Relationship between trauma severity and analgesia standards used in traffic accident victims

RELAÇÃO ENTRE A GRAVIDADE DO TRAUMA E PADRÕES DE ANALGESIA UTILIZADOS EM ACIDENTADOS DE TRANSPORTE

RELACIÓN ENTRE LA GRAVEDAD DEL TRAUMA Y LOS ESTÁNDARES DE ANALGESIA UTILIZADOS EN ACCIDENTADOS DE TRÁNSITO

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ABSTRACT

This is a first-time study in Brazil, which identified the relations between the analgesic standard and trauma severity. To do this, an analysis was performed in a population of 200 traffic accident victims admitted for treatment at the emergency unit of a referral hospital for trauma care in the city of São Paulo. Trauma and lesion severity were characterized by anatomic severity indexes. Based on the analysis of the analgesic therapy, analgesia standards were constructed, founded on the World Health Organization analgesic scale. The results permitted to identify the statistic association between trauma severity and distinct analgesia standards. The dissemination of these findings could serve as the basis to design analgesia protocols in trauma and improve care quality, besides encouraging the development of studies in an area with so many knowledge gaps.

KEY WORDS

Wounds and injuries.
Analgesia.
Pain.
Accidents, traffic.

RESUMO

Trata-se de um estudo inédito realizado no país, que identificou relações entre o padrão analgésico e a gravidade do trauma. Para tal, analisou-se uma população de 200 acidentados de transporte admitidos para tratamento na unidade de emergência de um hospital referência para o atendimento ao trauma no Município de São Paulo. A gravidade das lesões e do trauma foi caracterizada por índices de gravidade anatômicos. A partir da análise da terapia analgésica encontrada, construíram-se padrões de analgesia, tendo como base a escala analgésica da Organização Mundial de Saúde. Os resultados permitiram identificar associação estatística entre a gravidade do trauma e padrões distintos de analgesia. Espera-se que a divulgação desses achados possa servir de base para a criação de protocolos de analgesia em trauma e melhoria da qualidade da assistência, além de servir de estímulo para o desenvolvimento de estudos em uma área com tantas lacunas de conhecimento em nosso meio.

DESCRITORES

Ferimentos e lesões.
Analgesia.
Dor.
Acidentes de trânsito.

RESUMEN

Se trata de un estudio inédito, realizado en el país, que identificó relaciones entre el estándar analgésico y la gravedad del trauma. Para esto, se analizó una población de 200 accidentados en el tránsito, admitidos para tratamiento en una Unidad de emergencia de un hospital de referencia para la atención de traumas, en el Municipio de San Pablo. La gravedad de las lesiones y del trauma fue caracterizada por índices de gravedad anatómicos. Del análisis de la terapia analgésica encontrada se construyeron estándares de analgesia, teniendo como base la escala analgésica de la Organización Mundial de Salud. Los resultados permitieron identificar una asociación estadística entre la gravedad del trauma y los distintos estándares de analgesia. Se espera que la divulgación de lo encontrado pueda servir de base para crear protocolos de analgesia en traumas, mejorar la calidad de la asistencia y servir de estímulo para el desarrollo de estudios en un área con tantas lagunas de conocimiento en nuestro medio.

DESCRIPTORES

Heridas y traumatismos.
Analgesia.
Dolor.
Accidentes de tránsito.

INTRODUCTION

Pain is a frequent motive to seek care at the emergency sector and a large part of emergency care services are due to external causes (third death cause in Brazil, not considering those with unclear definitions). Traffic accidents are responsible for a substantial part of the morbidity, mortality, and disabilities in that country, besides their considerable socioeconomic cost. There were approximately 32,000 deaths due to traffic accidents in Brazil in 2005[1].

Pain is recognized as one of the main consequences of trauma and its repercussions are considered highly harmful to one's organism. Although traumas occur frequently, little attention has been given to the traumatized victim in terms of pain management. This situation is not much studied in our environment and, therefore, has been evidenced by studies performed in other countries[2-3].

Pain is an unpleasant sensory and emotional experience, associated to a real or potential tissue injury, and described according to that injury. Acute pain appears as a warning that something is wrong in the body. In the emergency sector, this type of pain is very frequent due to its relation to traumatic injuries, burns, infections and inflammations[4].

The constant reaction processes due to persistent acute pain result in vicious cycles that progressively increase the trauma patient's body dysfunctions and hazardous effects, including hypoventilation, increased heart rate, reduced peripheral blood perfusion, and reflex muscle contraction. These effects worsen the patient's shock condition since it deteriorates the mechanical performance of the left ventricle, due to the reduced oxygen supply and increased plasma loss[4].

The major objectives in trauma patient care are to improve tissue perfusion, minimize cell damage and anoxia-associated physiological alterations, to manage hemorrhages, and to keep the patient's life signs and neck stable[5].

Hence, it seems clear that appropriate pain evaluation, management and relief, besides the humanitarian aspect, should be a vital part of accident victim care, with a view to contributing to maintain basic physiological functions and avoiding harmful side effects resulting from the persistent pain, as mentioned above.

Among acute types of pain, trauma pain is the least studied type in our environment. This fact was documented after an extensive bibliographic survey of the period from 1999 till2003. In view of the knowledge gaps in this field, the authors decided to develop a study with the following guiding question: is there any relation between trauma severity and the use of specific analgesia standards?

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METHOD

This is a descriptive, exploratory study using the quantitative approach. To do this, records of 200 patients hospitalized at an emergency unit were used.

The study was performed at a general public tertiary care hospital, considered a reference in the hierarchized trauma service system in the city of São Paulo.

A previous survey performed at the Medical File Division (MFD) of the referred hospital found that, in 2000 and 2001, on the average, 1,500 traffic accident victims were admitted per year for treatment, and that 640 of them remained hospitalized. After the statistical analysis, it was proposed that a sample analysis of this population should be performed, with a desired precision of 5%, expected prevalence of 50%, and risk of 1%, which resulted in 200 patient records to be analyzed. This represented about one third of the total population of hospitalized patients. The study was performed during the first semester of 2002.

The selection of the events considered traffic accidents was based on the criteria recommended by the World Health Organization (WHO), expressed in the International Statistical Classification of Diseases and Related Health Problems (ICD 10), under the alphanumeric codes (V01 to V099)[6].

For the proposed analysis, the following inclusion criteria were established for the subjects: be traffic accident victims coming directly from the accident scene, admitted at the emergency room, surviving the first 24 hours, and be older than 16 years; standardized in line with other studies by the same researchers.

The sample sources included computerized lists from the state of São Paulo data processing company (PRODESP), lists, provided by the MFD, of patients hospitalized due to traffic accidents, and records of patients hospitalized at the emergency room.

Based on the list of records of interest for the study, the researcher divided the sample into three large groups: patients who suffered car accidents, patient who were run over, and motorcycle accidents. Each record, within each group, received a specific number, following an ascending numerical order. From what was established in the statistical analysis, the following were selected at random: 80 records of car accident victims, 70 run-over victims, 50 motorcycle accident victims; i.e. a total of 200 patient records.

Data collection was initiated after the study was authorized by the Ethics Committee for Research Project Analyses of the hospital's Clinical Board (Report #074/02), and

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was performed in compliance with the MFD demands regarding patient record control and location for their analysis. All data were collected by the researcher.

For each patient, a data collection form was created and the information pertinent to the study was recorded from the moment the patient was admitted to hospital until a period of approximately 24 hours. The time recorded on the admission form was considered the starting point, and the medication hours on the admission form or patient record were used as the final mark.

The analgesia standards were organized similar to the WHO analgesic scale[7]. Standard I corresponds to the first step of the analgesic ladder (analgesics and antiinflammatories), standard II to the second (weak opioids) and third (strong opioids) steps, and standard III adds the use of midazolam to standard II, which is not included in this ladder. We cannot change the term *ladder* because it is a classic standardization by the WHO and is used in articles referring to pain and analgesia, being described exactly as a ladder with steps going up and down depending on the medication used. It is not a scale.

As for the analgesic standard, after analyzing the 200 records, 17 different analgesic prescriptions were identified. The 17 prescription models were regrouped in three analgesia standards, which served as the basis for the study analysis and for statistical possibilities. They are the following: I. Simple analgesic and/or nonsteroidal antiinflammatory drugs (NSAI); II. Simple analgesic + NSAI + Opioid(s); III. Simple analgesic + Opioid(s) + Midazolam.

Group I corresponds to the first step of the WHO Analgesic Ladder[7] and group II to the second and third steps. Group III was organized because it was considered that adding midazolam would indicate a therapeutic objective different from groups I and II.

This categorization did not take the medication, dose, interval, or administration means into consideration. This was decided based on the number of configurations that were found, which, unless widely organized, would make any statistical analysis impossible. The term 'simple analgesic' was used for dipyrone and paracetamol only to differentiate them from the rest, and not because of their composition.

To assess the severity of the injuries, the Abbreviated Injury Scale (AIS) was used, an anatomically based scale presented as a manual in which hundreds of injuries are listed according to their type, location and severity, accepted across the world[8]. The severity of each injury listed in the AIS ranges from minimum severity = 1 to maximum severity= 6; per definition injuries scored 3 or less are isolated injuries that are not life-threatening, and those with scores above 4 are considered severe, critical and fatal. These scores were defined by physicians specialized in traumatology and were included in the AIS manual, which contains thousands of injury descriptions, divided by body regions[8].

After recording and scoring all injuries, the trauma severity score (NISS) was calculated, which is defined as the sum of the square of the three highest AIS scores, regardless of the affected body region.

For future analyses regarding trauma severity, a cut-off point was established at NISS=16, which determined a severe/important trauma, following the orientation of the manual and according to studies performed using these indexes[8].

The data were stored in a database for descriptive and inference analyses. The results were organized in tables, and the frequencies in absolute and relative numbers. For the quantitative variables, the analysis was performed through the observation of minimum and maximum values and by calculating the mean, standard-deviation and median.

Chi-Square Test - used to verify the association between the studied variables and the homogeneity between the proportions. *Fisher's Exact Test* – indicated to evaluate the association between the variables and to compare proportions when the answer frequency is below five. In all tests, a 5% level of significance was considered.

RESULTS

Table 1 - Distribution of patients according to the analgesic standard groups - São Paulo - 2003

Analgesic standard		N	%
I	Analgesic analgesics + NSAI	82	41.0
II	analgesics + opioid analgesics + opioids analgesics + NSAI + opioid	56	28.0
III	analgesics + opioid + midazolam analgesics + opioids + midazolam	38	19.0
IV	Did not receive analgesics	24	12.0
Total		**200**	**100**

Note: (N = 200)

It is observed that Group I represented almost half (41%) the total analgesic use, and 24 patients (12%) did not receive analgesics. The opioid fentanyl was found only in Group III. The analgesics found in the medical prescriptions and included in the analgesia standards proposed for the analysis were the following:

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Table 2 - Distribution of the prescribed analgesics per pharmacological group - São Paulo - 2003

Pharmacological Groups		N	%
Simple Analgesics	dipyrone	176	49.4
	paracetamol	16	4.5
Nonsteroidal Antiinflammatory (NSAI)	diclofenac	12	3.4
	ketoprofene	13	3.6
	tenoxicam	7	2.0
Opioids	tramadol	12	3.4
	codeine	10	2.8
	meperidine	37	10.4
	morphine	12	3.4
	fentanyl	31	8.7
Sleep inducer	midazolam	27	7.6
Hospital sedative	*	3	0.8
Total		**356**	**100.0**

*excluded from the analysis.   Note: (N=356)

Table 3 - Distribution of patients according to the analgesic standard and trauma severity score NISS<15 and NISS>16 - São Paulo - 2003

Analgesic Standard	NISS		
	1 – 15	16 – 74	Total
I	62 (63.3%)	20 (25.7%)	82 (46.6)
II	30 (30.6%)	26 (33.3%)	56 (31.8)
III	6 (6.1%)	32 (41.0)	38 (21.6)
Total	**98 (100.0)**	**78 (100.0)**	**176 (100.0)**

$\chi^2 = 37.80$; p = 0.001   Note: (N = 176)

Considering that some patients received more than one medication, in total, 356 analgesics were prescribed in the first 24 hours to 179 patients. Dipyrone represented almost half (49.4%) of all prescribed analgesic medication. Among opioids, meperidine was the most prescribed, with 10.4%.

The Chi-Square test showed a statistical association between the two variables: between the lowest trauma severity ranges and standard I (63.3%), and between the highest severity ranges and standard III (41.0%). As for standard II, the distribution was balanced.

Table 4 - Distribution of injuries in one single most severely affected body region, according to the analgesic standard and trauma severity score NISS < 15 and NISS > 16 - São Paulo - 2003

Analgesic Standard	NISS		
	1 – 15	16 – 74	Total
I	58 (62.4%)	19 (27.1%)	77 (47.2)
II	29 (31.2%)	20 (28.6%)	49 (30.1)
III	6 (6.4%)	31 (44.3%)	37 (22.7)
Total	**93 (100.0)**	**70 (100.0)**	**163 (100.0)**

$\chi^2 = 35.76$; p = 0.001   Note: (N = 163)

The statistical results indicated a significant association between the analgesic standard and trauma severity, highlighting the use of standard I (62.4%) for less severe cases and standard III (44.3%) for more severe cases (p = 0.001).

Similarly, for the most frequently affected body region, the statistical analysis showed a significant association between the analgesia standard and trauma severity score NISS (p = 0.001).

Table 5 - Distribution of injuries on the most frequently affected body regions, according to the analgesic standard - São Paulo - 2003

Analgesic Standard	Body Region						
	Head/neck	Face	Chest	Abdomen/pelvic contents	Limbs/pelvic girdle	External Surface	Total
I	30 (54.5%)	36 (75.0%)	3 (18.7%)	4 (25.0%)	12 (22.6%)	28 (66.7%)	113 (49.1)
II	10 (18.2%)	8 (16.7%)	13 (81.3%)	9 (56.3%)	25 (47.2%)	11 (26.2%)	76 (33.1)
III	15 (27.3%)	4 (8.3%)	- -	3 (18.7%)	16 (30.2%)	3 (7.1%)	41 (17.8)
Total	**55 (100.0)**	**48 (100.0)**	**16 (100.0)**	**16 (100.0)**	**53 (100.0)**	**42 (100.0)**	**230 (100.0)**

$\chi^2 = 37.42$; p = 0.001   Note: (N = 230)

DISCUSSION

The analysis of 200 records of patients seen at the emergency unit of a public hospital identified that analgesics were prescribed to 179 patients, corresponding to 89.5% of the total sample. It was found that *simple* analgesics were the most often prescribed medications for pain relief (Table 2).

For instance, dipyrone, either used with another medication or alone, was the most prescribed drug, appearing 91 times in the form *if necessary*, in 60 cases as a secondary medication in the treatment, and in 31 as the only analgesic on the prescription. These are concerning facts since they suggest insufficient pain relief for the severity and frequency of the injuries. Using analgesics (dipyrone or paracetamol) alone as the only active principle for pain relief at the emergency room leads to an inquiry by pain researchers (1994): are doctors in the emergency sector too stingy with analgesics[9]?

Some analgesics are frequently used because of their efficacy, tradition or price. Dipyrone is probably the most used analgesic over the last decades because, besides being an analgesic, it has an antipyretic action[10]. Dipyrone is a traditional, highly used medication. There are no doubts about its effect, but its isolated indication might be insufficient for moderate and intense post-traumatic pain[9].

It appears that the question above is a timely concern, since there is unanimity in the literature reports that state that strong opioids (meperidine and morphine) are the ideal and necessary drugs for treating intense pain, while weak opioids (codeine and tramadol) are indicated for moderate pain. Moderate and intense pain appear as the most common in the emergency sector, especially due to injuries like fractures, contusions, torsions, traumatic amputations and lacerations, which are suggestive of very painful situations[2-3,9].

The WHO analgesic ladder proposed the use of nonsteroidal antiinflammatory drugs, weak and strong opioids, in this order, for increasingly intense oncological pain. These analgesics can be associated with other medications (anxiolytic, antidepressant and anticonvulsive drugs, and others), especially in cases of chronic pain. Aspirin, codeine and morphine are the standard analgesics in this ladder[7].

Several studies have proven the efficacy of the WHO program to relieve oncological pain. This proposal has surpassed the initial recommendation for pain management in cancer and has become the guideline for pain management in general[11-12].

Despite the flexibility of the organization of analgesic standards in the present study, it was observed that weak (tramadol and codeine) and strong (morphine and meperidine) opioids were used via intravenous (IV) administration in 100% of cases, and every patient received at least one dose and a maximum of three doses of pain relief medication. As to the hours, the administration was done at pre-established times and following an on-demand regimen, with no conduct standardization among the teams.

In Brazil, opioids with a stronger analgesic action have a more restricted use by physicians in the emergency sector[13]. This occurs because opioids are usually related to important neurological problems and cancer, and have undesirable side effects. Especially in general practice, they are rarely used. They are the strongest analgesics in medicine, and provide patients with pain relief and well-being. It is believed that, in a near future, they will have a broader use because of their beneficial effects. Today, the use of opioids is more restricted to physicians specialized in pain, neurologists and anesthesiologists[13-14]. Due to their strength and efficacy, they are indicated for intense and moderate pain in the treatments of acute situations, like in the postoperative period[15].

The reduced use of strong opioids, more specifically morphine (3.4%) and meperidine (10.4%), in the emergency sector (Table 2) can be related to the stigma of addiction associated to these drugs. This factor has no relation with its use in acute pain in the emergency sector. Another reason for it not being much used is health professionals' lack of knowledge and fear to use these drugs[16].

It appears to be opportune to perform a detailed analysis of the severity of injuries and trauma in patients who received strong opioids. Regarding morphine, two patients presented NISS=5 due to face and external surface regions. In the other ten cases, the NISS was equal to or above 16 and not above 24, and referred injuries to the patient's chest, lower limbs and abdomen. In the specific case of the meperidine used in 37 patients, there was no standardization related to trauma severity or to an affected body region.

It was observed that some patients with similar injury and trauma severity and in a stable hemodynamic condition did not receive any analgesics or were medicated with *simple* analgesics. Patients with craniocerebral trauma were excluded from this analysis.

Hence, it is confirmed that is it important to discuss the undertreatment and inefficient evaluation of trauma, as well as the need to develop analgesia protocols for the emergency setting, considering that analgesic prescription has been based on the beliefs and personal values of each professional[16].

The findings from these studies lead to a reflection about our own actions as practitioners and professors when choosing classes and contents that assure our students and future colleagues the necessary safety and quality in the care that is delivered, or would there be some setting or area of expertise with no pain, as of birth?

For the craniocerebral segment, it was observed that standards I and II were important, especially for standard III in cases of greater severity. Analyzing the meanings of these data, two hypotheses were formulated: it was supposed that standard I occurred in situations of less severe brain injuries, and standard III was used for more severe injuries. To support these hypotheses, the data collection

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instrument was checked again to verify if there was any concordance between the severity of the injury and the analgesic standard. It was observed that, different from the other body regions, the severity of the brain injuries had an equal distribution between AIS ≤ 3 (50.8%) and AIS ≥ 4 (49.2%). It should be pointed out that, in the 200 studied patients, 84 injuries had an AIS score ≥ 4, and that 58 (49.2%) of these were in the head/neck region. This finding is extremely important due to the high prognostic value determined by injuries to this body segment.

Craniocerebral trauma in traffic accident victims is the isolated injury that most frequently occurs in severe and fatal cases[17].

A (detailed) analysis of the patient records showed that 64.4% of the victims with AIS injuries ≥ 4 received group III drugs. On the other hand, 61.8% of those with AIS injuries ≤ 3 received group I drugs.

It should be stressed that all patients with brain injuries who received standard II drugs had, in addition to the brain injury, one or more lesions in other body parts, either the chest and/or abdomen/pelvic contents and/or upper limbs that were described as very painful.

It is believed that fentanyl was used for victims with AIS injuries = 4 for the head region because it is a narcotic analgesic (opioid) frequently used for short periods of analgesia, as a secondary anaesthetic, and in the pre-intubation period. Regarding the use of midazolam, it is believed it was chosen since it is a hypnotic sedative that induces sleep and is frequently used for preoperative sedation.

Hence, it is affirmed that basically two analgesic conducts were adopted for craniocerebral trauma victims: one of a *wider and simpler* nature, when dipyrone or paracetamol are seen as the first-choice drugs for less severe injuries, and another more *specific* conduct for patients with more severe brain injuries and, in these cases, fentanyl and midazolam appeared as the chosen drugs.

Regarding face and external surface injuries, standard I analgesia prevailed in term of severity, as well as for the frequency of these injuries. Standard II analgesia appeared as the most frequent for the chest, abdomen and limbs regions, i.e. weak and strong opioids were the most used for pain relief (Table 5).

As for trauma severity, it was observed there was a significant relation between the lowest severity ranges (NISS ≤ 15) and analgesia standard I, and between the highest severity ranges (NISS ≥ 16) and standard III.

By analyzing each body region, it appears that this significant relationship was mainly due to the use of group I drugs for the face and external surface regions, mostly affected with AIS injuries ≤ 2, and head injuries in which analgesia standard III was used for AIS injuries = 4. AIS injuries = 3 for limbs, chest and abdomen reinforce that there is important pain involved in these injuries in the context of trauma and, therefore, standard II is indicated in these cases.

The association between less severe trauma and the use of *simpler* analgesics, and between more severe traumas and the use of stronger analgesics might be evident but, paradoxically, no studies were found in Brazilian literature to evidence this finding. This fact indicates there is an urgent need for continuous research on pain and analgesia in the emergency sector.

CONCLUSION

A statistical association was observed between trauma severity (NISS) and the analgesia standard, which points out that one standard is used for trauma severity (NISS) ≤ 15 and another standard is used for cases with ≥ 16, especially due to the severity of craniocerebral trauma.

It is expected that this study could serve as a basis for the development of analgesia protocols, for discussing this issue in courses for the standardization of polytrauma patient care in hospital and prehospital settings, to increase familiarity with opioids, and provide more support to pain groups from health and teaching institutions.

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