The Journal of Maternal-Fetal & Neonatal Medicine

ISSN: 1476-7058 (Print) 1476-4954 (Online) Journal homepage: www.tandfonline.com/journals/ijmf20

An evaluation of intra-hospital transport outcomes from tertiary neonatal intensive care unit

Osman Bastug, Tamer Gunes, Levent Korkmaz, Ferhan Elmali, Fatma Kucuk, Mehmet Adnan Ozturk & Selim Kurtoglu

To cite this article: Osman Bastug, Tamer Gunes, Levent Korkmaz, Ferhan Elmali, Fatma Kucuk, Mehmet Adnan Ozturk & Selim Kurtoglu (2016) An evaluation of intra-hospital transport outcomes from tertiary neonatal intensive care unit, The Journal of Maternal-Fetal & Neonatal Medicine, 29:12, 1993-1998, DOI: 10.3109/14767058.2015.1072158

To link to this article: https://doi.org/10.3109/14767058.2015.1072158

Published online: 27 Aug 2015.

THE JOURNAL OF MATERNAL-FETAL & NEONATAL MEDICINE

http://informahealthcare.com/jmf
ISSN: 1476-7058 (print), 1476-4954 (electronic)

J Matern Fetal Neonatal Med, 2016; 29(12): 1993–1998
 DOI: 10.3109/14767058.2015.1072158

Taylor & Francis
Taylor & Francis Group

ORIGINAL ARTICLE

An evaluation of intra-hospital transport outcomes from tertiary neonatal intensive care unit

Osman Bastug[1], Tamer Gunes[1], Levent Korkmaz[1], Ferhan Elmali[2], Fatma Kucuk[3], Mehmet Adnan Ozturk[1], and Selim Kurtoglu[1]

[1]*Department of Pediatrics, Division of Neonatology, Kayseri, Turkey,* [2]*Department of Biostatistics and Medical Bioinformatics, Kayseri, Turkey, and* [3]*Department of Nursing, Erciyes University Medical Faculty, Kayseri, Turkey*

Abstract

Introduction: Patient transport has more important side effects in patients in the newborn age group than in other age groups. This study was performed to evaluate the intra-hospital transport of infants in the neonatal intensive care unit(NICU).

Methods: A total of 284 babies hospitalized in the neonatal unit and transported inside the hospital were divided into three groups based on their weights at the time of transport. Their places of transport and important changes in the vital functions of the newborn that might have been caused by transport were recorded with a view to understand the vital effects of intra-hospital transport on the newborn.

Results: In our unit, the primary reasons for transport were determined to be echocardiography and radiology (26.4% and 25.7%, respectively). In our study, hyperglycemia and hypothermia were among the statistically most significant side effects associated with transport ($p < 0.05$). It was found that 19% and 27% of the patients had hyperglycemia and hypothermia, respectively. There was a significant difference in the blood sugar levels and the body temperature between pre- and post-transport ($p < 0.05$). There were no significant differences in the pH, blood gas CO_2, heart rate and breath rate values between pre- and post-transport ($p > 0.05$). As expected, the complication rate was higher in babies with low weight.

Conclusions: Current weight is useful for assessing the risks of untoward outcomes associated with intra-hospital transport. Protecting patients from hypothermia during the time spent outside of the NICU would reduce the risk of complications.

Keywords

Intensive care unit, intra-hospital transport, neonatal

History

Received 18 December 2014
Revised 6 July 2015
Accepted 9 July 2015
Published online 27 August 2015

Introduction

Newborn transport is usually perceived as the relocation of unwell newborns out of the hospital. However, they are frequently transported inside the hospital for reasons such as imaging, consultation, and surgery. In addition, it has been reported that intra-hospital transport occurs more frequently than inter-hospital transport. The incidence of adverse effects that have occurred during intra-hospital transport, as reported in the studies done, is within the range of 6–70% [1,2].

The quality of transport depends on the quality of the transport vehicle, equipment, and the skills of the transport team to monitor and assess patients, and to give appropriate measures of resuscitation when needed [3,4]. The American Academy of Pediatrics recommends that pediatric transport should be capable of rapidly delivering advanced and skilled pediatric critical care at the patient's bedside, at the referring hospital and be able to maintain that level of care during transport to the receiving hospital [5].

Address correspondence: Osman Bastug, Department of Neonatology, Erciyes University School of Medicine, Talas C 38039 Kayseri, Turkey. Tel: +90-0-3522076666. Fax: +90-0-352-4375825. E-mail: drosman76@hotmail.com

The scoring system employed in predicting transport risk in the newborn subjected to relocation is generally planned considering the birth weights of the patients [6,7]. In the present study, we have aimed to report the intra-hospital transport of patients in our hospital and to study the undesirable effects of transport in view of the current weights of the babies.

Methods

A total of 284 babies who were hospitalized in the Neonatal Intensive Care Unit of Erciyes University Medical Faculty for treatment and underwent intra-hospital transport for some reason from 1 January 2012 to 1 January 2014 were included in the study. The babies were transported at all times of the day. In the study only the current weights of the babies during transport were used, and the study groups were formed according to these weights. These groups were as follows: group 1, 501–1500 g; group 2, 1501–2500 g; group 3, above 2500 g.

Data were collected on gender, weight at the time of transport, reasons for transport, vehicles of transportation, peak heart beats, breathing rates, blood glucose levels, body temperatures, blood gases (pH, CO_2), the receiving

department, and the time spent out of neonatal unit. The groups were recorded (as radiology, echo, surgical operation, ROP, angiography) according to their reasons for transportation (Table 1). The group named the ''other'' group, which appears among the reasons for transportation, included patients transported for otorhinolaryngology, electroencephalography, electromyography, and similar procedures.

In the transport team there was always either a senior assistant doctor experienced in intubation, or an orderly experienced in neonatal care. In addition, each team had a nurse and an intern doctor to complete the transport team. In other words, each team consisted of 3 people. Clinical assessment and the recording of the patient's vital signs were performed immediately before and after the patient's admission to the receiving unit by the senior pediatric assistant.

Special care was taken to replicate the conditions of the incubator used for patient transport to the conditions in the unit where the patient stayed, and to preserve them throughout transportation. Children who were in open beds in the ward were moved in open beds or carried (45%), while those kept in an incubator were moved in transport incubators (55%).

Patients kept in an incubator were transported in Hill-Rom Air Shields TL-500 (Batesville, IN) transport incubators. Each patient had a pulse oximeter and an infusion pump. Studies of blood gases were performed by means of a Siemens Rapidlab-348 (Munich, Germany). The respiratory requirements of those patients to be transported intubated were not met by means of mechanical ventilator in the transport incubator but by using air bags.

Body temperatures below 36°C were considered to be hypothermia, capillary blood sugar below 50 mg/dl to be hypoglycemia, and that above 120 mg/dl to be hyperglycemia. SPSS 16.0 (Chicago, IL) was used statistical analyses and Windows program for the comparison of the groups. For comparisons of the pre- and post-transport data, one-way ANOVA and paired samples *t*-test were used, with $p < 0.05$ being considered to be statistically significant. This study was approved by Erciyes University Ethics Committee, Turkey. Parental consent was obtained.

Results

Of the 284 newborn subjects included in the study, 39.02% (*n*:111) were male and 60.08% (*n*:173) female. Overall, the number of babies transported inside the institution, their percentages and the reasons for their transport were grouped according to their current weights and are presented in Table 1. The age of the patient at the time of transportation is given in Table 1. The most frequent reasons for transport were echocardiographic (26.4%) and radiological imaging (25.7%) methods, and the least frequent transport reason was determined to be angiographic study (2.8%) (Table 1).

No patient died within the first 24 h of transport. All the patients were normoglycemic before transport. However, the follow-up studies of blood sugar after transport revealed that 2.8% (*n*:8) of the patients had hypoglycemia, while 19% (*n*:54) had hyperglycemia (Table 2). When compared, the groups were not statistically different in terms of hypoglycemia ($p > 0.05$). However, the total number of patients in the hypoglycemic group (*n*:8, 2.8%) was quite small compared to

Table 1. Babies transported and the reasons for their transport.

Groups	Female/Male *n* (%)	The ages of the patients at the time of the transport *n* (%) 0–24 hours	1–3 days	4–7 days	8–15 days	>16 days	Total	The mean time spent out of the unit (minute) mean±SD [median {IQR}]	Echocardiography *n* (%)	Radiology *n* (%)	Surgical *n* (%)	Eye* *n* (%)	Angiography *n* (%)	Other *n* (%)	Total *n* (%)
Group 1 (501–1500g)	14/18	1 (0.4)	0	0	1 (0.4)	30 (10.6)	32 (11.2)	106.8±62.4[a] [92.5 {90}]	3 (1.1)	8 (2.8)	6 (2.1)	13 (4.6)	1 (0.4)	1 (0.4)	32 (11.2)
Group 2 (1501–2500g)	47/56	3 (1.1)	5 (1.8)	11 (3.9)	16 (5.6)	68 (23.9)	103 (36.3)	77.3 ± 54.2 [60 {63}]	30 (10.6)	29 (10.2)	13 (4.6)	17 (6)	2 (0.7)	12 (4.2)	103 (36.3)
Group 3 (>2501g)	50/99	5 (1.8)	21 (7.4)	26 (9.2)	37 (13)	60 (21.1)	149 (52.5)	82.2 ± 51.2 [65 {71}]	42 (14.8)	36 (12.7)	21 (7.4)	2 (0.7)	5 (1.8)	43 (15.1)	149 (52.5)
Total	111/173 (39.1)/(60.9)	9 (3.2)	26 (9.2)	37 (13)	54 (19)	158 (55.6)	284 (100)	83.2 ± 54.2 [65 {80}]	75 (26.4)	73 (25.7)	40 (14.1)	32 (11.3)	8 (2.8)	56 (19.7)	284 (100)

IQR: Interquartile Range.
*Patients were transported for diode laser treatment of retinopathy of prematurity and examination of the eye. Examination of patients of retinopathy of prematurity was performed in incubator.
[a]There was a significant difference in the mean time spent out of the unit (minute) between group 1 and other groups ($p < 0.05$).

Table 2. The out-of-the-unit time and the blood sugar levels of the babies transported.

Groups	*The mean blood sugar levels of the pre transport all patients	* The mean blood sugar levels of the post transport all patients	The number of the post transport hypoglycemia patients *n* (%)	*The mean blood sugar levels of the post transport hypoglycemic patients	The number of the post transport hyperglycemic patients *n* (%)	*The mean blood sugar levels of the post transport hyperglycemic patients
Group 1, *n*:32	112 ± 39^{b} [103.5 {24}]	$124 \pm 81^{d,e}$ [98 {68}]	1 (0.4)	41	13 (4.6)	188 ± 95^{g} [153 {131–195}]
Group 2, *n*:103	90 ± 26^{c} [88 {29}]	$94 \pm 32^{d,f}$ [88 {43}]	4 (1.4)	39.3 ± 5.6 [41.5 {34–43}]	17 (6)	149 ± 16^{g} [153 {134–156}]
Group 3, *n*:149	87 ± 30^{c} [82 {26}]	$96 \pm 49^{e,f}$ [83 {29}]	3 (1.1)	46.0 ± 2.7 [45 {44–47}]	24 (8.5)	178 ± 77^{g} [150.5 {132–194}]
Total, *n*:284	91 ± 31^{a} [86 {29}]	98 ± 49^{a} [85 {38}]	8 (2.8)	42.0 ± 5.2 [43 {41–45}]	54 (19)	171.2±70.4 [152.5 {134–177}]

*Mean ± standard deviation [median {Interquartile Range}], blood glucose unit; mg/dl, capillary blood sugar below 50 mg/dl were considered to be hypoglycemia, and that above 120 mg/dl to be hyperglycemia.
[a]There was a significant difference in the blood sugar levels between before and after transport ($p < 0.05$).
[b]There was a significant difference in the blood sugar levels of the pre transport between group 1 and other groups ($p < 0.05$).
[c]No significant differences in the blood sugar levels of the pre transport between group 2 and group 3 ($p > 0.05$).
[d]No significant differences in the blood sugar levels of the post transport between group 1 and group 2 ($p > 0.05$).
[e]There was a significant difference in the blood sugar levels of the post transport between group 1 and group 3 ($p < 0.05$).
[f]No significant differences in the blood sugar levels of the post transport between group 2 and group 3 ($p > 0.05$).
[g]No significant difference in the mean blood sugar levels of the post transport hyperglycemic patients among groups ($p > 0.05$).

the other groups (Table 2). Following transport, it was observed that hyperglycemia had developed in 13 (40.6%) of the 32 patients in group 1, and hyperglycemia was proportionally more common in this group. In addition, the mean blood sugar in this group was 188 mg/dl, and the highest blood sugar, too, was in this group.

When studied generally, the risk of hypoglycemia increased as the out-of-the-unit time increased. Interestingly, the babies in whom hyperglycemia developed were mostly in group 1, which was ascribed to the fact that not only the out-of-the-unit times of these groups were longer, but also they had lower current weights (Tables 1 and 2). Of the babies transported, 10.6% (*n*:30) were intubated, 8 (25%) of whom were in group 1. Of the intubated babies, 5 were re-intubated for various reasons. Four of the patients whose intubation tubes were replaced were in group 1.

When compared, pre-and post-transport blood pH and CO_2 levels did not show any statistically significant difference among the groups ($p > 0.05$) (Table 3).

Among the compared vital findings, hypothermia was the only one to exhibit significant differences ($p < 0.05$), and it was directly proportional to the time spent out of the unit, and inversely proportional to their current weights. While hypothermia occurred in none of the patients before transport, it was seen that 27.1% (*n*:77) of them had body temperatures below 36 °C after transport (Table 3). Hypothermia was detected in 21 (65.6%) of the 32 patients in group 1 and in 31 (30.1%) of the 103 patients in group 2. Post-transport hypothermia occurred most frequently in these groups. The lowest level of post-transport hypothermia was encountered in group 3 by 25 (16.8%) babies. The peak heart beats of the babies before and after transport did not differ significantly ($p > 0.05$) (Table 3).

Discussions

Although intra-institution transport of the newborn age group is quite common, the number of relevant studies in the literature is deplorably low. In intra-institution transport, life-threatening consequences may arise even though the transport distance is shorter and safer than in inter-institution transport [8,9]. In the present study, we aimed both to contribute to the subject and to report the untoward effects observed in patients subjected to intra-hospital transport in our hospital. While doing this, we used their current weights as a basis not the patients' birth weights. Therefore, discretion should be exercised on the basis of benefit and risk when deciding to transport a patient in newborn units for follow-up [10–12].

Neonatal Intensive Care Unit (NICU) patients often require diagnostic and treatment procedures in other hospital areas, and complications during transport may aggravate their clinical status; however, a large proportion of events are potentially preventable, especially hypothermia, and cardiac and respiratory deterioration [13].

Attempts have been made to develop a scoring system for patients so that these untoward effects can be predicted, prevented, and contained, if they arise. Among the most well-known are the Transport Risk Index of Physiologic Stability (TRIP) and the Mortality Index for Neonatal Transportation scoring systems.

Table 3. Levels of blood gases and vital findings of the babies transported.

Groups	[¥]Pre transport blood gas Ph mean ± SD	[¥]Post transport blood gas Ph mean ± SD	[¥]Pre transport blood gas PCO^2 mean ± SD	[¥]Post transport blood gas PCO^2 mean ± SD	Pre transport heart rate mean ± SD	Post transport heart rate mean ± SD	Pre transport breath rate mean ± SD	Post transport breath rate mean ± SD	Pre transport body temperature mean ± SD	Post transport body temperature mean ± SD	[&]The number of post transport hypothermic patients *n* (%)
Group 1 *n*: 32	7.40 ± 0.1	7.37 ± 0.1	48.7±11.3	49.3 ± 16.4	140 ± 21	134 ± 24	53 ± 9	55 ± 6	36.6 ± 0.3	35.5 ± 0.9	21 (7.4)
Group 2 *n*: 103	7.41 ± 0.1	7.40 ± 0.1	39.8±9.6	40.6 ± 11.9	149 ± 16	145 ± 22	52 ± 8	52 ± 9	36.7 ± 0.4	36.1 ± 0.7	31 (10.9)
Group 3 *n*: 149	7.40 ± 0.1	7.40 ± 0.2	37.4±11.2	37.3 ± 9.4	140 ± 20	139 ± 24	55 ± 11	54 ± 13	36.7 ± 0.5	36.3 ± 0.6	25 (8.8)
Total *n*:284	7.40 ± 0.1[a]	7.40 ± 0.1[a]	39.6 ± 11.2[b]	40.0 ± 12.0[b]	143 ± 19[c]	141 ± 23[c]	54 ± 10[d]	53 ± 11[d]	36.7 ± 0.4[e]	36.1 ± 0.7[e]	77 (27.1)
G1vsG2	*p*>0.05	*p*>0.05	***p*<0.01**	***p*<0.05**	***p*<0.05**	*p*>0.05	*p*>0.05	*p*>0.05	*p*>0.05	***p*<0.01**	
G1vsG3	*p*>0.05	*p*>0.05	***p*<0.01**	***p*<0.01**	*p*>0.05	*p*>0.05	*p*>0.05	*p*>0.05	*p*>0.05	***p*<0.01**	
G2vsG3	*p*>0.05	*p*>0.05	*p*>0.05	*p*>0.05	***p*<0.01**	*p*>0.05	*p*>0.05	*p*>0.05	*p*>0.05	***p*<0.05**	

Statistically significant values are indicated in bold.
Group comparisons: G1 vs G2, group 1 versus group 2; G1 vs G3, group 1 versus group 3; G2 vs G3, group 2 versus group 3.
[¥]Blood gas analysis was performed with capillary whole blood.
[&]Body temperatures below 36 °C were considered to be hypothermia.
[a]No significant differences in the pH values between before and after transport ($p > 0.05$).
[b]No significant differences in the blood gas CO_2 values between before and after transport ($p > 0.05$).
[c]No significant differences in the heart rate values between before and after transport ($p > 0.05$).
[d]No significant differences in the breath rate values between before and after transport ($p > 0.05$).
[e]Significant difference in the body temperature of the transported patients between before and after transport (*p*:0.01).

The TRIP score was developed by Lee et al. In this system physiological parameters such as body temperature, respiration, blood pressure, and noxious stimuli response are used. It was validated to assess the risk of neonatal mortality within seven days after NICU admission, intra-hospital mortality and grade III/IV intra-ventricular hemorrhage in the first 72 h following transport [14].

The TRIP score and heart rate variability (HRV) were assessed in a study before, during, and after transport. Higher HRV in the group of neonates, who did not differ in the illness severity TRIP score from the lower HRV group, was associated with a faster and significant decrease in heart rate after transport, and mechanical ventilation for 2–4 days. Statistically significant differences were found between all heart rate variability values during transport and in the NICU treatment [7,15,16].

In our study there was no statistically significant difference in heart beats between pre- and post-transport ($p > 0.05$) (Table 3). We believe that the most important effect of neonatal transport should be observed in the heart. However, we think that our patients were not exclusively NICU patients, but also included other types of pediatric patients in the neonatal unit (mature, premature, NICU) and this led us to reach such a conclusion. The mortality index for neonatal transportation proposed by Broughton et al. was designed and validated to evaluate the risk of neonatal death based on first-minute Apgar, birth weight, presence of congenital anomalies, post-natal age, arterial pH, and partial oxygen pressure, and was obtained at the moment of inter-hospital transport request [17].

In these two scoring systems used for inter-hospital and intra-hospital transport scoring, the birth weights of the patients are considered not the current weights. In our study the great majority of patients were transported after postnatal day 15. An important proportion of the patients transported within the first 24 h were determined to have been sent for echocardiography (Table 1). It has been reported in some studies that patients' transport in their own bed can pose such problems as the coming-off of catheters, intubation tubes, and chest tubes, as was also the case in our study [18].

In similar studies, too, assessing the intra-hospital transport of not only pediatric but also of adult patients, it has been reported that clinical problems occurred during transport in rates varying between 6–70%. It has also been demonstrated that the rate of the problem decreased when transport was conducted by a trained team [2,8,12,19].

In our study, the group of patients whose current weights were over 2500 g was the largest with 149 (52.5%). The reason for this was that it comprised the more stable patient group, which was most suitable for transport. The smallest group consisted of 32 patients (11.3%) whose weights were below 1500 g. The reason for this was that the patients in this group were treated more selectively when the decision to transport them was taken.

The time spent out of the unit was longer in group 1 (106.8 ± 62.4). The reason for this was thought to be that surgical and ROP laser treatment was proportionally greater in this group. The complications reported in the literature to arise during transport are hypothermia, hypoglycemia, hypoxia, and hypotension. In our study, hypothermia (27.1%) and hyperglycemia (19%) were the most frequent problems. Hypothermia occurred in patients in group 1, who were operated on for retinopathy, and stayed longer out of the unit. A significant difference was found between the out-of-the-unit time and the patients' current ages, and hypothermia ($p < 0.05$) (Table 3).

To protect patients from hypothermia during transportation, it has been suggested that automatic-heat-controlled incubators with double glazing be used, that patients wear in their hats and be wrapped in polyethylene shields against cold. In addition, it was pointed out prior to transport that keeping the axillary heat at 36.5 °C and above was protective against hypothermia, and it was suggested the patients should have body temperatures between 36 and 36.4 [20].

In our study, while the development of hypothermia in babies transported in open beds was an expected finding, it was observed that hypothermia developed to a greater degree in babies transported in incubators. The reason for this was thought to be that the patients transported in incubators were more susceptible to hypothermia since they were more premature and had lower current weights. In addition, it was observed that there was an inverse relationship between hypothermia and the current weight of the newborn (Table 3). When looked at from this perspective, consideration of current weights might contribute to the prediction of adverse changes, like hypothermia, in vital functions associated with transport.

In our study, unlike the literature, while there was no pronounced rise in the rate of hypoglycemia, the increase in the number of hyperglycemic patients was noteworthy (Table 2). It was thought that the patients being transported immediately after being fed, or being given intravenous liquid support prevented hyperglycemia development. Hyperglycemia occurred more frequently in group 1, which consisted of patients who underwent surgical operations or ROP examination. While it was thought that the development of hyperglycemia might depend on liquid loading, its occurrence, especially after painful procedures, was also considered as a response to stress. It was also thought that the endocrine response of these patients to external stress might have been more exaggerated owing to their lower current weights compared to those with greater current weights. During transport, the monitoring of patients, preparation of the appropriate means needed for the administration of necessary liquid, inotrope, and other medical treatments, checking incubators, as well as attentiveness to problems that might arise, and transportation being undertaken by a trained team are extremely important for the prevention of the complications associated with intra-hospital transport.

Conclusions

In order to prevent the complications that may develop during intra-hospital transport, appropriate conditions should be provided for procedures like ultrasonography, echocardiography, EEG, and monitoring, which can be performed at the patient's bedside, and the patient should not be transported for such reasons.

As for procedures in babies for whom transport is inevitable, pre-transport stabilization of the patient is the

most important precaution in preventing any complications likely to arise. Prior to transport, by contacting the unit to which the patient is scheduled to go, the transportation of the patient should be arranged at a suitable time, and the time out of the unit should be minimized as much as possible.

In addition, the prediction of potential complications associated with transportation by the transport team and by the person in charge of transport, and the measures taken accordingly can reduce negative effects. Consideration of the current weights in the transport scoring systems used in predicting these adverse events will enable accurate assessments, and thus may contribute for preventing potential complications. However, more advanced studies are necessary to reach a more definite conclusion.

Declaration of interest

The authors declare that they have no conflict of interest.

References

1. Shirley PJ, Bion JF. Intra-hospital transport of critically ill patients: minimising risk. Intensive Care Med 2004;30:1508–10.
2. Waydhas C. Intrahospital transport of critically ill patients. Crit Care 1999;3:R83–9.
3. Dryden CM, Morton NS. A survey of interhospital transport of the critically ill child in the United Kingdom. Paediatr Anaesth 1995;5: 157–60.
4. McCloskey KA, Johnston C. Pediatric critical care transport survey: team composition and training, mobilization time, and mode of transportation. Pediatr Emerg Care 1990;6:1–3.
5. American Academy of Pediatrics Committee on Hospital Care: guideline for air and ground transportation of pediatric patients. Pediatrics 1986;78:943–50.
6. Vieira AL, Santos AM, Okuyama MK, et al. Predictive score for clinical complications during intra-hospital transports of infants treated in a neonatal unit. Clinics (Sao Paulo) 2011;66:573–7.
7. Snedec N, Simoncic M, Klemenc M, et al. Heart rate variability of transported critically ill neonates. Eur J Pediatr 2013;172:1565–71.
8. Vieira AL, Guinsburg R, Santos AM, et al. Intra-hospital transport of neonatal intensive care patients: risk factors for complications. Rev Paul Pediatr 2007;25:240–6.
9. Wright I, Rogers PN, Ridley S. Risks in intrahospital transport. Ann Intern Med 1988;108:638.
10. Braman SS, Dunn SM, Amico CA, Millman RP. Complications of intrahospital transport in critically ill patients. Ann Intern Med 1987;107:469–73.
11. Link J, Krause H, Wagner W, Papadopoulos G. Intrahospital transport of critically ill patients. Crit Care Med 1990;18:1427–9.
12. Smith I, Fleming S, Cernaianu A. Mishaps during transport from the intensive care unit. Crit Care Med 1990;18:278–81.
13. Moss SJ, Embleton ND, Fenton AC. Towards safer neonatal transfer: the importance of critical incident review. Arch Dis Child 2005;90:729–32.
14. Lee SK, Zupancic, JA, Pendray M, et al. Canadian Neonatal Network. Transport risk index of physiologic stability: a practical system for assessing infant transport care. J Pediatr 2001;139: 220–6.
15. Wallen E, Venkataraman ST, Grosso MJ, et al. Intrahospital transport of critically ill pediatric patients. Crit Care Med 1995;23: 1588–95.
16. Ferrer AP, Sucupira AC, Grisi SJ. Causes of hospitalization among children ages zero to nine years old in the city of São Paulo, Brazil. Clinics (Sao Paulo) 2010;65:35–44.
17. Broughton SJ, Berry A, Jacobe S, et al. Neonatal Intensive Care Unit Study Group. The mortality index for neonatal transportation score: a new mortality prediction model for retrieved neonates. Pediatrics 2004;114:e424–8.
18. Lima DP. Transporte intra e inter-hospitalar do paciente grave. In: Pinheiro CT, Carvalho WB, eds. Programa de atualização em medicina intensiva (PROAMI). Porto Alegre: Artmed/ Panamericana 2008;37–86.
19. Beckmann U, Gillies DM, Berenholtz SM, et al. Incidents relating to the intra-hospital transfer of critically ill patients. An analysis of the reports submitted to the Australian Incident Monitoring Study in Intensive Care. Intensive Care Med 2004;30:1579–85.
20. Vieira AL, Santos AM, Okuyama MK, et al. Factors associated with hypothermia during intra-hospital transport in patients assisted in a Neonatal Intensive Care Unit. Rev Paul Pediatr 2011;29:13–20.