

The Spanish triage system in the evaluation of newborns in pediatric emergency departments

El sistema español de triaje en la evaluación de los neonatos en las urgencias pediátricas

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Received: 21-9-2015; Accepted: 1-7-2016

Abstract

Introduction: Triage in emergency departments classify patients according to priority levels of care. Newborns are a vulnerable population and require rapid assessment. **Objective:** To correlate priority levels in newborns seen in the pediatric emergency department with hospital admission, resource consumption, and care times. **Patients and Method:** Observational study, using the Andorran Triage Model (MAT-SET) database with ePATV4 software, in pediatric emergencies. Newborns were classified into 3 levels of established care as level I resuscitation, level II emergency, and level III urgent. The correlation between priority levels and the categories of hospital admission and resource consumption were analyzed, as well as the time spent on medical care and length of stay in the emergency department. **Results:** The study included 1,103 infants. The highest priority level was positively correlated with hospital admission ($r = 0.66$, $P < .005$) and resource consumption ($r = 0.59$, $P < .005$). The medical care times were 126 ± 203 , 119 ± 51 , and 33 ± 81 min for levels I, II, and III, respectively, and the stay in emergency department was 150 ± 203 , 131 ± 80 , and 55 ± 86 min, respectively, for these levels ($P < .05$). **Conclusion:** The higher level of priority in the care of newborns in the pediatric emergency department was positively correlated with increased need for hospitalization and resource consumption. They also required a more time for medical care and longer length of stay in the emergency department.

Keywords:

Paediatric emergency;
Triage;
Neonates;
Hospital admission;
Resource consumption.

Introduction

Pediatric emergency rooms are usually overloaded with patients, many of whom are seen for non-urgent causes. This situation affects the management

of emergency services^{1,2}. Structured triage is a system that classifies patients by levels of urgency rather than severity and allows patients who require priority attention to be evaluated by health personnel within an adequate time frame. In this way, it is easier to clari-

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fy the concepts of urgency, severity and complexity of patients who come to the emergency. In the Department of Pediatric Emergencies (DPE) parents or caregivers of patients frequently confuse the degree of urgency with the severity of the disease. This situation leads to the importance of the subjective aspect of an urgency, that is, the perception there is a quick need for attention^{3,4}.

The high percentage of non-urgent examinations in the DPE is also related to other more complex causes, such as limitations in primary care, the convenience of caregivers and trust in professionals, among others⁵⁻⁷. In developed countries, the profile study of pediatric patient caregivers with non-urgent conditions who visit the DPE reveals low levels of education, low socioeconomic levels and immigrants with little knowledge of the language, among others⁸.

The age group that most frequently uses the DPE are those under 5 years of age⁹ and, of these, a percentage of about 2% are children younger than 28 days of age¹⁰⁻¹². Although most visit are for non-serious conditions, these have to be carefully evaluated to rule out life-threatening situations due to an increased vulnerability at this age. The characteristics of the newborns in the DPE are not very different from those that are examined in the departments of neonatal emergencies¹³. In the USA, more than 350,000 newborns per year visit pediatric emergency rooms¹⁴. In developing countries, where the highest percentage of neonatal mortality is concentrated, the perception of the warning signs is distorted by sociocultural factors that, together with deficiencies in neonatal care, expose the newborn to an increased risk of receiving inadequate care. The so-called cultural diseases in some regions of Latin America can delay the arrival of ill newborns to health centers, due to the magical conceptions that relatives have of diseases¹⁵. The pediatric emergency physician must have a reliable, useful and valid tool that allows them to classify patients so that they can prioritize care.

In the DPE of our hospital, the Andorran triage model and the Spanish triage system (MAT-SET) have been used for 5 years, with the triage aid program (e-PAT) with 5 levels of care, which has undergone some modifications made by nurses previously trained. About 1,100 newborns visit the DPE every year. According to the MAT-SET, children younger than 28 days of age will be classified in one of the 3 higher levels, depending on the reason for consultation and the symptoms present.

The objective of the present study is to establish the correlations between the 3 levels of priority in neonatal care with the need for hospitalization, the consumption of resources and the time of medical care and stay in the emergency.

Material and Method

A retrospective, descriptive, observational study was conducted using the DPE database. Patients aged between 0 and 28 days, who visited a DPE of a reference pediatric hospital were included; they were classified according to the priority level of care according to MAT-SET¹⁶. The hospital's DPE working group made triage modifications consisting of: 1) prior application of the Pediatric Assessment Triangle (American Academy of Pediatrics). It is a step that lasts 60 s, without altering the triage times, and allows to immediately recognize to those patients that the MAT-SET classifies as level I. Because the nurses had previous advanced training in its implementation, the team responsible for the development and implementation of triage at the pediatric hospital decided to keep it. 2) The implementation of a command that enables reports related to levels of urgency with other indicators of quality and other variables of care activity, such as diagnosis to patient discharge, consumption of resources, among others, to be obtained. The Pediatric Assessment Triangle is a tool used for the initial rapid assessment of the child. It consists of 3 components: appearance, respiratory work and circulation of the skin, which together identify the pathophysiological state of the patient (cardiopulmonary status, cerebral and metabolic function). Each of these components is evaluated separately and allows to discern between a stable or unstable patient¹⁷.

The variables analyzed in this study were: age, gender, reason for consultation, level of priority, use of ancillary diagnostic methods (laboratory and images), hospitalization, time of medical care (from the time the pediatrician begins cares for the patient until conclusion) and length of stay in the emergency, depending on the priority level. We analyzed the level of triage and its correlation with both hospital admission and the use of ancillary diagnostic methods. The data were analyzed using the SPSS 21 software. Qualitative variables were expressed as percentages and the comparison was performed with the Pearson chi-square test. Correlation analysis was performed using the Goodman-Kruskal gamma test. Quantitative variables were expressed as averages with their standard deviations. The comparison of the time of stay in the urgency in the three levels of care was made by means of the Anova test using Kruskal-Wallis methods.

Overtriage or undertriage was defined as when prioritization is above or below what is necessary, determined by the measurement of the resources used and the time required for medical care and patient discharge or admission. If a patient is classified as level II priority, but does not require the use of resources such as laboratory or images or a long time of medical care, and is discharged, we consider it as an overtriage.

The protocol was approved by the Research Ethics Committee of the hospital, which released from informed consent (approval No. 0032). All data was kept confidential.

Results

In the period between December 1, 2013 and December 1, 2014, 86,925 patients were treated in the DPE, of which 1,143 were newborns (1.3%). A total of 1,103 patients were enrolled in the study, 40 were excluded due to technical problems at the time of classification. The mean age was 15.2 ± 7.6 days (95% CI: 14.8-15.7) and 95% came from urban areas. Other characteristics of the study population are shown in Table 1. Three newborns were classified as level I (3/1,103), one due to septic shock, one for gastroschisis and one with marked jaundice and history of seizures, who entered cardiac arrest, was resuscitated and died shortly thereafter. The most frequent reasons for consultation at levels II and III are shown in Table 2. The correlation between the priority levels and categories of hospitalization and consumption of resources are presented in Figures 1 and 2, respectively. The time of care and length of the emergency stay according to priority levels can be seen in Table 3. Eighty-two percent of the patients were cared for within 20 mins of arrival at the DPE. Analyzing secondary data, infants less than 7 days old were hospitalized in 32.6% (64/196) of the cases, while those aged ≥ 7 days in 20.5% (186/907) (OR 1.8, 95% CI: 1.32-2.67, $p < 0.0005$). There were no

differences in gender between those who were hospitalized and those who were discharged from the DPE.

Discussion

Newborns who had a higher priority level using the MAT-SET application were hospitalized more frequently in relation to the other levels. In the analysis we found a moderate correlation between the priority level and hospitalization. A similar result was found when analyzing levels of triage with resource consumption. Reviewing literature, we have not found a study evaluating triage system applications in the neonatal period.

Table 1.

	N°	%
Edad < 7 días	196	17,8
Género masculino	595	54
Género femenino	508	46
Nivel I (resucitación)	3	0,3
Nivel II (emergencia)	376	3,1
Nivel III (urgencia)	724	65,6
Ingreso hospitalario	250	22,7
Utilización de recursos (laboratorio o imágenes)	286	25,9

n = 1.103.

Table 2.

Nivel I	N°	Nivel II		Nivel III			
		N°	%	N°	%		
Paro cardiorrespiratorio	1	Fiebre	105	28	Control	171	24
Gastrosquisis	1	Irritabilidad	46	12	Irritabilidad	156	21
Shock séptico	1	Lesiones de piel	41	11	Congestión nasal	126	17
Total	3	Dificultad respiratoria	37	10	Estreñimiento	41	6
		Ictericia	27	7	Tos	32	5
		Congestión nasal	25	7	Vómitos	27	4
		Vómitos	21	5,5	Alteraciones del cordón	29	4
		Apnea/cianosis	21	5,5	Ictericia	22	3
		Diarrea	15	4	Secreción ocular	22	3
		Tos	14	4	Diarrea	15	2
		Secreción ocular	6	2	Lesiones de piel	10	1
		Control	5	1	Trastornos en alimentación	10	1
		Alteraciones del cordón	5	1	Control posbronquiolitis	7	1
		Trastornos en alimentación	2	0,5	Fiebre	6	1
		Estreñimiento	1	0,5	Otros	56	7
		Otros	5	1			
Total	3	Total	376	100	Total	724	100

Although more than half of the infants classified as level II were not hospitalized, we did not consider this as overtriage because most had symptoms of upper airway obstruction due to extensive nasal secretion and required immediate health care such as aspiration and stabilization prior to discharge. The percentage of hospitalization was higher in level II infants compared to those in level III.

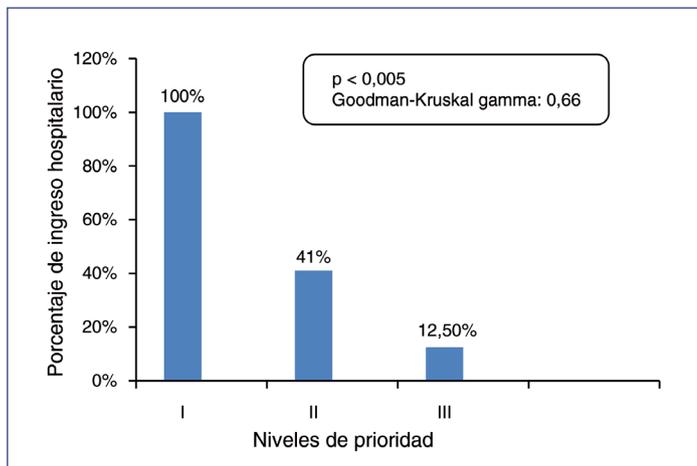


Figure 1.

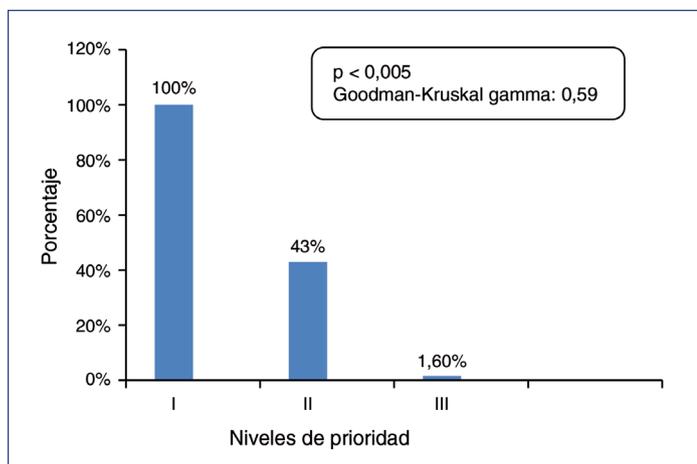


Figure 2.

Overtriage in pediatric patients has been analyzed in a recent study using Ped-TTAS triage with 5 levels of attention, compared with one of its modifications, in relation to an assessment of vital signs. In this study, tachycardia was found to be a cause of overtriage¹⁸.

A small number of infants were classified as level I, a result similar to that found in the validation study of MAT-SET in pediatric patients¹⁹. The 3 patients at level I were really very serious patients: sepsis (septic shock), a newborn with gastroschisis and a patient who arrived at cardiorespiratory arrest with marked jaundice and a history of seizures. Therefore, priority was correctly identified in patient care.

At level III, 12.6% of observed undertriage corresponded to infants who were checked for crankiness and jaundice. This figure is similar to that reported in the study in Manchester of triage validation for urgent pediatric care in a population aged 0 to 16 years. The authors found an overtriage of 54% and an undertriage of 12%²⁰. We did not follow up these patients to determine the percentage of reassessments and subsequent hospitalization, because it was not within the objectives of the present study. In the group of newborns who were examined for fever, we observed undertriage in 5% of the cases. That is, they were not at the level they should be. Newborns with some symptoms, in this case fever, should be at level II according to the triage studied; however, they were classified as level III.

Analyzing the general characteristics of the newborns treated in the DPE in the studied period, as well as the reasons for consultation, we find data similar to those of other authors^{10,11}. Most were examined for minor illnesses or lack of information from parents about newborn care in relation to umbilical cord management, hygiene, difficulty initiating breastfeeding and early hospital discharge, among others. A group of healthy newborns arrived for a postnatal checkup. This situation is mainly due to the deficit in the primary care, related to the difficulties to obtain appointments. The prevalence of mild diseases and examinations of newborns without diseases was reflected in the triage with high prevalence of newborns in level III care.

A little less than a quarter of the infants were hospitalized, figures similar to those found in two other studies^{10,11} and higher than those reported by another¹².

Table 3.

Nivel de prioridad	Tiempo de atención (min)	p	Tiempo de estadía en Urgencias (min)	p
Nivel I	203 ± 126		203 ± 150	
Nivel II	119 ± 51	< 0,05*	131 ± 80	<0,05*
Nivel III	81 ± 33		86 ± 55	

n = 1.103. *Anova de una vía de Kruskal Wallis.

The percentages of resource utilization in the DPE were also similar to those found in the cited reports. Analyzing the time of care and the time of stay in the emergency, it was found that, with a higher priority in care, the greater the duration of time, which indicates greater complexity of medical care.

The use of triage in DPEs has not only allowed the identification and care of patients requiring priority attention, but also contributed to improve the flow of patients and to create a common communication language¹⁶. Currently there are several models that classify patients into 5 levels of care²¹⁻²³. However, there have been difficulties in implementation these in developing countries. The World Health Organization recommends in these countries the use of a triage method, the Emergency Triage Assessment and Treatment (ETAT), which has been implemented in some developing countries with good results²⁴. This study has the limitation of not having follow-up for all the infants, sent to their home from the DPE. Also, there has not been an analysis for either the intra- and inter-observer validity of nurses who perform triage, or that of the emergency physicians. Nevertheless, evaluation of its implementation and analyze the undertriage must continue.

According to our results, we consider that the MAT-SET and ePATv3 are a very useful tool in the

DPE to discriminate which newborns need priority attention. In addition, they help to improve care regarding the waiting time of these vulnerable patients.

Ethical Responsibilities

Protection of people and animals: The authors state that no experiments have been performed on humans or animals for this research.

Confidentiality of data: The authors state that they have followed the protocols of their work center on the publication of patient data.

Privacy rights and informed consent: The authors state that no patient data appears in this article.

Conflict of interest

The authors declare that they have no conflict of interest.

Acknowledgements

The authors thank Lourdes Vera for her dedication and work in obtaining patient data from the computerized triage system and the quality control commands.

References

- Berry A, Brousseau D, Brotanek JM, Tomany, Korman S, Flores G. Why do parents bring children to the emergency department for nonurgent conditions? A qualitative study. *Ambul Pediatr*. 2008;8:360-7.
- Somon H, Hirsh D, Rogers A, Massey R, DeGuaman M. Pediatric Emergency Department overcrowding: Electronic medical record for identification of frequent lower acuity visits. Can we effectively identify patients for enhanced resource utilization? *J Emerg Med*. 2009;36:311-6.
- Gomez Jimenez J. Urgencia, gravedad y complejidad: Un constructo teórico de la urgencias basado en el triaje estructurado. *Emergencias*. 2006;18:156-64.
- Gomez Jimenez J. Clasificación de los pacientes en los servicios de Urgencias y Emergencias. Hacia un modelo de triaje estructurado de urgencias y emergencias. *Emergencias*. 2006;15:165-74.
- Doobinn KA, Heidt PE, Gross TK, Isaacman DJ. Nonurgent pediatric emergency department visits: Care-seeking behavior and parental knowledge of insurance. *Pediatr Emerg Care*. 2003;19:10-4.
- Vinelli NF, Mannucci C, Laba NI, et al. Consultas no urgentes al departamento de urgencias de un hospital pediátrico. *Arch Argent Pediatr*. 2013;109:8-13.
- Kibicek K, Liu D, Beaudin C, et al. A profile of nonurgent emergency department use in an urban pediatric hospital. *Pediatr Emerg Care*. 2012;28:977-84.
- Morrison AK, Myrvik MP, Brousseau DC, Hoffmann RG, Stanley RM. The relationship between parent health literacy and pediatric emergency department utilization: A systematic review. *Acad Pediatr*. 2013;13:421-9.
- Ho Kwak Y, Kim DK, Jang HY. Utilization of emergency department by children in Korea. *J Korean Med Sci*. 2012;27:1222-8.
- Fernandez Ruiz C, Sainz de la Masa T, Curcoy Barcenilla AI, Lasuen del Olmo N, Luaces Cubells C. Asistencia a neonatos en el servicio de urgencias del un hospital pediátrico terciario. *An Pediatr (Barc)*. 2006;65:123-8.
- Perez Solis D, Pardo de la Vega J, Fernandez Gonzalez N, Ibañez Fernandez A, Prieto Espuñes S, Fanjul Fernandez L. Atención a neonatos en una unidad de urgencias pediátricas. *An Pediatr (Barc)*. 2003;59:54-8.
- Calado CS, Pereira AG, Santos VN, Castro MJ, Maio JF. What brings newborns to the emergency department?: A 1-year study. *Pediatr Emerg Care*. 2009;25:244-8.
- Millar KR, Gloor JE, Wellington N, Joubert GI. Early neonatal presentations to the pediatric emergency department. *Pediatr Emerg Care*. 2000;16:145-50.
- Lee HC, Bardach NS, Maselli JH, Gonzalez R. Emergency department visits in the neonatal period in the United States. *Pediatr Emerg Care*. 2014;30:315-8.
- Delgado-Noguera MF, Calvache-España JA, Tabares Trujillo RE, del Cairo-Silva C, Bedoya-Idrobo LM. Percepciones de signos de alarma en enfermedad neonatal de los cuidadores y trabajadores de la salud en Guapi Colombia. *Rev Salud Publica*. 2007;9:39-52.
- Soler W, Gomez Muñoz M, Bragulat E, Alvarez A. El triaje: herramienta fundamental en urgencias y emergencias. *An Sist Sanit Navar*. 2010;33 supl 1:55-68.
- Diekmann RA, Brownstein D, Gausche-Hill M. The pediatric assessment triangle. A novel approach for the rapid evaluation of children. *Pediatr Emerg Care*. 2010;26:312-5.
- Chang YC, Ng CJ, Wu CT, Chen LC, Chen JC, Hsu KH. Pediatric overtriage as a consequence of the tachycardia responses of children upon ED admission. *Am J Emerg Med*. 2015;33:1-6.

19. Gomez Jimenez J, Boneu Olaya F, Becerra Cremidis O, et al. Validacion clínica de la versión del programa de ayuda al triaje (Web e PAT v3 del modelo andorrano de triaje (MAT) y sistema español de triaje (SET). Fiabilidad, utilidad y validez en la población pediátrica y adulta. *Emergencias*. 2006;18:207-14.
20. Van Veen M, Steyeberg EW, Ruige M, et al. Manchester triage system in Paediatric emergency care: Prospective observational study. *BMJ*. 2008;337:a1501, doi: 10.1136/bmj.a1501. Erratas en: *BMJ*. 2008;337:a1849.
21. O'Neill KA, Molczan K. Pediatric triage: A 2-tier 5 level system in the United States. *Pediatric Emerg Care*. 2003;19:285-90.
22. Chang YC, Ng CJ, Wu CT, Chen LC, Chen JC, Hsu KH. Effectiveness of a five level paediatric triage system: An analysis of resource utilization in the emergency department in Taiwan. *Emerg Med J*. 2013;30:735-9.
23. Gravel J, Fitzpatrick E, Gouin S, et al. Performance of the Canadian triage and acuity scale for children: A multicenter database study. *Ann Emerg Med*. 2013;61:27-32.
24. Moyneux E, Ahmad S, Robertson A. Improved triage and emergency care for children reduces inpatient mortality in resource constrained setting. *Bull World Health Organ*. 2006;84:314-9.