies varied from using 5–10 units IM to 3–10 units IV.[63] A separate review of 46 clinical trials that assessed the prophylactic dose and duration of oxytocin in the postpartum period found that higher doses of oxytocin (30–80 international units) over a shorter period (30 minutes–1 hour) were more effective than lower doses (5–10 international units) in decreasing the rate of postpartum hemorrhage and the need for additional uterotonics.[67] However, other studies that analyzed institutional changes in oxytocin protocols did not find a benefit with higher doses.[68,69] In terms of treatment of postpartum hemorrhage, a wide variety of doses of oxytocin can be used.[70] At this time, ACOG recommends 10–40 international units IV infusion or 10 international units IM.[61,71]

Different timing of oxytocin administration has been proposed, including after delayed cord clamping, after delivery of the anterior shoulder, or after delivery of the placenta. Some clinicians elect to delay oxytocin administration until after the delivery of the placenta on the basis of studies that suggest an association between oxytocin administration and an increased risk of a prolonged third stage and retained placenta.[63] However, a systematic review and multiple RCTs have demonstrated that starting oxytocin after delivery of the anterior shoulder resulted in the shortest duration of the third stage and did not increase the incidence of retained placenta.[64,72,73]

Existing evidence suggests that the ideal timing of oxytocin administration for the third stage of labor is at the time of anterior shoulder delivery for the prevention of postpartum hemorrhage. The optimal dosing of postpartum oxytocin requires further investigation. However, according to current literature, 10–40 international units IV infusion or 10 international units IM is recommended to decrease blood loss and the need for additional uterotonics.

Box 1. Summary of Recommendations for Evidence-Based Management of Vaginal Birth

- Immediate pushing should be recommended over delayed pushing (Strong Recommendation, High Quality Evidence).[8,10]
- Neuraxial analgesia should be administered per patient birthing preferences (Strong Recommendation, Moderate Quality Evidence).[10,11,17]
- Delayed cord clamping is recommended at the time of vaginal birth for both term and preterm neonates (Strong Recommendation, High Quality Evidence).
- Umbilical cord milking is recommended as a replacement for delayed cord clamping in term and preterm (more than 27 wk), nonvigorous neonates (Strong Recommendation, Moderate Quality Evidence).[44,47,54,55]
- Warm compresses in labor and restrictive use of episiotomy are the best available strategies to prevent obstetric lacerations (Strong Recommendation, High Quality Evidence).[8,74]
- Episiotomy should not be performed as a routine practice (Strong Recommendation, High Quality Evidence).
- Third stage of labor should be actively managed with oxytocin, uterine massage, and cord traction. The role of uterine massage and cord traction in decreasing postpartum hemorrhage is not clear at this time (Strong Recommendation, High Quality Evidence).
- Oxytocin administration for the third stage of labor should be initiated at the time of anterior shoulder delivery to reduce the risk of postpartum hemorrhage (Strong Recommendation, High Quality Evidence).[61,71]

On the basis of the available literature, ACOG recommends active management of the third stage with oxytocin, uterine massage, and gentle cord traction for all patients, regardless of their bleeding risk.[71]

SUMMARY

Evidence-based management of vaginal birth is critical to optimizing maternal and neonatal outcomes. Recommendations are summarized in Box 1. Integration of evidence-based care into standard practice will ultimately improve outcomes for mothers and neonates. The authors acknowledge that this is not an exhaustive list of all aspects of care surrounding vaginal birth.

REFERENCES

1. Births: final data for 2021. National Vital Statistics Reports. Accessed September 21, 2023. https://cdc.gov/nchs/data/nvsr/nvsr72/nvsr72-01.pdf
2. Cahill AG, Srinivas SK, Tita ATN, Caughey AB, Richter HE, Gregory WT, et al. Effect of immediate vs delayed pushing on rates of spontaneous vaginal delivery among nulliparous women receiving neuraxial analgesia: a randomized clinical trial. JAMA 2018;320:1444–54. doi: 10.1001/jama.2018.13986

3. Di Mascio D, Saccone G, Bellussi F, Al-Kouatly HB, Brunelli R, Benedetti Panici P, et al. Delayed versus immediate pushing in the second stage of labor in women with neuraxial analgesia: a systematic review and meta-analysis of randomized controlled trials. Am J Obstet Gynecol 2020;223:189–203. doi: 10.1016/j.ajog.2020.02.002
4. Roberts CL, Torvaldsen S, Cameron CA, Olive E. Delayed versus early pushing in women with epidural analgesia: a systematic review and meta-analysis. BJOG 2004;111:1333–40. doi: 10.1111/j.1471-0528.2004.00282.x
5. Brancato RM, Church S, Stone PW. A meta-analysis of passive descent versus immediate pushing in nulliparous women with epidural analgesia in the second stage of labor. J Obstet Gynecol Neonatal Nurs 2008;37:4–12. doi: 10.1111/j.1552-6909.2007.00205.x
6. World Health Organization. WHO recommendations: intrapartum care for a positive childbirth experience. Accessed November 3, 2023. https://iris.who.int/handle/10665/260178
7. Approaches to limit intervention during labor and birth. Committee Opinion No. 687. American College of Obstetricians and Gynecologists. Obstet Gynecol 2017;129:e20–8. doi: 10.1097/AOG.0000000000001905
8. Gimovsky AC, Berghella V. Evidence-based labor management: second stage of labor (part 4). Am J Obstet Gynecol MFM 2022;4:100548. doi: 10.1016/j.ajogmf.2021.100548
9. Gregory WT, Cahill AG, Woolfolk C, Lowder JL, Caughey AB, Srinivas SK, et al. Impact of pushing timing on occult injury of levator ani: secondary analysis of a randomized trial. Am J Obstet Gynecol 2022;226:718.e1–10. doi: 10.1016/j.ajog.2022.02.020
10. First and second stage labor management. ACOG Clinical Practice Guideline No. 8. American College of Obstetricians and Gynecologists. Obstet Gynecol 2024;143:144–62. doi: 10.1097/AOG.0000000000005447
11. Obstetric analgesia and anesthesia. ACOG Practice Bulletin No. 209. American College of Obstetricians and Gynecologists. Obstet Gynecol 2019;133:e208–25. doi: 10.1097/AOG.0000000000003132
12. Deepak D, Kumari A, Mohanty R, Prakash J, Kumar T, Priye S. Effects of epidural analgesia on labor pain and course of labor in primigravid parturients: a prospective non-randomized comparative study. Cureus 2022;14:e26090. doi: 10.7759/cureus.26090
13. Babaoğlu G, Kiliçaslan B, Ankay Yilbaş A, Çelebioğlu B. Effects of different analgesic methods used for vaginal delivery on mothers and fetuses. Turk J Med Sci 2020;50:930–6. doi: 10.3906/sag-1911-61
14. Ashwal E, Livne MY, Benichou JIC, Unger R, Hiersch L, Aviram A, et al. Contemporary patterns of labor in nulliparous and multiparous women. Am J Obstet Gynecol 2020;222:267.e1–9. doi: 10.1016/j.ajog.2019.09.035
15. Peretz H, Tal A, Garmi G, Zafran N, Romano S, Salim R. Impact of epidural on labor duration and vacuum deliveries in twin gestations. Midwifery 2019;74:134–39. doi: 10.1016/j.midw.2019.03.025
16. Shmueli A, Salman L, Orbach-Zinger S, Aviram A, Hiersch L, Chen R, et al. The impact of epidural analgesia on the duration of the second stage of labor. Birth 2018;45:377–84. doi: 10.1111/birt.12355
17. Anim-Somuah M, Smyth RM, Cyna AM, Cuthbert A. Epidural versus non-epidural or no analgesia for pain management in labour. The Cochrane Database of Systematic Reviews 2018, Issue 5. Art. No.: CD000331. doi: 10.1002/14651858.CD000331.pub4
18. Gimovsky AC, Guarente J, Berghella V. Prolonged second stage in nulliparous with epidurals: a systematic review. J Matern Fetal Neonatal Med 2017;30:461–5. doi: 10.1080/14767058.2016.1174999
19. Antonakou A, Papoutsis D. The effect of epidural analgesia on the delivery outcome of induced labour: a retrospective case series. Obstet Gynecol Int 2016;2016:5740534. doi: 10.1155/2016/5740534
20. Hincz P, Podciechowski L, Grzesiak M, Horzelski W, Wilczyński J. Epidural analgesia during labour: a retrospective cohort study on its effects on labour, delivery and neonatal outcome. Ginekol Pol 2014;85:923–8. doi: 10.17772/gp/1883
21. Abhirami GR, Sathyavani C, George CE. The effect of epidural analgesia on the maternal and fetal outcomes in mothers undergoing induction of labour. J Obstet Gynaecol India 2022;72(suppl 1):174–9. doi: 10.1007/s13224-022-01622-1
22. Turner J, Flatley C, Kumar S. Epidural use in labour is not associated with an increased risk of maternal or neonatal morbidity when the second stage is prolonged. Aust N Z J Obstet Gynaecol 2020;60:336–43. doi: 10.1111/ajo.13045
23. Djaković I, Sabolović Rudman S, Košec V. Effect of epidural analgesia on mode of delivery. Wien Med Wochenschr 2017;167:390–4. doi: 10.1007/s10354-016-0511-9
24. Aneiros F, Vazquez M, Valiño C, Taboada M, Sabaté S, Otero P, et al. Does epidural versus combined spinal-epidural analgesia prolong labor and increase the risk of instrumental and cesarean delivery in nulliparous women? J Clin Anesth 2009;21:94–7. doi: 10.1016/j.jclinane.2008.06.020
25. Califano G, Saccone G, Diana B, Collà Ruvolo C, Ioffredo D, Nappi C, et al. Hands-on vs hands-off technique for the prevention of perineal injury: a randomized clinical trial. Am J Obstet Gynecol MFM 2022;4:100675. doi: 10.1016/j.ajogmf.2022.100675
26. Aquino CI, Guida M, Saccone G, Cruz Y, Vitagliano A, Zullo F, et al. Perineal massage during labor: a systematic review and meta-analysis of randomized controlled trials. J Matern Fetal Neonatal Med 2020;33:1051–63. doi: 10.1080/14767058.2018.1512574
27. Beckmann MM, Garrett AJ. Antenatal perineal massage for reducing perineal trauma. The Cochrane Database of Systematic Reviews 2006, Issue 1. Art. No.: CD005123. doi: 10.1002/14651858.CD005123.pub2
28. Aasheim V, Nilsen ABV, Reinar LM, Lukasse M. Perineal techniques during the second stage of labour for reducing perineal trauma. The Cochrane Database of Systematic Reviews 2017, Issue 6. Art. No.: CD006672. doi: 10.1002/14651858.CD006672.pub3
29. Tuuli MG, Gregory WT, Arya LA, Lowder JL, Woolfolk C, Caughey AB, et al. Effect of second-stage pushing timing on postpartum pelvic floor morbidity: a randomized controlled trial. Obstet Gynecol 2023;141:245–52. doi: 10.1097/AOG.0000000000005031
30. Bulchandani S, Watts E, Sucharitha A, Yates D, Ismail KM. Manual perineal support at the time of childbirth: a systematic review and meta-analysis. BJOG 2015;122:1157–65. doi: 10.1111/1471-0528.13431
31. Kibuka M, Thornton JG. Position in the second stage of labour for women with epidural anaesthesia. The Cochrane Database of Systematic Reviews 2017, Issue 2. Art. No.: CD008070. doi: 10.1002/14651858.CD008070.pub3
32. Gupta JK, Sood A, Hofmeyr GJ, Vogel JP. Position in the second stage of labour for women without epidural anaesthesia. The Cochrane Database of Systematic Reviews 2017, Issue 5. Art. No.: CD002006. doi: 10.1002/14651858.CD002006.pub4

33. Walker C, Rodríguez T, Herranz A, Espinosa JA, Sánchez E, Espuña-Pons M. Alternative model of birth to reduce the risk of assisted vaginal delivery and perineal trauma. Int Urogynecol J 2012;23:1249–56. doi: 10.1007/s00192-012-1675-5

34. Paternotte J, Potin J, Diguisto C, Neveu MN, Perrotin F. Delivery in lateral position: comparative study in low risk pregnancy between lateral and dorsal position for the delivery in eutocic vaginal birth. Gynecol Obstet Fertil 2012;40:279–83. doi: 10.1016/j.gyobfe.2011.07.039

35. Jiang H, Qian X, Carroli G, Garner P. Selective versus routine use of episiotomy for vaginal birth. The Cochrane Database of Systematic Reviews 2017, Issue 2. Art. No.: CD000081. doi: 10.1002/14651858.CD000081.pub3

36. Hartmann K, Viswanathan M, Palmieri R, Gartlehner G, Thorp J, Lohr KN. Outcomes of routine episiotomy: a systematic review. JAMA 2005;293:2141–8. doi: 10.1001/jama.293.17.2141

37. Pergialiotis V, Vlachos D, Protopapas A, Pappa K, Vlachos G. Risk factors for severe perineal lacerations during childbirth. Int J Gynaecol Obstet 2014;125:6–14. doi: 10.1016/j.ijgo.2013.09.034

38. Macleod M, Goyder K, Howarth L, Bahl R, Strachan B, Murphy DJ. Morbidity experienced by women before and after operative vaginal delivery: prospective cohort study nested within a two-centre randomised controlled trial of restrictive versus routine use of episiotomy. BJOG 2013;120:1020–6. doi: 10.1111/1471-0528.12184

39. Carroli G, Mignini L. Episiotomy for vaginal birth. The Cochrane Database of Systematic Reviews 2009, Issue 1. Art. No.: CD000081. doi: 10.1002/14651858.CD000081.pub2

40. Myers-Helfgott MG, Helfgott AW. Routine use of episiotomy in modern obstetrics. Should it be performed? Obstet Gynecol Clin North Am 1999;26:305–25. doi: 10.1016/s0889-8545(05)70077-2

41. Sartore A, De Seta F, Maso G, Pregazzi R, Grimaldi E, Guaschino S. The effects of mediolateral episiotomy on pelvic floor function after vaginal delivery. Obstet Gynecol 2004;103:669–73. doi: 10.1097/01.AOG.0000119223.04441.c9

42. Sagi-Dain L, Sagi S. The role of episiotomy in prevention and management of shoulder dystocia: a systematic review. Obstet Gynecol Surv 2015;70:354–62. doi: 10.1097/OGX.0000000000000179

43. Gurewitsch ED, Donithan M, Stallings SP, Moore PL, Agarwal S, Allen LM, et al. Episiotomy versus fetal manipulation in managing severe shoulder dystocia: a comparison of outcomes. Am J Obstet Gynecol 2004;191:911–6. doi: 10.1016/j.ajog.2004.06.041

44. Delayed umbilical cord clamping after birth. ACOG Committee Opinion No. 814. American College of Obstetricians and Gynecologists. Obstet Gynecol 2020;136:e100–6. doi: 10.1097/AOG.0000000000004167

45. Bruckner M, Katheria AC, Schmölzer GM. Delayed cord clamping in healthy term infants: more harm or good? Semin Fetal Neonatal Med 2021;26:101221. doi: 10.1016/j.siny.2021.101221

46. McAdams RM. Time to implement delayed cord clamping. Obstet Gynecol 2014;123:549–52. doi: 10.1097/AOG.0000000000000122

47. Seidler AL, Aberoumand M, Hunter KE, Barba A, Libesman S, Williams JG, et al. Deferred cord clamping, cord milking, and immediate cord clamping at preterm birth: a systematic review and individual participant data meta-analysis. Lancet 2023;402:2209–22. doi: 10.1016/S0140-6736(23)02468-6

48. Seidler AL, Libesman S, Hunter KE, Barba A, Aberoumand M, Williams JG, et al. Short, medium, and long deferral of umbilical cord clamping compared with umbilical cord milking and immediate clamping at preterm birth: a systematic review and network meta-analysis with individual participant data. Lancet 2023;402:2223–34. doi: 10.1016/S0140-6736(23)02469-8

49. Marrs L, Niermeyer S. Toward greater nuance in delayed cord clamping. Curr Opin Pediatr 2022;34:170–7. doi: 10.1097/MOP.0000000000001117

50. Qian Y, Ying X, Wang P, Lu Z, Hua Y. Early versus delayed umbilical cord clamping on maternal and neonatal outcomes. Arch Gynecol Obstet 2019;300:531–43. doi: 10.1007/s00404-019-05215-8

51. Nakayama JY, Perrine CG, Hamner HC, Boundy EO. Prevalence of delayed cord clamping among U.S. hospitals by facility characteristics. Obstet Gynecol 2021;138:802–4. doi: 10.1097/AOG.0000000000004564

52. Brown BE, Shah PS, Afifi JK, Sherlock RL, Adie MA, Monterrosa LA, et al. Delayed cord clamping in small for gestational age preterm infants. Am J Obstet Gynecol 2022;226:247.e1–10. doi: 10.1016/j.ajog.2021.08.003

53. Purisch SE, Ananth CV, Arditi B, Mauney L, Ajemian B, Heiderich A, et al. Effect of delayed vs immediate umbilical cord clamping on maternal blood loss in term cesarean delivery: a randomized clinical trial. JAMA 2019;322:1869–76. doi: 10.1001/jama.2019.15995

54. Katheria AC, Clark E, Yoder B, Schmölzer GM, Yan Law BH, El-Naggar W, et al. Umbilical cord milking in nonvigorous infants: a cluster-randomized crossover trial. Am J Obstet Gynecol 2023;228:217.e1–14. doi: 10.1016/j.ajog.2022.08.015

55. Katheria A, Reister F, Essers J, Mendler M, Hummler H, Subramaniam A, et al. Association of umbilical cord milking vs delayed umbilical cord clamping with death or severe intraventricular hemorrhage among preterm infants. JAMA 2019;322:1877–86. doi: 10.1001/jama.2019.16004

56. Begley CM, Gyte GM, Devane D, McGuire W, Weeks A, Biesty LM. Active versus expectant management for women in the third stage of labour. The Cochrane Database of Systematic Reviews 2019, Issue 2. Art. No.: CD007412. doi: 10.1002/14651858.CD007412.pub5

57. Rotem R, Lipski A, Weintraub AY, Baumfeld Y, Yohay D, Press F, et al. Third stage of labor placental complications and placenta-associated syndromes. J Matern Fetal Neonatal Med 2021;34:3350–4. doi: 10.1080/14767058.2019.1684468

58. Combs CA, Murphy EL, Laros RK. Factors associated with postpartum hemorrhage with vaginal birth. Obstet Gynecol 1991;77:69–76.

59. Magann EF, Evans S, Chauhan SP, Lanneau G, Fisk AD, Morrison JC. The length of the third stage of labor and the risk of postpartum hemorrhage. Obstet Gynecol 2005;105:290–3. doi: 10.1097/01.AOG.0000151993.83276.70

60. Yildirim D, Ozyurek SE, Ekiz A, Eren EC, Hendem DU, Bafali O, et al. Comparison of active vs expectant management of the third stage of labor in women with low risk of postpartum hemorrhage: a randomized controlled trial. Ginekol Pol 2016;87:399–404. doi: 10.5603/GP.2016.0015

61. Angarita AM, Berghella V. Evidence-based labor management: third stage of labor (part 5). Am J Obstet Gynecol MFM 2022;4:100661. doi: 10.1016/j.ajogmf.2022.100661

62. Du Y, Ye M, Zheng F. Active management of the third stage of labor with and without controlled cord traction: a systematic review and meta-analysis of randomized controlled trials. Acta Obstet Gynecol Scand 2014;93:626–33. doi: 10.1111/aogs.12424

63. Salati JA, Leathersich SJ, Williams MJ, Cuthbert A, Tolosa JE. Prophylactic oxytocin for the third stage of labour to prevent postpartum haemorrhage. The Cochrane Database of Systematic Reviews 2019, Issue 4. Art. No.: CD001808. doi: 10.1002/14651858.CD001808.pub3

64. Soltani H, Hutchon DR, Poulose TA. Timing of prophylactic uterotonics for the third stage of labour after vaginal birth. The Cochrane Database of Systematic Reviews 2010, Issue 8. Art. No.: CD006173. doi: 10.1002/14651858.CD006173.pub2

65. Knoll W, Phelan R, Hopman WM, Ho AMH, Cenkowski M, Mizubuti GB, et al. Retrospective review of time to uterotonic administration and maternal outcomes after postpartum hemorrhage. J Obstet Gynaecol Can 2022;44:490–5. doi: 10.1016/j.jogc.2021.11.011

66. Adnan N, Conlan-Trant R, McCormick C, Boland F, Murphy DJ. Intramuscular versus intravenous oxytocin to prevent postpartum haemorrhage at vaginal delivery: randomised controlled trial. BMJ 2018;362:k3546. doi: 10.1136/bmj.k3546

67. Roach MK, Abramovici A, Tita AT. Dose and duration of oxytocin to prevent postpartum hemorrhage: a review. Am J Perinatol 2013;30:523–8. doi: 10.1055/s-0032-1329184

68. McKenna DS, Rudinsky K, Sonek J. Effects of a new patient safety-driven oxytocin dosing protocol on postpartum hemorrhage. J Pregnancy 2014;2014:157625. doi: 10.1155/2014/157625

69. Dagraca J, Malladi V, Nunes K, Scavone B. Outcomes after institution of a new oxytocin infusion protocol during the third stage of labor and immediate postpartum period. Int J Obstet Anesth 2013;22:194–9. doi: 10.1016/j.ijoa.2013.03.007

70. Parry Smith WR, Papadopoulou A, Thomas E, Tobias A, Price MJ, Meher S, et al. Uterotonic agents for first-line treatment of postpartum haemorrhage: a network meta-analysis. The Cochrane Database of Systematic Reviews 2020, Issue 11. Art. No.: CD012754. doi: 10.1002/14651858.CD012754.pub2

71. Postpartum hemorrhage. Practice Bulletin No. 183. American College of Obstetricians and Gynecologists. Obstet Gynecol 2017;130:e168–86. doi: 10.1097/AOG.0000000000002351

72. Jackson KW, Allbert JR, Schemmer GK, Elliot M, Humphrey A, Taylor J. A randomized controlled trial comparing oxytocin administration before and after placental delivery in the prevention of postpartum hemorrhage. Am J Obstet Gynecol 2001;185:873–7. doi: 10.1067/mob.2001.117363

73. Oguz Orhan E, Dilbaz B, Aksakal SE, Altınbas S, Erkaya S. Prospective randomized trial of oxytocin administration for active management of the third stage of labor. Int J Gynaecol Obstet 2014;127:175–9. doi: 10.1016/j.ijgo.2014.05.022

74. Prevention and management of obstetric lacerations at vaginal delivery. ACOG Practice Bulletin No. 198. American College of Obstetricians and Gynecologists. Obstet Gynecol 2018;132:e87–102. doi: 10.1097/AOG.0000000000002841

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