

Effect of Fathers' Involvement in the Care of Neonates with Congenital Anomalies on Paternal Bonding: A Quasi-Experimental Study

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ABSTRACT

Background: The birth of a neonate with a congenital anomaly who is admitted to the neonatal intensive care unit (NICU) is a threat to the formation of paternal bonding. The present study aimed to assess the effect of fathers' involvement in the care of neonates with congenital anomalies on father-neonate bonding in NICUs.

Methods: This quasi-experimental study with a control group was conducted on fathers of neonates with congenital anomalies admitted to the NICU of Mofid Hospital affiliated to Shahid Beheshti University of Medical Sciences in Tehran, Iran, from January 2019-September 2021. A total of 60 participants were selected via the convenience sampling method and randomly assigned to two groups of experimental and control. The Mother-to-Infant Bonding Scale was used to collect the needed data. The intervention lasted for four weeks. In the first week, fathers attended three sessions on how to provide care; thereafter, over the next three weeks, fathers became involved in the care of their newborns. The data were analyzed in SPSS software (version 21), and a p-value less than 0.05 was considered statistically significant.

Results: After the intervention, there was a statistically significant difference between the mean scores of paternal bonding in two groups of control (4.41 ± 2.51) and experimental (2.21 ± 2.37) ($P=0.001$), with a lower score indicating a stronger paternal bond. The mean paternal bonding scores decreased to 6.59 ± 17.1 and 4.89 ± 0.54 in the two groups of intervention and control, respectively. The obtained results pointed to a significant difference between the two groups in terms of alterations in bonding scores ($P<0.001$).

Conclusion: As evidenced by the results of the present study, the participation of fathers in the care of their neonates with congenital anomalies was associated with a greater improvement of father-neonate bonding. Therefore, nurses need to devote more assiduous attention to the involvement of fathers in the care of these neonates.

Keywords: Congenital anomaly, Fathers, Neonatal intensive care unit, Neonates, Paternal bonding

Introduction

Congenital anomalies, which are structural, functional, or metabolic disorders affecting neonates at birth, are of prenatal origin and occur for a variety of reasons (1). A growing number of these anomalies has been endorsed across the globe during 2010-2016 (2). Congenital anomalies are responsible for 7% of neonatal deaths and millions of disabilities (3). The overall prevalence of congenital anomalies in recent years in Iran is on the rise and is estimated to be 18 per 1,000 live births (4).

The diagnosis of any congenital anomaly in a neonate is very stressful for parents since it affects their life and personal health, interferes with the performance of their parental role, and increases the risk of psychosocial problems (5,6). The birth of a neonate with a congenital anomaly is a threat to the formation of parent-neonate bonding (7,8); moreover, the hospitalization of these neonates in the neonatal intensive care unit (NICU) limits the physical contact of parents (10, 9). The conditions of the NICU, as well as the

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physical and bodily changes of neonates, interfere with the initial parent-neonate bonding (9) so that the process of bonding is impaired in 35% of neonates admitted to the NICU (9,10, 11). Parent-neonate bonding refers to a special emotional psychological connection between parents and neonates developing over time (12). The neonates who experience unsafe bonding will show such reactions as distress, anger, anxiety, and self-fear in the future (9, 13).

Bonding has positive effects, such as physiological stability, prevention of hypoglycemia, promotion of infant sleep, prevention of infection transmission, behavioral stability, reduction of crying, and a sense of security in the infant. Moreover, it stimulates the senses of the neonate when he/she is separated and lives in an incubator or is dependent on the equipment (12, 14). In addition, this bonding promotes parents' self-confidence, makes them ready and sensitive to take care of the neonate, and leads to an increase in their level of satisfaction (12). The time of the formation of this bond varies between parents. Mothers experience the creation of the bond during pregnancy and after birth; nonetheless, this bonding occurs in fathers slowly and more often after birth (15).

Fathers are the first people to enter the NICU and their support has a marked impact on the promotion of neonates' cognitive development (9,16) and sociability (17), as well as the reduction of the prevalence of early behavioral problems (18). Fatherly love is as equally important as maternal love in the neonate's health (19). However, almost all the studies have focused on the challenges of mothers, and less attention has been paid to fathers' role in neonatal care (9, 20)

Fathers of neonates with congenital anomalies face a variety of complex challenges (21) and their problems in parenting and communication with the neonate are the main cause of neonatal stress (22). In the NICUs, father-neonate bonding progresses slowly since fathers have limited interactions with their neonates due to the special conditions of neonates, the restrictions in the NICU, lack of facilities, and cultural issues (23). Fathers are referred to as the missing link in neonatal care (24, 25).

The involvement of parents in neonatal care is one of the basic principles of family-centered care and is a valuable way to reduce stress and increase parental empowerment (26, 24). Nurses play a supportive role in enhancing parental involvement in neonatal care, improving parents' skills and abilities, reducing parents' stress, and

ensuring neonatal safety by preparing the parents to take care of the neonate during hospitalization and after discharge (26). The results of studies have pointed out that training fathers on neonatal issues significantly reduces the level of anxiety experienced by fathers (27).

The birth of a neonate with congenital anomalies results in paternal stress and disrupts the process of paternal bonding. Moreover, this group of high-risk neonates often experience long-term hospitalization in the NICU and stay away from the parents; therefore, father-neonate bonding is formed much later after the birth of the neonate. Furthermore, only a few studies have addressed father-neonate bonding. In light of the aforementioned issues, the present study aimed to assess the effect of fathers' involvement in the care of neonates with congenital anomalies on the father-neonate bond.

Methods

This quasi-experimental study was conducted on fathers of neonates with congenital anomalies admitted to the NICU of Mofid Hospital affiliated to Shahid Beheshti University of Medical Sciences in Tehran, Iran, from January 2019-September 2021. The participants were fathers of neonates with congenital anomalies (head, face, neck, limbs, skeletal system, and nervous system) aged 20-45 years old. They were biological fathers and had no history of physical or mental illness, were able to read and speak in Persian, did not have any history of divorce, lived with their spouse, and had no previous experience of neonate hospitalization in the NICU. The neonates were single birth, admitted to the NICU, weighed over 1500 g, and affected with one of the physical congenital anomalies. Fathers were excluded from the study if their neonate's condition changed to severe illness during the study, the neonate was discharged, the mother suffered from postpartum depression or psychosis according to the case file, the father participated in the care of the neonate less than five times attending in NICU, and the neonate was transferred to another hospital. The participants were selected using the convenience sampling method and the selected fathers were randomly assigned to experimental and control groups. The number of participants in the research was calculated using the following formula; accordingly, 30 fathers were placed in each group considering the sample attrition rate:

$$n = 2(1.96 + 1.85)^2 \left(\frac{1}{0.70} \right)^2 = 25$$

$$\beta=0.20 \rightarrow Z \beta = 1.85$$

$$\alpha = 0.05 \Rightarrow z_{\alpha/2} = 1.96$$

$$1 - \beta = 0.80$$

$$(\mu_1 - \mu_2) / \sigma = 0.70$$

A demographic characteristics questionnaire and the Mother-to-Infant Bonding Scale were used to collect data. The demographic characteristics questionnaire contained items about father's age (year), education, income level, number of children, neonatal gender, neonatal birth rank, type of neonate feeding, type of anomaly, type of delivery, father's occupation, and neonatal age (days).

The Mother-to-Infant Bonding Scale was developed in 1997 to identify mothers' feelings about neonates and infants. This tool contains 10 items which measure mother-neonate bond on a 4-point Likert scale ranging from zero (not at all) to three (very high and most of the time). The total scores of the whole instrument vary from 0-30. A higher score indicates a weak bond and a lower score signifies a stronger bond with the neonate (28). This tool has been used in various studies and its validity and reliability have been established (29, 30). It can also be used to evaluate the father-neonate bond (32, 31, 20). This tool was translated into Persian for use in Iran and psychometrically measured on the community of fathers of premature neonates admitted to NICUs (20). Its validity was confirmed by an expert group consisting of 10 nurses and faculty members and the reliability of the scale was reported as 0.61 using test-retest reliability (20). In the present study, apart from examining the qualitative content validity and utilizing the opinions of experts, the content validity index (CVI) was determined from 0.71-0.80 and the internal consistency (Cronbach's α) of the scale was $\alpha=0.85$.

In the present study, the order of the control and case groups was determined based on a lottery, and the subjects were assigned to 10 groups ($n=6$). With a simple lottery, the first six fathers were allocated to the control group. After completing the sampling of the first six fathers (a duration of four weeks for everyone), one week was specified to avoid any contact between the fathers of the two groups, and the next six fathers were then placed in the intervention group. The lottery was then conducted again for the next two groups of six. Sampling continued until a sufficient number of people were included in the sample (i.e.,

from January 2019-November 2021).

In the control group, on the third day of hospitalization, after ensuring that the fathers visited the neonates, the demographic questionnaire and the Mother-to-Infant Bonding Scale were completed by the fathers in the NICU. In the control group, according to the NICU routines, the father just met his neonate.

In the experimental group, after making sure that the father and neonate met on the third day of the neonate's hospitalization, the demographic questionnaire and the Mother-to-Infant Bonding Scale were completed by the father in the ward. Thereafter, apart from the usual meeting of the fathers and neonates, the participants in the experimental group received the intervention for four weeks. The intervention consisted of three training sessions in the first week and six sessions of care delivery in the next three weeks (4 weeks in total). In the first training session, the fathers took an in-ward tour to get familiar with the ward environment, staff, and equipment, as well as the conditions of the hospitalized neonate. Subsequently, according to the type of neonate anomaly, in the second training session, fathers were instructed to take care of changing the neonate's position, feeding, hugging the neonate, touching, bathing, and changing the diaper. Moreover, some instructional materials were sent to the fathers separately for each type of care via WhatsApp. In the third training session, the fathers' questions were answered and some of the care services were practically performed by the researcher based on the father's needs. During the next three weeks, based on the father's desire and consent, a schedule was first planned for each father to engage in the care of the neonate twice a week.

In the second week, after the training sessions, the fathers attended the NICU twice at two days intervals; thereafter, the care was provided to the neonate by fathers with the support and presence of a researcher (third author). Before taking care, the researcher asked the father about that care, assessed the father's information, and re-taught him if necessary; subsequently, the father was asked to perform the desired care. Depending on the neonate's condition and needs, all fathers performed at least two of the care services at each time they attended the NICU. The fathers attended the NICU six times and cared for the neonate. It was possible to repeat the care at different times in the presence of the father.

At the end of the fourth week, the Mother-to-Infant Bonding Scale was completed again by fathers in the two groups. Six fathers were

excluded due to neonate discharge (n=3) and low participation rate (i.e., less than five times attending in NICU and taking care of neonate) (n=3). Fathers were present in NICU for a minimum of 2 and a maximum of 3 h. In both groups, the mothers were present at the neonate's bedside and the time interval between the fathers' visits was 2-3 days. The average time for the completion of both questionnaires was 10 min.

Ethical Considerations

This study was approved by the Ethics Committee of Shahid Beheshti University of Medical Sciences, Tehran, Iran (ethics code: IR.SBMU.PHARMACY.REC.1397.224). In addition, the objectives of the study were explained to the fathers and sufficient information was provided regarding the confidentiality of the questionnaires and the participants' withdrawal if they wished. The questions asked by the fathers were answered and they were assured of their neonate's safety. All fathers signed the written informed consent form.

Data Analysis

The data were analyzed in SPSS software

(version 21), and a p-value less than 0.05 was considered statistically significant. For qualitative variables, the chi-square test and Fisher's exact test were used, while for quantitative variables, an independent samples t-test was used when the data were assumed to be normal, and Mann-Whitney non-parametric test was employed when the data did not follow a normal distribution.

Results

The participants of this study included 60 fathers of neonates with congenital anomalies admitted to the NICU. The mean age scores of fathers were obtained at 29.7 ± 3.71 and 33.88 ± 6.45 years in intervention and control groups, respectively, signifying a statistically significant difference between the two groups ($P=0.006$). The mean age scores of neonates were reported as 2.89 ± 1.28 and 3.09 ± 0.88 days in the intervention and control groups, respectively ($P=0.726$). Most fathers in both groups were employees ($P=0.681$), and more than half of neonates in both groups were male ($P=0.128$) and born by cesarean section (CS) ($P=0.108$). The demographic characteristics of fathers and neonates are displayed in Table 1.

Table 1. A description of the participants' demographic characteristics in the two groups

Characteristics	N(%)	N(%)	P-value
Father's education level			
High school and lower education	2 (6.7)	4 (12.3)	P=0.501*
Diploma	21(70)	20 (66.7)	
Academic degree	7 (23.3)	6 (20)	
Income level			
Weak	2 (6.7)	2 (6.7)	P=0.842*
Moderate	8 (26.7)	11(36.7)	
Good	20 (66.6)	17 (56.6)	
Number of children			
1-2	26 (86.7)	25 (83.4)	P=0.351*
2-4	2 (10)	4 (13.3)	
More than 4	1 (3.3)	1(3.3)	
Neonatal sex			
Female	14 (48.3)	15 (50)	P=0.107**
Male	16 (51.7)	15 (50)	
Neonate's birth rank			
First	17 (56.7)	13 (44.8)	P=0.447*
Second	9 (30)	12 (41.4)	
Third	3 (10)	3 (3.9)	
Fourth and more	1 (3.3)	2 (4.8)	
Neonate's feeding type			
Bottle-feeding	5(16.7)	4(10.3)	P=0.486**
Breast-feeding	25 (83.3)	26 (89.7)	
Neonate's anomaly			
Head, face, neck	17 (56.7)	19 (64)	P=0.118***
Nervous system	11(36.7)	9 (27.1)	
Muscular system and limbs	2 (6.7)	2 (6.9)	

Mann-Whitney U*; Chi-Square test**; Fisher exact test***

The results demonstrated that in the control group, the fathers' bonding scores in the post-test decreased, compared to those obtained in the pre-test, pointing to a significant difference ($P=0.001$). In the intervention group, a significant decrease was observed in the bonding scores after the intervention, compared to those before the intervention, signifying a significant difference ($P=0.001$). The comparison of the two groups demonstrated a significant difference in the bonding scores between the two groups after the intervention ($P=0.001$; Table 2). The mean paternal bonding scores decreased to 6.59 ± 17.1

and 4.89 ± 0.54 in the intervention and control groups, respectively. The results marked a significant difference between the two groups in terms of the changes in the bonding scores ($P<0.001$). The results of the analysis of covariance indicated that by adjusting for the variable of father's age, the average paternal bonding score on the post-test was 2.26 points lower in the intervention group, as compared to that in the control group (Table 3). No statistically significant correlation was observed between any of the demographic variables and paternal bond ($P>0.05$).

Table 2. Intra and intergroup comparisons of paternal bond scores

Group Stage	Intervention Mean \pm SD	Control Mean \pm SD	P-value
Pre-intervention	8.80 \pm 3.45	9.30 \pm 3.05	0.59*
Post-intervention	2.21 \pm 2.37	4.41 \pm 2.51	0.001*
P-value	0.001**	0.001**	

Paired samples t-test**; Independent- samples t-test*

Table 3. ANCOVA model with adjusting for father's age to compare paternal bonds in the two groups

Parameter	Estimation coefficient	Standard error	t-test	P-value	CI95%	
					Lower limit	Upper limit
Father's age	0.016	0.066	0.244	0.808	-0.117	0.149
Father's bond score before intervention	0.176	0.100	1.761	0.084	0.025	0.377
Intervention group	-2.256	0.721	-3.128	0.003	-3.704	-0.807
Control group	Reference point	0.00	0.00	0.00	0.00	

Discussion

This study was the first to examine the effect of fathers' involvement in the care of neonates with congenital anomalies on father-neonate bonding in the NICU. The results of the present study suggested that father-neonate bonding (scored 10 out of 30) was high in fathers of neonates with congenital anomalies (since the lower scores indicated a stronger bonding). On the contrary, Morovati et al. (2016) reported a lower score for father-neonate bonding in fathers of premature neonates (score 15 out of 30) (20). This discrepancy in results can be attributed to differences in the research sample and the type of intervention implemented in the present study.

Although it is expected that malformation in appearance, especially in neonates' faces and limbs, such as the small and fragile forehead of a premature neonate, can negatively affect physical contact and father-neonate bonding. In the present study, the fathers of neonates in the control group were also present in the NICU according to a predetermined schedule. Therefore, this issue may have affected father-neonate bonding scores in the control group.

In another study in Portugal, which was

almost similar to the present research in intensity, the mean father-neonate bonding score was 2.7 out of 3 measured on the first day after birth with a different questionnaire (29). Arshadi et al. also reported a high bonding score for a sample of 100 fathers of premature neonates in Tabriz (19). Although the father-neonate bonding has not received much attention in the current study as the mother-neonate bonding, it needs to be given more attention since fathers also have innate abilities to develop bonds and engage in neonatal care, especially fathers of neonates with congenital anomalies.

In the current study, the father-neonate bonding was significantly improved in both groups in post-test, compared to that in the pre-test. The father-neonate bonding begins as a special and reciprocal interaction from birth and develops during the first year of a neonate's life (33). Therefore, the presence of fathers can facilitate the development of father-neonate bonding over time as was the case for fathers in the control group in the present study. Research has also shown that in addition to factors, such as birth type and skin contact, the presence of fathers is also positively related to the father-neonate

bond (34).

The results of the present study pointed out that the improvement of fathers' bonding was significantly greater in the intervention group, as compared to that in the control group. Lower scores significantly showed that fathers were able to establish a stronger bond with their neonates than those in the control group. It appears that fathers' involvement in care, such as positioning and feeding the neonate, as well as changing diapers, leads to skin-to-skin contact with the neonate and creates special emotions, such as gratitude, happiness, and love that can enhance the paternal bond. In a study in 2019, the fathers participating in the study stated that their participation in care and their physical contact with healthy neonates had a positive effect on improving their bonding and responsibility (35).

Inconsistent with the results of the present research, a cohort study in 2021 demonstrated that the duration of paternal leave was not a stable predictor for father-infant bonding. This disparity can be ascribed to the assessment of bonding at 14 months postpartum and different cultures of fathers (German). In line with the present study, fathers' leave had been a predictor of father-infant bonding through the duration of infant care (36).

In accordance with the results of the present study, a clinical trial in Taiwan on 83 fathers of hospitalized neonates indicated that skin-to-skin contact with the neonate, as well as care, such as changing positions, changing diapers, and bathing by fathers, could enhance all dimensions of the dependence questionnaire in fathers (37). Furthermore, participation in neonatal care and skin-to-skin contact with the neonate can lead to more parent-neonate interaction by the reduction of parental stress and anxiety (38).

It has also been reported that skin-to-skin contact between father and neonate can reduce fathers' stress and anxiety by increasing oxytocin levels. Increased oxytocin promotes feelings of security, reduces anxiety, fosters feelings of satisfaction, and increases fathers' empathy and emotional connection with the neonate (39). Evidence also suggested that testosterone levels also decrease when fathers participate in a child's care and become more sensitive to the neonate (40), and all these exert a positive effect on the development of the paternal bonding process. In the present study, oxytocin levels were not measured; nonetheless, the increase in father-neonate bonding in the intervention group can be attributed to increased oxytocin levels following

skin-to-skin contact during neonatal care. Nonetheless, multiple studies have emphasized the positive effects of father-neonate bonding on the improvement of neonatal health. Moreover, they have identified father-neonate involvement and contact as actions contributing to the development of father-neonate bonding, as well as the promotion of neonate and family health (38, 41, 41). However, in NICUs in Iran, the presence of fathers and their engagement in neonatal care is not common for cultural reasons, and nurses spend less time with fathers (42).

The results of this study confirmed the beneficial presence of fathers and their participation in neonatal care in NICUs. The participation of fathers in the care led to skin contact between fathers and newborns. Moreover, engaging in the care of neonates with congenital anomalies admitted to the NICU and performing daily care in unexpected and stressful conditions can lead to a sense of self-confidence and greater adaptation to the conditions of the ward, thereby strengthening father-neonate bonding (37).

Fathers' involvement can also increase their sensitivity to neonates' reactions and behaviors, thereby improving the level of bonding (20). The results of a related study have suggested that fathers' involvement in daily care, such as bottle-feeding, has a great impact on the improvement of father-neonate interaction and bonding between them (43). Furthermore, a qualitative study evaluated the level of participation, beliefs, and self-confidence of fathers during neonates' hospitalization in the NICU and showed that making a special bonding was one of the experiences of fathers in participating in neonatal care. The fathers acknowledged that owing to their involvement in neonatal care, despite concerns about time constraints, a deep emotional bonding was developed between them, creating closeness and intimacy between them (38).

Another study assessed the effect of fathers' involvement in umbilical cord amputation on fathers' emotions, including father-neonate bonding. The results demonstrated that father-neonate bonding in fathers who had an experience of cutting the umbilical cord of their neonate increased one month after birth (29). In a similar vein, Morovati et al. showed that the participation of fathers in the care of premature neonates admitted to NICU based on developmental care increases the rate of father-neonate bonding and fathers' self-efficacy (20). In the present study, father-neonate bonding scores were not significantly correlated with fathers' and neonates'

demographic characteristics. Nevertheless, the results of a study by Bostanabadi et al. did not confirm the findings of the present research (19). The differences in the research environment and population may account for this disparity. Unlike the current research, in the abovementioned study, the neonates did not have any abnormalities, and fathers were referred to the clinic for the initial examination of their infants.

Incompatible with the results of the present research, another study with a statistical population different from the present study signified that the father's bond with a premature neonate admitted to three NICUs in the United States was more related to neonates' characteristics than father's demographic characteristics (34). To the best of our knowledge, no study has addressed paternal bonding in fathers of neonates with congenital anomalies. Therefore, it is recommended that further studies address factors affecting father-neonate bonding in Iranian society.

Among the notable limitations of this study, we can firstly refer to the self-reporting nature of the data collection tool. Secondly, given the impossibility of fathers' presence in the morning shift, the intervention was performed in the afternoon shift when too much noise sometimes disrupted fathers' focus on care. In addition, the father's mental and physical conditions at the time of care could have affected the outcomes of the study. The results of the present study should be generalized with caution since the research environment was concentrated only in one hospital.

It is suggested that fathers be encouraged to attend neonatal intensive care units to increase the possibility of promoting paternal bonding by taking care of their neonates. Further studies are also recommended to assess father-neonate bonding in fathers of neonates with major and combined abnormalities. The main contribution of the present study was that it was the first research conducted on fathers of neonates with physical abnormalities.

Conclusion

Fathers' involvement in the care of neonates with congenital anomalies is associated with a marked improvement in father-neonate bonding. Nurses need to devote more attention to educating fathers and involving them in the care of neonates, and this should be taken into account in the promotion of all care issues. The development and implementation of educational

programs are of particular importance in improving fathers' care capacity and skills, encouraging their presence in neonatal intensive care units, and removing the existing barriers. The implementation of educational programs for nurses and their familiarization with developmental and family-oriented care, as well as paying attention to neonates and parents as a unit of care, can have positive effects on the improvement of father-infant bonding

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Conflicts of interest

The authors declare that they have no conflict of interest regarding the publication of this article.

Ethical consideration

The present study was extracted from an M.Sc. thesis in neonatal intensive care nursing in Shahid Beheshti University of Medical Sciences and approved by the Ethics Committee (IR.SBMU.PHARMACY.REC.1397.224). All participants in the study were informed of the study objectives and signed a written informed consent form and were assured of the confidentiality of their personal information and the voluntary nature of participation.

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