A Questionnaire Assessing Utilization of Delayed Cord Clamping

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Abstract

Objective The study aimed to assess the practice of delayed cord clamping (DCC) and the awareness of its benefits for newborns between Obstetric (OB) and neonatal physicians. We examined if provider characteristics including years of experience, level of training, familiarity of the American College of Obstetricians and Gynecologists (ACOG)/American Academy of Pediatrics (AAP) recommendations, institutional policy, and the racial and ethnic background of patient population were associated with implementation of DCC.

Study Design This research is a cross-sectional online questionnaire study.

Results 975 questionnaires were returned. Overall, the awareness of ACOG versus AAP recommendations was 94 versus 86% ($p < 0.01$). 86 versus 78% of OB and neonatal physicians practiced or witnessed DCC >50% of the time, respectively ($p < 0.01$). An equal number of OB and neonatal physicians believed in the benefits to newborns of DCC. Physicians with >10 years of practice were less likely to acknowledge DCC benefits. Physicians with a majority of non-White patients were less likely to practice/witness DCC ($p < 0.05$).

Conclusion There continues to be room for improvement in the practice of DCC. Institutional policies and awareness of ACOG/AAP recommendations impact the understanding of the benefits of DCC and the likelihood of the practice. There is a significant difference in the practice of DCC among patients with different racial backgrounds. Hospital leadership may consider investing in the education and implementation of updated guidelines to ensure DCC is routinely practiced.

Keywords
- delayed cord clamping
- umbilical cord
- newborn

Key Points

- Knowledge of AAP/ACOG and institutional policies improved the practice of DCC.
- There is racial disparity in the practice of DCC.
- Physicians in practice for >10 years were less likely to know the benefits of DCC to full-term neonates.

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In 1801, Erasmus Darwin—an English physician, natural philosopher, and physiologist—wrote, "another thing very injurious to the child is the tying and cutting of the navel string too soon, which should always be left till the child has not only repeatedly breathed, but till all pulsation in the cord ceases. As otherwise, the child is much weaker than it ought to be.[1]" Today, nearly 220 years later, delayed cord clamping (DCC) remains a "hot topic" in the neonatal world.

Immediate umbilical cord clamping increases the risk of neonatal anemia and infant and pediatric iron deficiency.[2] Benefits of DCC in full-term (FT) neonates include increasing early hemoglobin concentrations in neonates and iron stores in infants.[3–8] In 2020, the American College of Obstetrics and Gynecology (ACOG) updated their committee opinion,[9] and the American Heart Association updated their guidelines for neonatal resuscitation and reaffirmed the importance of DCC for term infants[10] and include the umbilical cord management plan as the fourth prebirth question for neonatal resuscitation.[11] Despite this evidence and the recommendation from ACOG,[9,12] providers continue to practice immediate cord clamping.[13,14]

Objective

The primary objective of this study is to assess the frequency of DCC and the awareness of newborn benefits between the obstetrical (OB) and neonatal physician teams in the delivery room. This assessment takes place 7 years after the first release of ACOG committee cord clamping recommendations in 2012 and 3 years after the release from the American Academy of Pediatrics (AAP)[15] statement endorsing the ACOG recommendations.

The secondary objectives evaluate whether differences in practice are associated with years of experience, level of training, patient population, familiarity of ACOG/AAP policies and recommendations, the presence of an institutional policy, the racial and ethnic backgrounds of the population treated, and the percentage of practiced/witnessed DCC.

Materials and Methods

Informed Consent

A statement of consent with the purpose of study, voluntary nature of participation, confidentiality of the participants' responses, and the absence of information pertaining to the participants' identity were included in the survey.

Study Design

This is a questionnaire-based cross-sectional study. The questionnaire comprised of 15 questions (►**Supplementary Table S1** [available in the online version]) exploring the demographics, years of practice, type of practice, awareness of AAP/ACOG recommendations and institutional policies on DCC, the frequency of the practice of DCC by OB or the witness of DCC by the neonatal physician, knowledge of benefits and risks to premature/FT neonates, and the opinion on the significance of iron deficiency anemia in the participants' population. This was distributed online to members of the AAP Section of Perinatal-Neonatal Medicine (SOPMN) and ACOG during March and April of 2019. The survey was approved by the institutional review board from the Albert Einstein College of Medicine 2016–6502.

The ACOG research portal distributed the survey to 5,000 ACOG members via the survey platform, Qualtrics and included 5 weekly reminder emails. The AAP-SONPM distributed the survey to 3,000 members via SurveyMonkey with one reminder at week 3. The data collection period was 8 weeks. A minimum sample size of 150 per group was determined to yield 80% power with a two-sided significance level of 0.05 to detect a 16% difference between the OB and neonatal groups in the proportion who perceived benefit to DCC.

Statistical Analysis

The primary outcome was a response of "yes" to the survey question: "are there benefits to DCC in a FT neonates?" and a response of "$>50\%$" to the survey question: "how often do you practice/witness DCC?" The secondary objectives compared the difference in responses to perceived benefits of DCC and the outcome of practice/witness DCC, trainees versus attendings, years of practice, population, familiarity with AAP/ACOG policies, presence of an institutional policy, and the opinion on the significance of iron deficiency anemia in the patient population. Categorical variables were compared by using the Chi-square test and continuous variables were compared with the two-sample *t*-test between the two groups. Logistic regression models were also fit to the data to evaluate the independent predictors of the primary and secondary outcomes, and to adjust for potential confounding variables. All variables which were significant in the bivariate analyses were included in the logistic regression model as potential predictors. A two-sided *p*-value <0.05 was considered statistically significant.

Results

A total of 975 questionnaires were completed, 527 and 448 submitted by OB and neonatal physicians, respectively. The response rate was 10.5 and 14.9%, respectively as shown in ►**Table 1**. Significantly more attendings than trainees completed the survey in both groups. No difference was observed in the years of practice between the two groups. Both groups were familiar with the ACOG recommendations. There was a difference between the groups in familiarity with AAP recommendations. Further, the responses for the presence of an institutional policy, perceived benefits and risks of DCC in FT and preterm neonates, as well as the perception of iron deficiency anemia being a significant problem in their patient population were all significantly different between the two groups. However, 86% of OB physicians practiced DCC >50% of the time, whereas 78% of neonatal physicians witnessed DCC being performed >50% of the time.

There was no difference between trainees and attendings on knowledge DCC benefits for FT neonates. Sixty-eight percent of respondents who did not choose "yes" to be aware

Table 1 Characteristics of the obstetric physician team compared with the neonatal physician team

	Total ($n = 975$)	OB ($n = 527$)	Neonatal ($n = 448$)	p-Value[a]
Level of training, n (%) ($n = 1$ missing)				0.0141
Attending	834 (85.6)	437 (83.1)	397 (88.6)	
Trainees	140 (14.4)	89 (16.9)	51 (11.4)	
Years in practice, n (%)				0.0544
< 5	262 (26.9)	155 (29.4)	107 (23.9)	
5–10	137 (14.1)	79 (15.0)	58 (12.9)	
> 10	576 (59.1)	293 (55.6)	283 (63.2)	
Ethnicity of majority of patient population, n (%) ($n = 2$ missing)				<0.0001
Non-Hispanic White	533 (54.8)	246 (46.7)	287 (64.3)	
Hispanic	117 (12.0)	53 (10.1)	64 (14.3)	
Non-Hispanic Black	106 (10.9)	51 (9.7)	55 (12.3)	
Population too varied/unsure	217 (22.3)	177 (33.6)	40 (9.0)	
Familiar with ACOG recommendation on DCC, n (%) ($n = 4$ missing)	892 (91.9)	490 (93.0)	402 (90.5)	0.1662
Familiar with AAP recommendation for DCC, n (%) ($n = 2$ missing)	811 (83.4)	384 (72.9)	427 (95.7)	<0.0001
How often practice/witness DCC, n (%) ($n = 3$ missing)				<0.0001
$< 25\%$	77 (7.9)	45 (8.6)	32 (7.1)	
26–50%	95 (9.8)	29 (5.5)	66 (14.7)	
$> 50\%$	800 (82.3)	450 (85.9)	350 (78.1)	
Have an institutional policy for DCC, n (%) ($n = 3$ missing)				<0.0001
Yes	506 (52.1)	209 (39.8)	297 (66.4)	
No	290 (29.8)	196 (37.3)	94 (21.0)	
I don't know	176 (18.1)	120 (22.9)	56 (12.5)	
Aware of benefits of DCC for FT neonate, n (%) ($n = 6$ missing)				<0.0001
Yes	698 (72.0)	363 (69.0)	335 (75.6)	
No	49 (5.1)	42 (8.0)	7 (1.6)	
Indeterminate	184 (19.0)	95 (18.1)	89 (20.1)	
I don't know	38 (3.9)	26 (4.9)	12 (2.7)	
Risks of DCC in a FT neonate, n (%) ($n = 10$ missing)				<0.0001
Yes	448 (46.4)	251 (47.8)	197 (44.8)	
No	267 (27.7)	152 (29.0)	115 (26.1)	
Indeterminate	191 (19.8)	75 (14.3)	116 (26.4)	
I don't know	59 (6.1)	47 (9.0)	12 (2.7)	
Benefits of DCC in premature neonate, n (%) ($n = 5$ missing)				<0.0001
Yes	926 (95.5)	489 (93.0)	437 (98.4)	
No	7 (0.7)	7 (1.3)	0 (0.0)	
Indeterminate	15 (1.5)	9 (1.7)	6 (1.4)	
I don't know	22 (2.3)	21 (4.0)	1 (0.2)	

(*Continued*)

Table 1 (*Continued*)

	Total ($n = 975$)	OB ($n = 527$)	Neonatal ($n = 448$)	p-Value[a]
Risks of DCC in a premature neonate, n (%) ($n = 4$ missing)				<0.0001
Yes	451 (46.4)	231 (43.9)	220 (49.4)	
No	268 (27.6)	143 (27.2)	125 (28.1)	
Indeterminate	163 (16.8)	73 (13.9)	90 (20.2)	
I don't know	89 (9.2)	79 (15.0)	10 (2.2)	
Iron deficiency anemia in children is a significant problem in patient population, n (%) ($n = 1$ missing)				<0.0001
Yes	296 (30.4)	109 (20.7)	187 (41.7)	
No	363 (37.3)	214 (40.7)	149 (33.3)	
I don't know	315 (32.3)	203 (38.6)	112 (25.0)	

Abbreviations: AAP, American Academy of Pediatrics; ACOG, American College of Obstetricians and Gynecologists; DCC, delayed cord clamping; FT, full term; OB, obstetricians.
[a]Chi-square test or Fisher's exact test.

of DCC benefits to newborns were in practice for >10 years. Of the respondents who believed there are benefits to DCC in FT neonates, 94% were familiar with the ACOG recommendations. Similarly, 86% who believed DCC was beneficial for FT neonates were familiar with the AAP recommendation. Fifty-six percent of all responders had an institutional policy. In institutions where there was no policy for DCC, 26% answered "yes" to knowing the benefits of DCC versus 38% who had an answer other than "yes."

In the multivariable logistic regression analyses shown in ►**Table 2**, there was no difference between groups' knowledge of the benefits of DCC for FT neonates. Physicians in practice fewer than 10 years were more aware of the neonatal benefits of DCC than those in practice >10 years. Respondents familiar with the ACOG policy were more likely to believe that there were benefits to DCC. Familiarity with the AAP recommendations was not independently associated with perceived benefits of DCC. Respondents who did not have or were not aware of an institutional policy were less likely to be aware of the benefits to DCC.

In the bivariate analyses, survey responders who reported practicing/witnessing DCC >50% versus ≤50% of the time differed significantly with respect to racial and ethnic backgrounds of the patient population, familiarity with ACOG policies, familiarity with AAP recommendations, having an institutional policy, and viewing iron deficiency anemia as a significant problem in children.

In logistic regression analysis shown in ►**Table 3** with practice/witness DCC >50% as the outcome, more OB physicians performed DCC than neonatal physicians who witnessed DCC. Physicians who care for a majority of Hispanic and Black populations (vs. White) were less likely to perform DCC. Familiarity with the ACOG and AAP policies were significant factors that affected the practice of DCC. The absence of an institutional policy or the lack of awareness of an institutional policy was a significant factor that affected the practice/witness of DCC.

Table 2 Multivariable logistic regression model of outcome; benefits to delayed cord clamping in full-term neonate: yes versus other answer ($n = 962$, including factors with significant bivariate association)

	AOR (95% CI)	p-Value
OB (reference = neonatal)	0.81 (0.59–1.11)	0.1889
Years in practice		
< 5 (reference ≥ 10)	1.62 (1.14–2.30)	0.0067
5–10 (reference ≥ 10)	1.85 (1.16–2.94)	0.0097
Familiar with ACOG recommendation on DCC (reference = no)	2.25 (1.34–3.76)	0.0021
Familiar with AAP recommendation for DCC (reference = no)	1.28 (0.84–1.93)	0.2485
Have an institutional policy for DCC		
No (reference = yes)	0.59 (0.42–0.83)	0.0023
I don't know (reference = yes)	0.66 (0.44–0.99)	0.0425

Abbreviations: AAP, American Academy of Pediatrics; ACOG, American College of Obstetricians and Gynecologists; AOR, adjusted odds ratio; CI, confidence interval; DCC, delayed cord clamping; OB, obstetricians.

Discussion

This study described the differences among OB and neonatal teams' experience of DCC and knowledge of the benefits for newborns. OB and neonatal physicians are equally aware of

Table 3 Multivariable logistic regression model of outcome; practice/witness delayed cord clamping >50% yes versus other answer ($n = 963$, including factors with significant bivariate association)

	AOR (95% CI)	*p*-Value
OB (reference = neonatal)	3.73 (2.38–5.84)	<0.0001
Ethnicity of majority of patient population		
Hispanic (reference = White)	0.42 (0.25–0.72)	0.0015
Black (reference = White)	0.56 (0.32–0.97)	0.0370
Population too varied/ unsure (reference = White)	0.65 (0.39–1.06)	0.0855
Familiar with ACOG recommendation on DCC (reference = no)	1.77 (0.99–3.17)	0.0562
Familiar with AAP recommendation for DCC (reference = no)	1.80 (1.08–3.00)	0.0240
Have an institutional policy for DCC		
No (reference = yes)	0.15 (0.09–0.24)	<0.0001
I don't know (reference = yes)	0.15 (0.09–0.25)	<0.0001
Iron deficiency anemia in children is a significant problem in patient population		
No (reference = yes)	0.83 (0.53–1.28)	0.3969
I don't know (reference = yes)	1.71 (1.05–2.78)	0.0316

Abbreviations: AAP, American Academy of Pediatrics; ACOG, American College of Obstetricians and Gynecologists; AOR, adjusted odds ratio; CI, confidence interval; DCC, delayed cord clamping; OB, obstetricians.

the benefits to DCC in a FT neonate; however, those in practice longer are less likely to engage in the practice. Our study showed a much higher DCC rate compared with a study done in 2016 after the initial 2012 ACOG recommendations were published.[16] The reiteration by the ACOG in 2017 and an increased number of institutional policies on the topic likely made an impact to increase this practice. Furthermore, OB physicians were more likely than neonatal physicians to state that they witnessed/performed DCC >50% of the time. These differences could be due to the different delivery experiences between OB and neonatal physicians. Neonatal physicians are present at high-risk deliveries, where there is concern for neonatal distress and anticipated neonatal resuscitation which likely leads physicians witnessing DCC less frequently.

Though there was no difference in level of training, physicians in practice for more than 10 years were less likely to know the benefits of DCC. Contrary to our study, Chiruvolu et al did not find a difference in performing DCC by years in practice; however, these physicians were more likely to perform cord milking.[17] A study from Spain investigating variability and associated factors in the management of cord clamping[18] had a similar finding of professionals over 50 years old were less likely to perform DCC. According to a systematic review in 2005, physicians in practice for more years were less likely to adhere to standards of practice.[19] This highlights the importance of maintenance of certification for physicians and the need to be up to date on ever changing clinical practice guidelines. In 2014, Jelan et al[20] concluded that although there is substantial evidence of benefit, few institutions have policies regarding this practice and obstetricians' beliefs about the appropriate timing for umbilical cord clamping and its beneficial impact on neonatal outcomes are inconsistent.

Responders aware of the benefits of DCC and practiced/witnessed DCC >50% of the time were more likely to be aware of the AAP and ACOG recommendations and whether there was an institutional policy. Clinical policies rely on sound scientific evidence for generating "standards" or "rules" and have been developed to help provide efficient, comprehensive care and are known to be valuable tools in management decision-making.[21,22] Actionable statements represent the foundation of a clinical guideline and form an important bridge to subsequent performance measurement efforts. Further, a well-crafted guideline promotes quality by reducing health care variations, promoting effective therapy, and standardizing care. These findings support a study done by Leslie et al[16] that looked at umbilical cord clamping practices of U.S. obstetricians and suggested that institutional policies may influence attitudes on DCC. Widespread education for OBs and neonatal physicians that include the latest policies and guidelines on DCC will increase the likelihood of maintaining standard of care for umbilical cord management in the delivery room. Additionally, DCC should be discussed at all prenatal care visits and in preparation for the birth in the hospital or birthing center with the delivery team. Discussing the advantages of DCC antenatally will enhance joint decision-making and increase health literacy that benefits both the mother and her child. The neonatal resuscitation program amended its recommendations in 2021 and includes a discussion among the resuscitation team prior to delivery that includes umbilical cord management.[11]

Iron deficiency is the most common micronutrient deficiency in the world and affects 13.5% of toddlers in the United States.[23] The positive effect on reducing the incidence of anemia[24] and improving neurodevelopment in humans[25] by DCC is no longer theoretical. Despite the high percentage of responders who practiced/witnessed DCC, there continues to be room for improvement. Overall, close to 50% of responders believed DCC was associated with risks to FT neonates. Potential risks of DCC such as increased risk of hyperbilirubinemia[26–28] or increased risk of postpartum hemorrhage[29] are unfounded. This affords convincing evidence to reach for universal practice of DCC by medical teams.

Physicians in this study who cared for a majority of Hispanic and Black populations (vs. White) were less likely

to perform DCC. According to data from five National Health and Nutrition Examination Surveys,[30] the prevalence of anemia in preschool-age Black children was higher than both White and Hispanic children in the same age group. Similar findings were seen in toddlers where twice as many Hispanic and Black children were iron deficient compared with White children.[31] Racial disparities in healthcare are vast, affecting all scopes of medicine including many aspects of obstetric care.[32–36] The ACOG committee opinion in 2015[37] committed to the elimination of racial and ethnic disparities in the health and healthcare of women. Additionally, recent publications have shown a significant variation in quality of care for mothers and newborns of racial and ethnic backgrounds other than White.[38] Whether the DCC differences are due to disparities in health care or due to increased pregnancy-related comorbidities in minority populations[39,40] that may lead to high-risk deliveries, resulting in less DCC is beyond the scope of this study. However, awareness of these discrepancies and performing DCC for all eligible neonates is a simple and impactful measure in reducing iron deficiency in minority children. Apart from having true benefit for the neonate, this may lead to improved quality of care among minority patients.

A survey-based study has its limitations. There is recall bias and response rates were less than 15% from each group. Response rates, as reported in the literature from 2013 to 2018, vary widely and are generally <30%,[41] especially from those studies like this one, without monetary incentives. A recently published survey from the AAP SONPM had a similar response rate of 15.7%.[42]

Respondents were limited to members of the ACOG and AAP SONPM, which make up approximately 15% of practicing obstetricians and neonatologists, respectively. Additionally, this study excluded nurse practitioners, physician assistants, midwives, and pediatric hospitalists. This questionnaire did not address the duration of DCC or the practice of cord milking nor was DCC in preterm infants discussed due to its complexities in this age group.

This is one of the earliest survey studies on DCC that addresses OB and neonatal physicians' awareness of DCC and offers a better understanding of how DCC is perceived and is practiced in the United States. The impact of awareness of AAP and ACOG recommendations and the racial and ethnic background of the patient population on DCC were not studied prior to this survey and creates an opportunity to improve health care quality and equity.

Conclusion

In conclusion, DCC is not practiced universally and OB physicians perform DCC more often than what neonatal physicians observe. Institutional policies as well as awareness of the ACOG and AAP recommendations may impact the likelihood of performing/witnessing DCC. There appears to be racial disparities related to DCC. Hospital leadership and stakeholders should consider investing in the education and implementation of updated guidelines to increase DCC.

Authors' Contributions

S.R.U. conceptualized the study, participated with the data collection, data interpretation, drafting the article, and final approval of the manuscript. S.L.N. participated in the study design, data interpretation, drafting, and the finalization of the manuscript.

Note

This study was approved by the institutional review board.

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Conflict of Interest

None declared.

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