Original Study

Management of Hypothermia in Neonates with A Locally Made Resuscitation Trolley System

Khalid Mahmood* Sajid Hameed* Liaquat Ali*

Abstract

Hypothermia is associated with large number of serious complications. We face a lot of problems while treating babies with preoperative and post operative hypothermia. Hypothermia is preventable if proper measures are taken. In our set up we do not have proper warming system in neonatology units. We managed hypothermia successfully in neonates pre-operatively and post-operatively with the help of a locally made resuscitation trolley system designed and made by the authors.

OBJECTIVES: To asses the outcome of the neonates with preoperative and postoperative hypothermia a locally made resuscitation trolley system was used.

DESIGN: Retrospective study

PATIENTS AND METHODS: All neonates with hypothermia were shifted to the automatic resuscitation trolley system. A four hourly record of axillary temperature of all the babies under study was kept. The warmer rods were operated at 750 watts maximum till the surface temperature of the babies was normal.

RESULTS: A total of 510 neonates were managed during the period from July 2005 to June 2007. Out of these 108 neonates suffered hypothermia during some phase of pre-operative period. Eighty seven hypothermic babies were managed post-operatively. Fifteen normothermic babies were also managed on this automatic system. All the neonates with hypothermia preoperative and post operative were managed successfully on this system. Of the fifteen normothermic neonates who were also managed on this resuscitation system, only two developed hypothermia of 1 degree C.

CONCLUSION: Proper warming system can prevent hypothermia in neonates and many lives can be saved.

INTRODUCTION

Neonatal hypothermia is one of the most common problems seen during the management of neonates especially in the winter season. Hypothermia is the killer for the babies. Most of the neonatal units in our hospitals are not properly equipped with a warming system to control the temperature. Hypothermia is preventable with a little effort. The commonly available warming systems in our hospitals are very expensive, being imported from overseas against foreign exchange. We have devised an automatic resuscitation trolley system with a simple and safe warning system. This warming system and its results are discussed.

PATIENTS AND METHODS:

The automatic warming system has following features:

Surface area: Maximum of the baby is 0.28 M [2].

Illumination: It consists of two halogen bulbs of 50 watts with grading system to control the intensity of light.

Warming sources: Two glass rod elements of 750 watts rating of each are utilised. These are placed at the distance of 0.9 meters from the target surface.

Warming control system: This dual system, having a manual control, consists of a pure manual control for the intensity of the warming elements and an automatic system which consist of a sensor with a servo mode, sensing the temperature at the surface of the body of neonate and then controlling the working of the warming elements.

Alarm system: This is consists of a pulsatile tone with each pulse of radiation emitted. Volume of the tone is controllable.

Bed for neonate: It is very comfortable and is 0.9 meters from the heating elements.

Oxygen cylinder: It is attached on its side with a safe port for the delivery of oxygen at the time of need.

Suction Apparatus: It is provided near the base of the trolley for the suction of nasopharynx

Pulse oxymeter: It is attached on its front panel for the monitoring of oxygen saturation and pulse of the baby.

Head box: It is supplied for the safe delivery of oxygen to the baby.

During the time between July 2005 to June 2007, 510 neonates were managed with surgical problems in the Department of Paediatric Surgery, Allied Hospital, Faisalabad. One hundred and eight neonates suffered hypothermia during some phase of the pre-operative period. Eighty seven hypothermic babies were managed post-operatively. Fifteen normothermic babies were also managed on this automatic system. All neonates with hypothermia were shifted to automatic resuscitation trolley system. The four hourly record of axillary temperature of all the babies under study was kept. Actual body temperature was calculated by adding one degree C to the axillary temperature noted and cross checked with core temperature taken by a rectal thermometer at random. Both warmer elements were operated at 750 watts rating with manual control for a variable period of time till the body temperature rose to normal i.e 37^0 C. The warmer was slowed to 300 to 150 watts rating with a shift to the auto control system subsequently. For auto control, skin temperature was assessed with the help of probe sensor taped at some convenient site on the abdomen or axilla. The heart rate and oxygen saturation was also noted from pulse oxymeter on the system.

RESULTS

A total of 108 hypothermic neonates were managed on warming system pre-operatively. All of theses cases recovered from hypothermia successfully. Out of 87 hypothermic post-operative babies, who were managed on the trolley, only 5 could not recover from hypothermia and succumbed. Out of 15 normothermic babies, only 2 could not recover and died. We did minor surgical procedures with great convenience on this trolley such as maintenance of i/v line, exchange transfusion, wound debridement and chest intubations.

Table I
Outcome of preoperative hypothermic babies Managed on warmer system

No. of patients	Patients who suffered from hypothermia preoperatively	Managed on trolley system	Recovered
510	108	all	all

Success rate: 100%

Table II
Outcome of postoperative hypothermic babies Managed on warmer system

No. of patients	Patients who suffered from hypothermia postoperatively	Managed on trolley system	Recovered
510	87	87	82

Success rate: 94.25 %

Table III
Outcome of normothermic babies Managed on warmer system

No. of patients	Normothermic babies	Managed on trolley system	Recovered
510	15	15	13

Success rate: 86.6 %

DISCUSSION:

Hypothermia is a preventable problem. After delivery, the relative low ambient temperature and evaporation of the residual amniotic fluid from the skin increase the heat loss from the neonates. Neonates are homeotherms [1]. They are far more susceptible to change in environmental temperature than adults are because of small mass and a relatively large surface area, with little insulating material such as fat and hairs. The core temperature of a wet uncovered baby can drop by up to 1^0 C each minute. Heat is also lost through radiation, conduction, convection, evaporation, feeding and with excreta.

The neonates are unable to respond to cold by shivering, but have a highly specialized brown adipose tissue. This is capable of generating heat without shivering. Adequate preventive measures taken in this respect will certainly improve the management of neonatal problems. Hypothermia leads to acidosis and

hypoxia worsening cardiac function and destruction of surfactant [1,2]. Resuscitation of hypothermic babies is difficult as they show poor response to resuscitation measures especially the fluid therapy. The effect of anaesthetic agents is prolonged in the presence of hypothermia. Sepsis in the neonate can also lead to hypothermia [3,4].

During the winter months from November to March most of the newborns are found to be hypothermic at the time of admission. This is because of lack of knowledge of the attendants to take necessary measures to protect the newborn from cold during transportation without mothers. The need of specialized transport teams for the sick babies has been stressed.

In our set up a number of deaths can be attributed solely to hypothermia in the nurseries [5]. Our financial constraints do not justify buying costly warming equipments for our existing and newly constructed neonatal units. As a compromise following measures are routinely used to overcome the problems of hypothermia in our nurseries.

1-Room temperature is controlled with the help of gas and electric heaters or air conditioners.

2-Keeping the babies warm with the help of branded warming trolleys [6], incubators and warming blankets [7].

Considering the need for a cost effective and efficient neonatal warming system, the authors studied the problems of hypothermia[8,9,10,11] and subsequently designed an automatic warming system to overcome this complicated problem. The simple version of this system is already in successful use in various pediatric units in the country[12]. Our warming system is simple, requires minimal maintenance and proves to be effective. Results obtained with this system are comparable to standard resuscitation trolley systems. We faced significant difficulties in getting foreign systems. Most of the time spare parts of these systems are not available. This system will not only fulfills the needs of our neonatal intensive care units and operation theatre, but also help to save valuable foreign exchange.

REFERENCES

1. Pierro A, Eaton S, Ong E. Neonatal physiology and metabolic considerations. In: Grosfeld JL, O`Neill JA, Coran AG, Fonkalsrud EW eds. Pediatric Surgery. 6th ed. Philadelphia: Mosby Elsevier 2006:89-108.
2. Stains J, Turner TL. Taking care of the preterm infants. The Practitioner, 1996; 240(1567): 459-62.
3. Lenhardt R. Monitoring and thermal management. Best Pract Res Clin Anesthesiol, 2003 Dec;17(4):569-81.
4. Sessler DI. Preoperative heat balance. Anesthesiology 2000 Feb; 92(2): 578-96.
5. Shah AA, Waseem R, Saeed A et al. Frequency, risk factors and outcome in admitted neonates presenting with hypothermia. Pak Paed J June 2006;30(2):80-4.
6. Bredahl C, Lambert JP, Freundich M. Effect of radiant heater on post operative hypothermia; comparison with a reflective blanket. Eur J Anaesthesiol 1995; 12(6): 56-59.
7. Forstal RM. Etiology and management of inadvertent preoperative hypothermia. J Clin Anesth 1995; 7(8): 657-74.
8. Insler SR, Sessler DI. Peroperative thermo regulation and temperature monitoring . Anesthesiol Clin. 2006 Dec; 24(4): 823-37.
9. Brauer A. Perl T. Quintel M. Peroperative thermal management. Anesthetist 2006 Dec;55(12): 1321-39.
10. Khan SA.Post operative hypothermia:Incidence, Relation to age and Surgery.J Ayub Med Coll Abottabad Mar 2000;12(1):31-5
11. Galante D. Intraoperative hypothermia. Relation between general and regional anesthesia, upper- and lower body warming: what strategies in pediatric anesthesia? Paediatr Anaesth 2007 Sep;17(9):821-3.
12. Asad M, Saleem M, Mahood K et al. Management of hypothermia in neonatal surgery using locally made device. Pakistan Pediatric Journal.1998 June;22(2): 53-5.

AUTHORS:

- **Dr Khalid Mahmood**
  Assistant Professor
  Paediatric Surgery
  Punjab Medical College, Faisalabad
- **Dr Sajid Hameed**
  Associate Professor
  Paediatric Surgery
  Punjab Medical College, Faisalabad
- **Dr Liaquat Ali**
  Registrar
  Paediatric Surgery
  Punjab Medical College, Faisalabad