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Improvement of Hypothermia Control and Management Methods in Term Newborns after Training on Neonatal Hypothermia with the Help of Clinical Audit

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ABSTRACT

BACKGROUND AND OBJECTIVE: Maintenance of temperature at normal range by supplying heat and reducing its loss is an important part of neonatal care. This study aimed to investigate the effectiveness of in-service training for nurses on maintaining normal body temperature and eliminating heat stress and to compare the care practices to the current standards in term new-borns, before and after training on neonatal hypothermia care in hospitals affiliated to Babol University of Medical Sciences, in 2014.

METHODS: This descriptive-intervention study was performed on 98 newborns to evaluate the nursing care provided for prevention of neonatal hypothermia in the operating rooms, maternity and neonatal wards, and NICUs before and one month after training on neonatal hypothermia care. The data were obtained using a self-regulated checklist, which was designed according to the relevant standards of care for prevention of hypothermia. The checklists were scored based on the number of provided nursing care practices. The intervention included speech, educational posters, leaflets, and slides.

FINDINGS: The mean scores of nursing care before and after the intervention were 4.6±1.1 and 7.0±1.4 (out of 10), respectively, in the delivery rooms the respective mean sores were 8.4±1.4, and 11.1±0.7 (out of 13), for the operating rooms they were respectively 5.9±1.8, and 7.3±0.8 (out of 11), and in the NICUs they were 8.0±1.5, and 9.8±2.0, respectively (out of 14; p=0.0001). The prevalence of mild hypothermia at birth in the operating and delivery rooms was 38.1% and 21.5% before and after training, respectively.

CONCLUSION: The highest level of care for the preservation of warm chain was provided in operating rooms and the lowest level of care was observed in delivery rooms. To prevent hyperthermia, health policy-makers are recommended to focus more attention on maintaining temperature in and providing facilities for this purpose.

KEY WORDS: Hypothermia, Clinical Audit, Newborn.

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Introduction

Neonatal mortality rate is one of the indicators of development in any country. Maintenance of normal temperature in neonates and providing care for prevention of hypothermia are extremely important for reducing the rate of mortality in newborns (1-4). Thermal instability in newborns occurs when body temperature is out of the normal range. The normal range of axillary and skin temperatures in term newborn are 36.5-37.5° C and 35.5-36.5° C (5). Intermediate and severe hypothermia occur at 32-34.9° C and under 32° C, respectively.

All the newborns are at risk of thermal instability. Maintaining body temperature at a normal range through providing heat and decreasing its loss is an important part of neonatal care. In the absence of constant monitoring, body temperature of newborns might immediately decrease, and calorie and oxygen consumption would increase in order to compensate for the lost heat, which leads to a rapid depletion of energy resources (brown fat and glycogen) (5).

Keeping the newborns warm is one of the responsibilities of healthcare providers, and nurses as one of the biggest groups of healthcare providers, must have adequate knowledge and skills in order to prevent hypothermia (6). Quality of care is dependent on heat chain provision, early detection of hypothermia, and performing urgent therapeutic interventions. In prevention of hypothermia, the standards and desirable nursing care level should be determined. One of the common methods for improvement and evaluation of quality is clinical audit (7).

Through clinical audit, various aspects of diagnosis, treatment, patient care, and use of resources can be evaluated and compared with the standards. Therefore, it can help with identifying weaknesses and removing the differences and shortcomings to achieve the best possible treatment (8-10). Investigating the impact of nursing care on neonates and providing feedback on nurses' practice, in addition to enhancing motivation for improvement of care procedures, can improve the quality of neonatal services through proper planning in various aspects of nursing care (5, 11).

As a result, we should make sure that urgent care is provided for newborns in maternity wards, operating rooms, neonatal units, and during transition of newborns, so that harm to newborns is prevented, and neonatal hypothermia is not developed. This study was conducted to provide information on maintaining the natural body temperature and eliminating thermal stress and to compare the provided care practices with the standards before and after training on neonatal hypothermia care, in hospitals affiliated to Babol University of Medical Sciences, 2014.

Methods

This descriptive-intervention study was conducted on 98 term neonates in 2014, after obtaining approval of the Ethics Committee of Babol University of Medical Sciences and explaining the purpose of this study to the officials of the operating rooms, neonatal and maternity wards, and neonatal intensive care units (NICU) of the hospitals affiliated to Babol University of Medical Sciences. The number of observations in Ayatollah Rohani Hospital, Shahid Yahyanejhad, and Amirkola children, and the mean number of monthly admission of patients in each of the mentioned hospital wards were recorded. According to Delavar et al. the prevalence of hypothermia is reported to be about 42% (12). The nursing care scores before and after training were given based on the number of nursing care practices observed in each hospital ward. The study included the care related to maintenance of heat chain, which is used to prevent hypothermia. A total of 98 cases of care were selected through gradual random sampling method before and after the intervention.

In each hospital ward, structured observations were performed during care practices for prevention of hypothermia using an especially designed checklist. The results of the observations were recorded as "it was being done" and "it was not being done". The care provided for the maintenance of heat chain to prevent hypothermia before and one month after training was evaluated. Moreover, we measured the body temperature of 42 newborns, who were born in the maternity wards and operating rooms of the hospitals affiliated to Babol University of Medical Sciences at birth, as well as before and after transition.

The data collection tools included four self-regulated checklists that could determine the level of standard nursing care for prevention of neonatal hypothermia in various wards. Information related to body temperature of the neonates, who were born in the maternity wards and operating rooms, was recorded at birth, before and after transition, and before and after training. Eventually, the obtained information was compared with the standards. Factors requiring modification were improved through training (intervention). The intervention included speech,

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putting up educational posters, distributing pamphlets and educational materials, and slides installed on the computers of each ward. After that, care practices for prevention of hypothermia in 98 newborns was observed once again, and the sores obtained before and after training were compared with each other.

The checklists were designed based on the latest standards indicated in nursing and medical reference books, scientific articles published in reliable journals, and instructions of hospitals that were mostly for recognizing the ability of personnel in identifying ways to prevent neonatal hypothermia and providing solutions (5, 12-17).

Checklist 1: Care for prevention of hypothermia in the neonatal wards included 10 items such as measuring the body temperature at birth, immediately covering up the baby with a piece of cloth after entering the neonatal ward, covering infants' head with a hat, having attendants of the newborns warm their hands, using a probe, adjusting the incubator or heating, adjusting hospital bed or incubator, setting the neonates' room temperature at 26-22°C, measuring the temperature of the baby one and four hours after birth, and covering the scale's pan with warm bedding.

Checklist 2: Care for prevention of hypothermia in the maternity wards included thirteen items as follows: having the door of the ward closed, adjusting the temperature of the maternity room at 25-28° C, keeping the recovery bed warm beforehand, keeping infants' covers warm under a heater before the surgery, using three towels for drying, keeping the heater away from the way or air outlet, covering the scale with a warm bedding, putting the infant on mother's stomach while being covered with a hat and blanket, starting breast feeding 30 minutes after birth, measuring the temperature of the infant before transition, and covering the infants with clothes, a hat, and socks after birth.

Checklist 3: Care for prevention of hypothermia in the operation rooms included eleven items such as adjusting the maternity room temperature at 25-28° C, keeping the recovery bed warm beforehand, adjusting the side rails of the hospital beds, warming the newborn quickly, keeping the infants' covers warm under a heater before surgery, using three towels for drying, keeping heaters away from the way or air outlet, covering the scale with a warm bedding, measuring the temperature of the baby before transition, and covering the infants with clothes, a hat, and socks after birth.

Checklist 4: Care for prevention of hypothermia in the NICUs included fourteen items as follows: continuous monitoring of body temperature of infants who needed special care, connecting probe to the infant, not putting the infant on the sensor (the place of probe), placing the cot or incubator one meter away from the wall or window, adjusting the side rails of the bed or incubator, adjusting the heater or incubator according to the body temperature of the infants, having the sensor and the place of skin that is located on the sensor clean, wetting oxygen to prevent evaporation of skin, setting the respiratory or ventilation hood above temperature 35-34°C, warming the hands before touching the baby, keeping the temperature of NICU at 26-22°C, bathing the baby six hours after birth, and measuring the temperature of the baby before and after bath. Contents of the checklists, speech topics, educational posters, leaflets, and slides were validated in terms of the clarity, easiness, and being relevant to the questions and contexts of standard nursing for the prevention of neonatal hypothermia in different wards at the pilot stage and before the start of the main study. Validity of the contents was established by neonatologists and faculty members of School of Nursing and Midwifery. In addition, the checklists were given to two observers, who simultaneously filled out ten checklists for 10 newborns.

Intra-class correlation coefficient of the checklists was calculated to be 0.81. First, the total score of each form was estimated, then descriptive (frequency, percentage) analysis and Chi-square, t-test, and Fisher's exact test were performed, using SPSS version 16. $p<0.05$ was considered statistically significant.

Results

The mean weight and Apgar scores of the infants at birth were 3.3±0.3 kg and 9±3, respectively. Standards of care for prevention of hypothermia for term newborns was 54%, which increased to 70% after the intervention (P=0.0001). The highest level of consistency between hypothermia-prevention care practices and the standard care (based on the care checklists for prevention of hypothermia in neonatal rooms) was related to adjusting the side rail of bed or incubator and adjusting the temperature of the neonatal room. The standards of care for prevention of hypothermia for term newborns in the delivery rooms was 64.6%, which increased to 85.4% after training (p=0.0001). Care practices related to warming the

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newborn quickly, pre-heating the bed and coverings of the newborn, and breast feeding by mother 30 minutes after birth at delivery room had the highest level of consistency with the standards. The mean temperature of the hypothermic newborns was 26.5±1.4°C, and the mean temperature of the rooms of non-hypothermic newborns was 25.0±1.7°C. During the first evaluation of the operating rooms, almost 21% of the standards of care for prevention of hypothermia in term infants were followed. This value increased by 4.7% after training and auditing the implementation of the standards (p=0.0001). The highest level of care for prevention of hypothermia was associated with keeping the newborn warm, pre-heating the coverings of the newborn, and using three towels for drying the infants. Following the standards of care for prevention of hypothermia in term newborns in the NICUs in the first evaluation was about 36.3%, which reached to 44.5% after training and auditing (p=0.0001). Adjusting the side rail of bed or incubator, and using wet oxygen had the highest level of consistency with the standards of care for prevention of hypothermia in the NICUs (table 1). After training, the mean temperature of the delivery and operating rooms (p=0.002), the mean body temperature of the newborns at birth (p=0.049), and the mean body temperature of the newborns after transition (p=0.020) significantly increased (table 2). The prevalence of hypothermia decreased (<36.5°C) after the intervention (from 38.1% to 19%), which was not statistically significant.

Table 1. Evaluation of care provided for prevention of hypothermia in term newborns in the neonatal wards, delivery and operating rooms, and neonatal intensive care units

Stages of the study	not being done N(%)	being done N(%)	Total N(%)	P-value
Neonatal intensive care unit (N=34)				
Before	4.6(46)	5.4(54)	10(100)	0.0001
After	3(30)	7(70)	10(100)	
The maternity ward (N=14)				
Before	4.6(35.4)	8.4(64.6)	13(100)	0.0001
After	1.9(14.6)	11.1(85.4)	13(100)	
The operating room (N=28)				
Before	5.1(18.2)	5.9(21)	11(100)	0.0001
After	3.8(13.5)	7.2(25.7)	11(100)	
The neonatal intensive care unit (N=22)				
Before	4.2(19)	8.0(36.3)	14(100)	0.0001
After	4.2(19.0)	9.8(44.5)	14(100)	

Table 2. Total assessment of the effect of training on the term infants' temperature (n=42)

Intervention / Body temperature of the newborns	Before Mean±SD	After the Mean±SD	P-value
At birth	36.7±0.1	36.9±0.5	0.490
Before transmission	36.6±0.2	36.8±0.4	0.102
After transmission	36.5±0.5	36.7±0.2	0.020
Room temperature	25.6±1.0	26.3±0.8	0.002
Hypothermia (36.5>) N(%)	16(38.1)	9(21.5)	0.479
Without Hypothermia (36.5≤) N(%)	26(61.9)	33(78.5)	

Discussion

The prevalence rate of hypothermia in this study was 38.1%. The prevalence of neonatal hypothermia is different in various parts of Iran. In a review article, the prevalence of hypothermia in term newborns in Iran was reported to range between 4.7% and 53.3% (18). In a study conducted by Aghajani Delavar et al., the prevalence of hypothermia in healthy term newborns in the hospitals affiliated to Babol University of Medical Sciences was reported to be 42% (12). In addition, after one month of training, the level of hypothermia reduced by 10.5%.

The prevalence of hypothermia in Babol, north of Iran, was higher than Ahvaz, south of Iran (19). There are several reasons for this difference, the most important of which can be the warm weather of the south of Iran. The prevalence rate of hypothermia in Tehran is reported to be more than 50% (20). Hypothermia in developed countries is only observed in infants with weight loss. Previous studies showed that the prevalence of hypothermia in low-weight infants in Canada ranged between 11.5% and 12.5% (4). Therefore, the applied interventions for prevention of neonatal hypothermia have not been sufficient. The mean room temperature in hypothermic infants was 26.5±1.4° C, and the mean room temperature in non-hypothermic newborns was 25.0±1.7° C.

The temperature of the delivery rooms did not have a significant relationship with hypothermia, even though training had an effect on the increase of the room temperature. Akbarzadeh Bagheban et al. conducted a study on infants hospitalized in the NICU; it was reported that room temperature had a significant effect on eliminating hypothermia (1). However, these results were not in agreement with those of our study. There are several reasons for this discrepancy, the most important of which is the short stay of newborns in delivery rooms. According to the checklists, the level

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of care for prevention of hypothermia in various wards before and after training was different. The least amount of care for prevention of hypothermia was observed in the operating rooms and the most mount of it was observed in the delivery rooms. In a study performed to evaluate the nursing care for the prevention of hypothermia in the hospitals affiliated to Beheshti University of Medical Sciences, it was reported that the most amount of care was provided in NICUs (21).

In our study, the method of care for prevention of hypothermia, and the most and the least amount of care was different in each ward, and based on the designed checklists it was inconsistent with the standards. In the NICUs, adjusting the side rail of hospital bed or incubator and the use of wet oxygen were the most commonly observed care practices for prevention of hypothermia. In a study by Najafipoor et al., the quality of care for the prevention of hypothermia was higher than other studies (21).

In the neonatal wards, training had the lowest effect on usage of probe and routine measurement of body temperature of the newborns. In the delivery rooms, training had the lowest effect on regulation of room temperature and measuring the temperature of the newborn before transition. In the operating rooms, the lowest effect was pertinent to measuring infants' body temperature and covering their head with a hat and putting clothes on them before transition, and in the NICUs, the least impact was observed in adjusting the wards' temperature and warming hands before touching the infants. Neonatal hypothermia remains an unresolved problem. Although simple training (general) on care for the prevention of hypothermia has improved the preventive methods and controlling of hypothermia in term newborns in the neonatal and maternity wards, operating rooms, and NICUs, the provided care is still far from being standard. Providing sufficient training and effective evaluation of nursing educational programs are recommended to prevent hypothermia (13, 22).

For the educational programs to be effective, providing support before, during, and after the programs seems to be necessary (23). We suggest the healthcare policy-makers to monitor the maintenance of temperature and provide the required facilities. In addition, further studies on hypothermia in premature newborns, who are at higher risk of hypothermia, prevention of hypothermia with the help of hospital staff, holding workshops on clinical audit for hospital staff, and performing another clinical audit in neonatal wards, delivery and operating rooms, and NICUs is recommended.

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