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Original Article

The Effect of Kangaroo Care and Breastfeeding on Reducing the Pain due to Hepatitis B Vaccine Injection in Newborn Infants: A Comparative Analysis

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ABSTRACT

Aim: This study was conducted to compare the effects of breastfeeding (BF) and kangaroo mother care in newborns on the level of pain and physiological changes due to an injection of the hepatitis B vaccine.

Materials and Methods: This study was designed as a comparative experimental study. The sample of this study consisted of a total of 70 infants, including 35 in the Kangaroo group and 35 in the BF group, who were followed up in the postnatal ward at Zeynep Kamil Training and Research Hospital between August 2016 and February 2017 and who also met the sample criteria. The pain levels, duration of crying, heart rates (HR) and oxygen saturation (SpO_2) of the newborn infants were compared before and after a hepatitis B vaccine injection.

Results: It was determined that there was no statistically significant difference between the infants in the BF and kangaroo mother care groups in terms of their pain scores (Z=0.949; p=0.343), SpO_2 levels (Z=1.032; p=0.302), HR (Z=0.206; p=0.837) and duration of crying (Z=0.135; p=0.892). Following the vaccination, the HR and pain scores of the infants in the BF gruop increased by less and they had a shorter duration of crying.

Conclusion: According to these results, BF infants is effective in reducing the pain induced by invasive interventions as this is easily applicable, takes little time, encourages breast milk and strengthens the mother-infant attachment.

Keywords: Hepatitis B, pain, breastfeeding, kangaroo mother care, infant

Introduction

The Taxonomy Committee of the International Association for the Study of Pain defines pain as an unpleasant biochemical or emotional condition or behavior which arises from a certain area of the body, depends or does not depend on tissue damage, is affected by an individual's previous experiences and aims to detract from an undesired condition (1). A common opinion which was believed until the 1980s was that newborns did not perceive pain adequately due to their underdeveloped nervous systems due to their incomplete myelination. In those years, the high risk of side effects from and addiction to analgesics, the thought that the experience of pain does not affect the newborn and ethical contradictions prevented the examination of pain

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and its effects in the newborn (2). Studies have shown that breast milk and skin-to-skin contact have proven analgesic effects, and breast milk has positive effects on a newborn's heart rate (HR), oxygen saturation (SpO_2) and crying time after a painful intervention (3).

Vaccinations that are frequently applied to healthy children cause feelings of pain in these children.

Consequently, both pharmacological and non-pharmacological methods are used to reduce these feelings of pain (4). Non-pharmacological methods include breast milk, changing position, kangaroo care and touching, massage, sucrose application, giving a pacifier, and playing music (2,5,6). Although all these interventions have been shown to provide a significant difference when applied alone, the number of the studies comparing these interventions is very limited. In the present study, it was thought that comparing effective interventions in reducing pain, such as "kangaroo mother care" (KMC) and "breastfeeding" (BF), would be indicative in reducing pain of infants who cannot be breastfed.

In the present study, we aimed to investigate a comparison of the physiological effects of BF and kangaroo care in newborns on the level of pain induced by the injection of the hepatitis B vaccine.

Materials and Methods

Sample

The sample of the study consisted of a total of 70 infants, including 35 in the KMC group and 35 in the BF group, who were followed up in the postnatal ward at Zeynep Kamil Maternity and Children Training and Research Hospital between August 2016 and February 2017 and who met the sample criteria.

The inclusion criteria for this study were as follows: newborns whose parents participated voluntarily in this study and who were born full-term by vaginal delivery, had a body weight of 2,500-4,000 grams, had 1-minute and 5-minute Apgar scores of >7, had a postnatal age within the first 24 hours, were examined by a physician and accepted to be healthy, and had no skin lesions. The exclusion criteria for this study were as follows: those who were born in the 36+6 weeks of gestation or before according to their mothers' last menstrual date, were older than 24 hours or had health problems.

As a result of the Power analysis (G*Power 3.1.9.2) which was conducted for the experimental study based on a similar previous study (4), it was found that when taking D as 1.97 in the evaluation conducted based on the post-procedure pain scores of the infants, the sample size determined for Power=0.80, b=0.20, and a=0.05 was specified to be a total of 12 individuals (minimum 6 individuals for each group). In a standard experimental study, it is recommended to include 30 individuals in each group in order to conduct the study with 80% power (7). As a consequence, when considering its applicability in statistical tests, the sample group consisted of a total of 70 infants comprising 35 in the experimental group and 35 in the control group by taking possible case losses into consideration in order for the data to have strong reliability.

Randomization

This study was conducted using a randomization method (drawing lots). In the lots method, 35 red cards and 35 yellow cards were put into a black bag. Before the infant was assigned to the study group, the service nurse was asked to draw a card from this bag. Red cards represented the BF group, while yellow cards represented the kangaroo care group.

Data Collection Tools

The following tools and forms were used to collect the data of the study.

- Data Collection Form,
- Neonatal/Infant Pain Scale (NIPS),
- Pulse Oximeter,
- Chronometer.

Data Collection Form

In order to record the data of the study, the data collection form was prepared by the researchers in accordance with the literature. The data collection form consisted of two sections. The First Section consisted of 13 questions about the infant's date of birth, postnatal age, week of gestation, delivery method, gender, Apgar score, medical diagnosis, birth weight, height, head circumference and feeding style, whether or not the infant was stable in their general condition and whether the infant had any skin damage or not. The Second Section involved NIPS evaluation criteria used to evaluate the infant's pain score.

Neonatal/Infant Pain Scale

NIPS was developed by Lawrence et al. (8) and its Turkish validity and reliability study was conducted by Akdovan and Yıldırım (9). It is a scale developed specifically for newborn infants. It consists of a total of 6 criteria; facial

expression, crying, breathing patterns, arm movements, leg movements, and state of arousal. There are 2 scorings (0-1) in all categories except for crying, which has 3 scorings (0-1-2). The total score of the scale varies between 0 and 7. A high score signifies a higher intensity of pain.

Pulse Oximeter

A calibrated Nellcor pulse oximeter was used to measure the SpO_2 and HR of both groups before and after the vaccination.

Chronometer

The infants' duration of crying was evaluated with the chronometer of an Iphone 6s. The chronometer was started at the moment when the infant started crying and stopped at the moment when the infant stopped crying.

Procedure

The infants to whom kangaroo care would be applied were undressed in a way that only their diapers were left, which provided skin-to-skin contact with their mothers.

Conversely, those infants in the BF group were undressed only on one leg to allow for the injection, held on their mothers' lap and the BF was started.

Before the vaccination, a pulse oximeter probe was attached on the infants in both the KMC and BF groups and their pain scores, SpO_2 and HR values were recorded.

The vaccine injection was performed three minutes after the KMC or BF interventions were initiated (4). When the infant started crying during the vaccination, the researcher started the chronometer and when the crying stopped, the chronometer was stopped and the duration of crying was recorded. As soon as the injector was removed from the infant's leg, HR and SpO_2 were recorded with the help of the pulse oximeter in both the BF and kangaroo care groups and then the NIPS was evaluated.

Data Assessment

The results obtained from this study were evaluated using IBM SPSS Statistics 22 (IBM SPSS, Turkey) program for statistical analyses. The suitability of certain parameters for the normal distribution was evaluated with the Shapiro Wilks test. In the assessment of the data of this study, along with descriptive statistical methods (mean, standard deviation, frequency), Student's t-test for normally distributed ones and Mann-Whitney U test for non-normally distributed ones were used to compare the quantitative data between two groups. The chi-square test, Yates's Correction for Continuity, and Fisher's Exact chi-square tests were used to compare qualitative data. Significance was evaluated at a level of $p<0.05$.

Ethical and Legal Aspects of the Study

In order to conduct this study, ethics committee approval (IRB: 205) was received from Zeynep Kamil Maternity and Children Training and Research Hospital and institutional permission was obtained. For the NIPS used to evaluate pain in this study, written permission was obtained from Yıldırım who authored the Turkish validity and reliability study from the Children's Hospital of Eastern Ontario Research Institute via e-mail. Before conducting this study, the mothers of all the infants were informed about the study and their written permission was obtained via an informed consent form.

Results

The descriptive characteristics of the infants included in this study are presented in Table I. The infants in this study were all healthy and only breastfed. When comparing the descriptive characteristics of the infants according to the groups, it was determined that there was a statistically significant difference between the groups in terms of the week of gestation (Z=-2,662, p=0.008). When comparing the infants birth weight (Z=-0.311, p=0.756), height (Z=-0.012, p=0.990) and head circumference (Z=-0.061, p=0.952), there was no statistically significant difference between the groups (Table II).

There was no significant difference in terms of SpO_2 (Z=-1,895, p=0.058) and HR (Z=-0.723, p=0.470) between the groups. It was observed that there was a significant decrease in the SpO_2 of the infants in both groups and an increase in their HR values after the vaccination (Table III). When the groups were compared in terms of the difference in the decrease of SpO_2, it was determined that there was no significant difference between the infants in the KMC (-4.09±5.22) and BF (-4.49±6.08) groups (Z=-0.212, p=0.832). Similarly, it was observed that there was an increase of 16.17±11.43/min in the HR in the KMC group and an increase of 15.14±14.01/min in the BF group. There was no statistically significant difference between the groups (Z=-1,681, p=0.093) (Table III).

When comparing the groups in terms of the duration of crying, it was observed that there was no statistically significant difference (Z=-0.135, p=0.892). When comparing the groups in terms of NIPS score, it was also seen that there was no statistically significant difference between them (Z=-0.949, p=0.343) (Table IV).

Discussion

Non-pharmacological methods used to reduce pain in newborns include kangaroo care and BF. It has been determined that BF (10) and kangaroo care are effective at reducing pain (11).

Sajedi et al.'s (12) study examining the effect of kangaroo care on physiological parameters during intramuscular injections in newborns, determined that SpO_2 which was 97.2 before the injection decreased to 97.1 after the injection in the kangaroo care group. The reason for the stability of SpO_2 was associated with the vitamin K administration, which was different from the present study. This suggests that the hepatitis B vaccine causes a greater sense of pain than vitamin K injection.

Efe and Ozer (13) reported on the effects of BF on pain experienced during a vaccination stating that the HR of infants which was 138.85±35.89/min before the vaccination increased to 153.36±29.60/min after the vaccination, which

Table I. Distribution of the descriptive characteristics of the infants (n=70)

Characteristics		**Min.-Max.**	**Mean ± SD**
Gestation week (w)		37-42	39.04±1.41
Age (hour)		3-24	14.07±6.13
1st min APGAR		7-9	7.26±0.50
5th min APGAR		8-10	9.77±0.46
Birth weight (g)		2,500-4,000	3.297.14±381.09
Length (cm)		45-56	49.76±2.01
Head circumference (cm)		29-38	33.74±1.54
Characteristics		**n**	**%**
Sex	Girl	39	55.7
	Boy	31	44.3
Medical diagnosis	Healthy	70	100.0
Feeding choice	Breast milk	70	100.0
General health status	Quiet	70	100.0
Skin damage	Absent	70	100.0

SD: Standard deviation, Min.: Minimum, Max.: Maximum

Table II. Comparing the descriptive characteristics of the infants according to the groups (n=70)

Characteristics		**Kangaroo (n=35)**	**Breastfeeding (n=35)**	**Z**	**p-value**
		(Median)	**(Median)**		
Age (hour)		12.43±6.40 (12)	15.71±5.46 (16)	-2,327	0.020*
Gestation week (w)		39.56±1.22 (40)	38.48±1.42 (38)	-2,662	0.008**
1st min APGAR		7.40±0.55 (7)	7.11±0.40 (7)	-2,735	0.006**
5th min APGAR		9.66±0.48 (10)	9.89±0.40 (10)	-2,499	0.012*
Birth Weight (g)		3.310.29±387.03 (3,350)	3.284.00±380.24 (3,300)	-0.311	0.756
Height (cm)		49.86±1.93 (50)	49.66±2.11 (50)	-0.012	0.990
Head circumference (cm)		33.83±1.50 (34)	33.66±1.59 (34)	-0.061	0.952
		n (%)	**n (%)**	**χ2**	**p-value**
Sex	Girl	21 (60)	18 (51.4)	0.232	0.630
	Boy	14 (40)	17 (48.6)		

Z: Mann-Whitney U test; χ^2: Continuity (Yates) chi-square test
*p<0.05; **p<0.01

was similar to the present study. Efe and Ozer (13) reported that SpO_2 which was 96.64±2.93% before the intervention decreased to 95.97±3.08% after the intervention. In contrast to the present study, this smaller decrease in SpO_2 was associated with the fact that the age (2-4 month-old infants) of their sample group was higher than in the present study.

In the study by Fallah et al. (14) which compared the effects of kangaroo care, BF and swaddling on infants vaccinated with Bacillus, Calmette-Guerin (BCG), the infants were breastfed for two minutes before the vaccination and one minute during and after the vaccination, whereas the kangaroo care was applied ten minutes before the intervention and for one minute during and after the intervention. In the BF group, the duration of crying was found to be 26.61 seconds just as in the present study. However, it was observed that the duration of crying was two times longer in the kangaroo care group (45.12 seconds) than in the study group of the present study. In the study by Fallah et al. (14), the reason for the duration of crying being two times longer than the present study despite a longer period of kangaroo care was associated with the BCG vaccination.

Kashaninia et al. (15) evaluated the behavioral reactions of 100 healthy newborns to intramuscular injection and found that pain scores were lower in the kangaroo care group than in the control group to whom no kangaroo care was applied. At the same time, the duration of crying was found to be 14.55 seconds in the kangaroo care group and 24.61 seconds in the control group. The difference in

Table III. Distribution and comparison of SpO_2 and HR levels of infants before and after the vaccination (n=70)

Characteristics		**Kangaroo (n=35)**	**Breastfeeding (n=35)**	**[1]Z**	**p-value**
		(Median)	**(Median)**		
O_2 saturation	Before vaccine	96.37±2.59 (97)	97.46±2.24 (98)	-1,895	0.058
	After vaccine	92.29±4.81 (94)	92.97±6.39 (95)	-1,032	0.302
	Difference	-4.09±5.22 (-3)	-4.49±6.08 (-3)	-0.212	0.832
	[2]Z	-4,446	-3,635		
	p	0.001**	0.001**		
HR	Before vaccine	129.20±14.93 (130)	132.69±16.62 (129)	-0.723	0.470
	After vaccine	145.37±14.58 (146)	147.83±18.82 (144)	-0.206	0.837
	Difference	16.17±11.43 (18)	15.14±14.01 (13)	-1,681	0.093
	[2]Z	-4,670	-4,919		
	p	0.001**	0.001**		

[1]Z: Mann-Whitney U test, **p<0.01
[2]Wilcoxon Signed Rank test
HR: Heart rates

Table IV. Comparing the distribution of pain scores and the duration of crying of the infants before-after the vaccination (n=70)

Characteristics		**Kangaroo (n=35)**	**Breastfeeding (n=35)**		
		(Median)	**(Median)**	**[1]Z**	**p-value**
Duration of crying (seconds)	Before vaccine	0.00±0.00 (0)	0.00±0.00 (0)	0.001	1.000
	After vaccine	22.14±17.37 (18)	18.6±8.54 (18)	-0.135	0.892
	[2]Z	-5,013	-5,090		
	p	0.001**	0.001**		
NIPS score	Before vaccine	0.00±0.00 (0)	0.00±0.00 (0)	0.001	1.000
	After vaccine	6.46±1.27 (7)	6.29±1.36 (7)	-0.949	0.343
	[2]Z	-5,508	-5,373		
	p	0.001**	0.001**		

[1]Z: Mann-Whitney U test, **p<0.01
[2]Wilcoxon Signed Rank test

the data acquired from that study regarding the duration of crying in comparison to the results of the present study may be associated with the fact that vitamin K was administered intramuscularly in the study by Kashaninia et al. (15).

Kostandy et al. (16) suggested that skin-to-skin contact decreased the feeling of pain caused by the hepatitis B vaccine. They applied kangaroo care to newborns 10-15 minutes before the intervention, and found the duration of crying after the vaccination to be 16 seconds. The reason for the duration of crying being shorter than in the present study may be associated with the kangaroo care being applied to the newborns for 15 minutes before the intervention which is 12 minutes longer than in the present study.

Efe and Savaşer (10) examined the effects of BF and oral sucrose on pain caused by peripheral venous blood-letting in 102 newborns. They found that the duration of crying was 28.62±33.71 seconds in the BF group. The reason for the duration of crying being longer in those newborns in the BF group than for those in the present study may be associated with the difference of the intervention. Additionally, Efe and Savaşer (10) determined that the HR value which was 147.8±14.16/min before the intervention increased to 153.2±18.4/min after the intervention in those infants to whom sucrose was applied and the HR value which was 142.9±13.7/min before the intervention increased to 153.2±27/min after the intervention in those infants in the BF group and that there was no difference between them. In the study by Efe and Savaşer (10), HR increased by 10.3/min in the BF group before and after the application and by 15.14/min in the present study. It was thought that the difference of 4.84 /min between them may be associated with the differences between the interventions applied as the venous blood-letting procedure caused a longer sense of pain than the hepatitis B vaccine.

In their study examining the effects of various interventions applied to newborns on pain and the duration of crying, Yilmaz and Arikan (17) divided 120 newborns to whom heel lance would be applied into four groups, namely; breast milk, sucrose, pacifier and control groups. Two mL of breast milk was given to the breastmilk group via an injector two minutes before the procedure. The HR of the breast milk group increased from 132.60/min to 156.87/min after the intervention, which is similar to result of the present study. The reason for the higher HR rate values after the intervention compared to the present study was associated with the fact that the intervention was applied during BF in the present study, whereas in the study by Yilmaz and Arikan (17), breast milk was given via an injector before the intervention and also the heel lance application is a procedure lasting for a longer period.

In the present study, the pain score of the BF group to whom the hepatitis B vaccine was applied was found to be 6.29±1.36 over 7 points; whereas, in the study by Koç and Gözen (5), the pain score of the reflexology group was found to be 5.47±2.11 over 10 points. The pain scales used in the two studies are different but when compared, the pain score was found to be higher in the present study. The fact that the infants were older (6 months) and reflexology was applied as a method of reducing pain in the study by Koç and Gözen (5) was thought to have resulted in this difference as the infants in the present study were newborns and more sensitive to pain.

Study Limitations

Before the study, pain assessment was planned to be evaluated by a nurse who was blinded to the research and who would watch video camera recordings of the infants during the vaccine injection. However, it was considered that it would not be ethical to take video footage during BF and KMC and so the assessments were made by the researcher. Therefore, the limitation of this study was the lack of observers who were blinded to the research.

Conclusion

It was determined that even though there was no significant difference between the SpO_2 and HR levels between the groups before and after the vaccination, the HR of the BF group increased by less than KMC group after the vaccination.

The NIPS pain score was found to be lower in the BF group after the vaccination but this difference was not statistically different between the groups. Those infants in the BF group had a shorter duration of crying than those in the KMC group although this was not statistically significant. According to these results, it can be seen that BF is effective in order to reduce pain in infants induced by invasive interventions. Additionally, BF is easily applicable, takes little time, encourages breast milk and strengthens the mother-infant attachment.

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Ethics

Ethics Committee Approval: In order to conduct this study, ethics committee approval (IRB: 205) was received from Zeynep Kamil Maternity and Children Training and Research Hospital and institutional permission was obtained.

Informed Consent: Before conducting this study, the mothers of all the infants were informed about the study and their written permission was obtained via an informed consent form.

Peer-review: Internally peer-reviewed.

Authorship Contributions

Concept: T.K.T., Design: T.K.T., D.G., Data Collection and/or Processing: T.K.T., Literature Search: T.K.T., Writing: T.K.T., D.G.

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