SCIENTIFIC LETTERS

Use and cost of antidotes for acute poisoning in a hospital emergency department

Indicación y coste de los antídotos utilizados en el tratamiento de las intoxicaciones agudas atendidas en un servicio de urgencias hospitalario

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Poisonings constitute a medical emergency and the administration of an antidote can play a major role in their treatment[1]. However, antidotes are not exempt from adverse effects and in some cases their economic cost is high[2]. The aim of this study is to describe the use of antidotes, evaluate the suitability of their indication, the safety of their administration and their cost.

Study carried out between January 1 and June 30, 2018 in the emergency department of an urban high-tech hospital. Through the SAP-Pharmacy/IPA drug prescription program, intoxicated patients were identified and given an antidote. Pharmaceutical costs generated by the use of these antidotes and other associated medication that the patient may have received during their stay in the emergency department were considered. The appropriateness of the administration of the antidote was assessed by the existence of criteria for its indication, as well as the absence of contraindications. The antidote was considered effective if it managed to reverse or prevent, in whole or in part, the action of the toxin. Safety was evaluated by the presentation of adverse reactions associated with its use.

RegistDuring the study period, 649 toxicological emergencies were recorded and in 67 of them six antidotes were used, alone or in combination. Their general characteristics are shown in Table 1. The most frequently used antidotes were flumazenil, naloxone and N-acetylcysteine. The analysis of the suitability to indicate the use of the antidote, its efficacy and the observation of side effects is shown in Table 2. Overall, the indication of the antidote was considered suitable in 65 patients (97%). In 2 cases, the indication of flumazenil was not suitable, as the patients had previously had a seizure. The antidotes were effective in 58 patients (86.5%), while in 5 cases there was no improvement. The antidote was shown to be safe in 63 patients (94%). Two intoxicated patients who were given flumazenil showed a confusional picture with agitation. One patient treated with naloxone developed a withdrawal syndrome and one intoxicated patient receiving N-acetylcysteine had an allergic reaction.

The cost of the global pharmacological treatment for the 67 patients was 8,602.73 euros, of which 8,057.85 euros (93.7%) corresponded to antidotes and 544.88 euros to other drugs (activated carbon, etc.). The most expensive antidote was the antidigital antibodies, since in the three cases in which they were used they had a total cost of 5,824.38 euros, that is, more than double the cost of all the antidotes used in the other 64 patients. The final evolution was favourable in all cases, except for one patient with suicidal ideation who ingested potassium cyanide.

Although around 40 antidotes are available, for more than 30 years, flumazenil, naloxone and N-acetylcysteine have been the most frequently used antidotes[3] in emergency departments. These hospital departments also deal with infrequent but extraordinarily serious poisoning[4,5] in which the remaining antidotes must be available in a very short time.

For this reason, and also because of the high price of some antidotes[6],

Table 1. Characteristics of the 67 poisonings treated with antidotes

	n (%)
Antidotes used	
Flumazenil	29 (43.3)
Naloxone	11 (16.4)
Flumazenil + Naloxone	10 (14.9)
N-acetylcysteine	10 (14.9)
Anti-digital antibodies	3 (4.5)
Flumazenil + N-acetylcysteine	1 (1.5)
Naloxone + N-acetylcysteine	1 (1.5)
Fomepizol	1 (1.5)
Hydroxycobalamin	1 (1.5)
Cost of drug treatment per vial in euros	
Anti-digital antibodies	970.73
Hydroxycobalamin	576.75
Fomepizol	197.45
N-acetylcysteine	9.03
Naloxone	1.19
Flumazenil	1.09
Patient destination (%)	
Discharged home	33 (49.3)
Intensive care unit admission	14 (20.9)
Transfer to another health centre	11 (16.4)
Conventional hospitalization	7 (10.4)
Admission to psychiatric hospital	2 (3.0)

Table 2. Adequacy, efficacy and safety of use of antidotes, used alone or in combination, in 67 poisonings

	Suitability		Efficiency			Safety	
	Yes n (%)	No n (%)	Yes n (%)	No n (%)	Not valuable n (%)	Yes n (%)	No n (%)
Flumazenil (n = 29)	27 (93.1)	2 (6.8)	28 (96.5)	0	1 (3.4)	27 (93.1)	2 (6.9)
Naloxone (n = 11)	11 (100)	0	8 (72.7)	2 (18.2)	1 (9.0)	10 (90.9)	1 (9.1)
Flumazenil + Naloxone (n = 10)	10 (100)	0	9 (90)	1 (10)	0	10 (100)	0
N-acetylcysteine (n = 10)	10 (100)	0	8 (80)	0	2 (20)	10 (100)	0
Anti-digital antibodies (n = 3)	3 (100)	0	2 (66.7)	1 (33.3)	0	3 (100)	0
Flumazenil + N-acetylcysteine (n = 1)	1 (100)	0	1 (100)	0	0	0	1 (100)
Naloxone + N-acetylcysteine (n = 1)	1 (100)	0	1 (100)	0	0	1 (100)	0
Fomepizol (n = 1)	1 (100)	0	1 (100)	0	0	1 (100)	0
Hydroxycobalamin (n = 1)	1 (100)	0	0	1 (100)	0	1 (100)	0

strategies must be used to optimise their availability[7,8].

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Implementation of an advanced nursing triage protocol for managing moderate pain in the emergency department

Implantación de un protocolo de triaje avanzado de enfermería en el manejo del dolor moderado en urgencias

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Pain management presents a challenge to the health care system[1]. It increases the probability of attending a hospital emergency department (ED)[2] by five times and is one of the main reasons for consultation[3]. Its approach has required the need to consider it as a "5th vital sign", as well as the development of numerous protocols[4-6].

Severe or intense pain is prioritized in the ED, as is moderate or mild pain, albeit with a lesser or non-urgent level of triage. Nurses need to take an active role in implementing protocols for early detection and management of pain[7,8]. At the Costa del Sol Healthcare Agency (ASCS), a multidisciplinary group was created to develop a "Protocol for the management of moderate pain in the emergency department" which, through advanced triage, offered patients who met the inclusion criteria an oral analgesia kit while they waited to be assessed by the physician. The aim of our study was to assess the appropriateness of its activation and its impact on the need for further analgesia in the ASCS ED.

A retrospective cohort study was designed and conducted in the two ASCS EDs from November 1, 2014 to November 30, 2015. The reference population in 2015 was 462,000 inhabitants. The study population was all patients with pain at the time of admission and triage classification who met the following inclusion criteria: age between 14-65 years, any presence of moderate pain, levels III or IV according to the Spanish Triage System, absence of previous structural pathology, no allergy to paracetamol or dexketoprofen and who had not taken analgesia in the 6 hours prior to consultation. The intervention consisted of the triage nurse offering an indivisible oral analgesia kit composed of 1 g of paracetamol and 25 mg of dexketoprofen. Verbal consent was obtained from the patient. Patients who met the inclusion criteria and agreed to receive the kit were deemed to have had the protocol activated appropriately. Activation was considered inadequate in those patients who received the kit, although they presented chronic pathology, allergies or level V in triage. The main outcome variables were: adequate activation of the procedure, need or not for post-administration analgesia, status at discharge and time from end of triage to discharge. Independent variables were age, sex, care center, number and type of analgesia, pain location, previous pathologies, reason for consultation and level of triage. Descriptive analysis was performed, using measures of central tendency, dispersion and position (median and interquartile range -IQR-) for quantitative variables, and frequency distribution for qualitative ones. All were described with their 95% confidence intervals (95% CI). The chi-square test was used to evaluate differences in the distribution of appropriateness of protocol activation with respect to the patients' sociodemographic variables, and the level of statistical significance was set at $p < 0.05$.

During the study period, 181,190 emergencies were addressed. A total of 85.3% of patients showed some degree of pain: 133,523 (86.4%) mild, 20,285 (13.1%) moderate and 801 (0.5%) severe or intense. Among patients with moderate pain, the protocol was activated for 2,860. To estimate the rate of significant pain reductions in patients with protocol

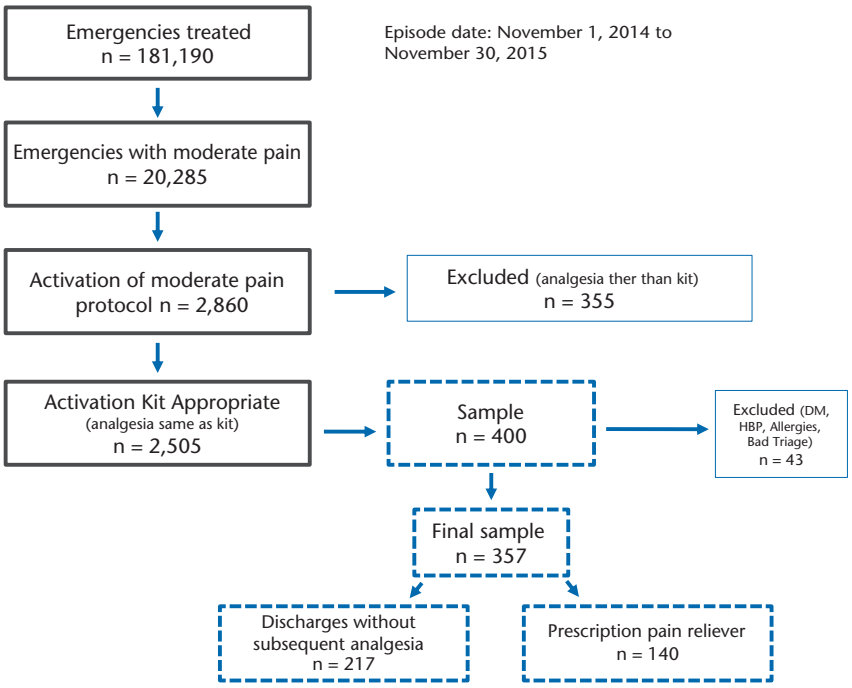

Figure 1. Flow chart. HBP: high blood pressure; DM: diabetes mellitus

activation, starting from a volume of 2,860 cases of moderate pain, estimating 50% of adequate protocol activation for moderate pain (a parameter that requires a greater volume of individuals), for a 95% confidence level, and 5% accuracy, and adding an additional 15% to minimize possible losses in the information source, it was necessary to assess 400 cases of activation in the study period. Of these, 43 episodes had inadequate activation: 31.1% had diabetes mellitus (DM), 53.1% had high blood pressure (HBP), 9.4% had allergies to one of the drugs, 21.9% had chronic conditions other than DM and HBP, and 25.6% had triage level V (Figure 1). Of the 357 episodes with adequate administration, 92% were adjusted to the procedure (CI 95%: 89.2-94.8). Women accounted for 51.8% and the mean age was 37 years (SD: 12.3). Patients with pain scores 4 and 5 were the majority, accounting for 64% and 25.8% respectively. By triage levels, IV represented 72.8%. The main reasons for consultation were: traumatic pain (40.6%), non-traumatic pain (18.2%) and lumbar-dorsal pain (17.1%). 60.8% (n = 217) required no analgesia during their stay in the ED after administration of the initial triage kit (CI 95%: 55.6-66.0). In the 140 (39.2%) episodes that required analgesia with subsequent medical prescription, the intravenous route was predominant in 52.1% (Table 1).

These data are consistent with those of the study by Finn et al.[9], where the influence of triage analgesia administration by Advanced Practice Nursing (APN) was assessed, and levels of VAS pain were shown to be significantly reduced after the intervention. Hatherley et al.[10], in a comprehensive review of the literature, concluded that APN allowed for increased health care effectiveness. In conclusion, we can say that this intervention allows improved care of patients attending the emergency department by reducing pain while waiting for medical evaluation with high activation adequacy, which we consider to increase the effectiveness and efficiency of the care received.

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Table 1. Characteristics of episodes with appropriate activation

Variables	N = 357 (%)
Sex	
Man	172 (48.2)
Woman	185 (51.8)
Age (years)	
14-29	108 (30.3)
30-49	185 (51.8)
50-65	64 (17.9)
Mean (SD)	37.0 (12.3)
Centre	
HSC	288 (80.7)
HARB	69 (19.3)
Pain during triage (score)	
4	227 (64.0)
5	91 (25.8)
6	32 (8.3)
7	7 (2.0)
Level of triage	
III	97 (27.2)
IV	260 (72.8)
Reason for consultation	
Headache	25 (7.0)
Traumatic pain	145 (40.6)
Non-traumatic pain	65 (18.2)
Lumbar-dorsal pain	61 (17.1)
ENT pain	47 (13.2)
Others	14 (3.9)
Pain location	
Yes	357 (100.0)
Condition at discharge[a]	
Asymptomatic	276 (82.6)
Minimal pain (or partial improvement)	37 (11.1)
Same as on arrival	21 (6.3)
Triage end time - emergency discharge (min)	
Medium (IQR)	173.0 (174.0)
Post-protocol analgesia administered in triage	
No	217 (60.8)[b]
Yes	140 (39.2)
Route of administration of subsequent analgesia	
Intravenous	73 (52.1)
Intramuscular	47 (33.6)
Subcutaneous	21 (15.0)
Oral	7 (5.0)
Number of subsequent analgesics	
1	91 (65.0)
2	43 (30.7)
3	4 (2.9)
4	2 (1.4)
Triage end time - second analgesia (min)	
Medium (IQR)	104.0 (88.0)
Waiting time for the nursing ward (min)	
Median (IQR)	6.0 (9.8)

[a]Excluded were 19 runaway patients and 4 unrecorded discharges. [b]95%CI: 55.6-66.0.
SD: standard deviation; ENT: ear, nose and throat; IQR: interquartile range HCS: Hospital Costa del Sol; HARB: Benalmadena High Resolution Hospital (Spanish acronym); HBP: high blood pressure; DM: diabetes mellitus.

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Procedures for pediatric sedation and analgesia: professional training and practice of nurses in Spanish emergency departments

Procedimientos de sedoanalgesia pediátricos: formación y práctica profesional de los enfermeros en los servicios de urgencias españoles

Nerea Santos[1], Garbiñe Pérez[1], Silvia García[1], Santiago Mintegi[1,2]

Acute pain is one of the most common reasons for consultation in paediatric emergency departments (ED)[1,2], and has the particularity of being associated with significant anxiety. Anxiety has been associated with the practice of procedures[3]. For this reason, the administration of sedoanalgesia is common, which consists of the use of sedative or dissociative agents, with or without analgesics, in order for the patient to better tolerate pain and anxiety. One of the functions of paediatric nursing is the initial assessment of the paediatric patient upon arrival to the ED and the evaluation of the administration of analgesics or sedatives. It is common for pain in the paediatric age to be inadequately managed[2,4]. This may be due to a lack of knowledge on the part of health professionals and inadequate application of these knowledge[2,4]. This may be due to a lack of knowledge of health professionals and inadequate application of these treatments[2,4]. It is our hypothesis that training in sedoanalgesia received by Spanish ED nurses is scarce and heterogeneous even though these treatments are administered on a regular basis. Therefore, the aim of this study is to describe the training received and professional practice of Spanish ED nurses in paediatric sedoanalgesia procedures.

A multicenter, descriptive and cross-sectional study was designed by means of an internet enquiry conducted in 2017 among nurses in 25 of the 30 EDs that are members of the Spanish Society of Pediatric Emergencies, which includes a head nurse. The survey was based on an adapted questionnaire already used in a previous study[5]. The questionnaire included sociodemographic variables, questions on practical training in sedoanalgesia techniques - evaluated from 0 to 10 - and systems used for the assessment of pain and knowledge about it - measured with a Likert-type scale with 5 values. The EDs belonged to 13 autonomous communities and 16 (64%) were exclusively pediatric, 18 EDs (72%) were third level, 5 second level and 2 first level. In total, 718 surveys were sent to all the nursing professionals working in the participating EDs.

A total of 455 (63.4%) responses were received, of which 399 (87.6%) were women, with a median age of 37 years (IQR 31-47) and a median professional experience of 14 years (IQR 7-27) as a general nurse and 5 (IQR 1-10) in the ED. One hundred and thirty-four nurses (29%) were specialists in pediatrics, 38 (8%) had completed a master's degree and 2 (0.4%) were doctors. With regard to the professional training received, there were 200 nurses (44%) who had participated in courses on analgesia and sedation in paediatrics. Of the 255 courses taken, the promoter of the training was in 123 (27%) the hospital itself, 38 (8.3%) congresses, 33 (7.2%) universities, 19 (4.1%) nursing colleges, 19 (4.1%) other hospitals, 12 (2.6%) trade unions and 11 (2.4%) professional associations. The main contents of the training received focused on pharmacological measures for pain and anxiety control (93%), pain assessment systems (83%) and non-pharmacological measures (70.8%). The median score of the training received in sedoanalgesia was 5/10 (IQR 4-7).

Table 1. Variables related to assessment of training, knowledge and completion of courses on analgesia, sedation and pain in paediatrics

	Univariante analysis		Multivariante analysis	
	Value of p	OR (95% CI)	Value of p	OR (95% CI)
A) Assessment of training on analgesia, sedation and pain in pediatrics ≥ 5/10				
Experience as nurse				
< 1 year	–	(1 Reference)	–	–
1- 5 years	0.521	0.479 (0.051-4.529)	–	–
≥ 5 years	0.578	0.535 (0.059-4.839)	–	–
Experience in pediatrics ED				
< 1 year	–	(1 Reference)	–	(1 Reference)
1- 5 years	0.004	2.230 (1.283-3.876)	0.004	2.230 (1.283-3.876)
≥ 5 years	< 0.001	2.627 (1.528-4.517)	< 0.001	2.627 (1.528-4.517)
Specialist in pedaitrics (Yes)	0.024	1.687 (1.071-2.658)	–	–
Master (Yes)	0.054	2.294 (0.988-5.329)	–	–
Age > 40 years	0.800	1.053 (0.707-1.569)	–	–
B) Assessment of knowledge to correctly evaluate pain in children ≥ 5/10				
Experience as nurse				
< 1 year	–	(1 Reference)	–	–
1- 5 years	0.541	1.789 (0.277-11.554)	–	–
≥ 5 years	0.256	2.852 (0.468-17.383)	–	–
Experience in pediatric ED				
< 1 year	–	(1 Reference)	–	–
1- 5 years	0.007	2.266 (1.256-4.086)	0.007	2.258 (1.247-4.090)
≥ 5 years	< 0.001	3.862 (2.100-7.103)	< 0.001	3.905 (2.115-7.210)
Specialist in pediatrics (Yes)	0.030	1.837 (1.059-3.184)	–	–
Master (Yes)	0.051	3.313 (0.997-11.007)	0.047	3.420 (1.015-11.522)
Age > 40 years	0.185	1.374 (0.859-2.200)	–	–
C) Conducting courses on paediatric analgesia and sedation				
Experience as nurse				
< 1 year	–	(1 Reference)	–	–
1- 5 years	0.712	0.706 (0.111-4.487)	–	–
≥ 5 years	0.438	0.490 (0.081-2.967)	–	–
Experience in pediatric ED				
< 1 year	–	(1 Reference)	–	–
1- 5 years	0.121	1.553 (0.890-2.710)	–	–
≥ 5 years	0.103	1.571 (0.913-2.701)	–	–
Specialist in pediatrics (Yes)	0.242	1.272 (0.850-1.906)	–	–
Master (Yes)	0.001	3.611 (1.750-7.450)	0.001	3.611 (1.750-7.450)
Age > 40 years	0.532	0.887 (0.610-1.291)	–	–

ED: Emergency department.

There were 146 professionals (32%) who rated it below 5/10 and 91 (20%) rated their knowledge about pain in children below 5 out of 10. Experience in paediatric EDs and academic master's training were related to better knowledge assessment (Table 1). Regarding professional practice, it is noteworthy that 391 respondents (85.9%) reported using paediatric pain assessment scales in their daily practice. However, more than 60% of respondents were more confident in their own impressions. A wide variety of pain and anxiety management medications were recorded for children: midazolam 367 (80%), EMLA cream (lidocaine and prilocaine) 362 (79%), LAT gel (lidocaine, adrenaline and tetracaine) 354 (77%), nitrous oxide 315 (69%), fentanyl 276 (60%), ketamine 240 (52%), morphic chloride 226 (49%), ethyl chloride 155 (35%) and propofol 78 (17%). Aspects of improvement in their use were identified (Table 2).

Table 2. Improvement aspects identified in the administration of drugs for paediatric sedoanalgesia procedures in the emergency departments

Drug	Improvement aspect	N=455	% (95% CI)
Ketamine	Unaware of required monitoring	362	79.5 (75.6-83)
	Incorrect administration speed	203	44.6 (40.1-49.2)
	Unknown possible adverse effects	149	32.7 (28.6-37.2)
Ethyl chloride	Unknown mode of administration	166	36.5 (32.2-41)
LAT Gel	Unnecessary if biological glue	152	33 (29.2-37.8)
	Does not know places with contraindication of its application	82	18 (14.7-21.8)
Nitrous oxide	Unaware of required monitoring	110	24.2 (20.4-28.3)

LAT: lidocaine, adrenaline and tetracaine.

The results indicate that training in pediatric sedoanalgesia for ED nurses is scarce and not systematized; professional practice is heterogeneous and with areas for improvement. These data should be interpreted with caution, since the methodology used (internet survey and selection of centres as members of a scientific society) has limitations. The results, however, are similar to previous studies carried out in other settings[6-8] and suggest that systematized training programs should be implemented, as well as establishing protocols in line with current recommendations[2,4,9].

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