

Original article

## The effect of central nervous system depressant, stimulant and hallucinogenic drugs on injury severity in patients admitted for trauma

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### ABSTRACT

**Objective:** The effect of drugs other than alcohol on severity of trauma remains unclear. Pooled data analyses in previous studies that grouped substances with opposite effects on the central nervous system (CNS) may have masked the influence of substances on injury severity. The aim was to analyze the effect of stimulant, hallucinogenic and depressant drugs other than alcohol on injury severity in trauma patients.

**Methods:** The presence of alcohol, stimulant drugs (cocaine, amphetamines and methamphetamines), depressant drugs (benzodiazepines, opiates, methadone and barbiturates) and hallucinogenic drugs (THC and PCP) was analyzed in 1187 patients between 16 and 70 years old admitted to a trauma hospital between November 2012 and June 2015. Injury severity was determined prospectively as the Injury Severity Score. A multivariate analysis was used to quantify the strength of association between exposure to substances and trauma severity, using the presence of alcohol as a stratification variable.

**Results:** Drugs other than alcohol were found in 371 patients (31.3%): 32 (2.7%) stimulants, 186 (15.3%) depressants, 78 (6.6%) hallucinogenics and 75 (5.6%) polydrug use. The presence of CNS depressant substances was associated with increased injury severity only in patients also exposed to alcohol, with an adjusted odds ratio of 4.63 (1.37-15.60) for moderate injuries and 7.83 (2.53-24.21) for severe.

**Conclusion:** CNS depressant drugs had a strong influence on injury severity in patients who screened positive for alcohol consumption.

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## Efecto de las drogas alucinógenas, estimulantes y depresoras del sistema nervioso central sobre la gravedad de la lesión en pacientes ingresados por traumatismos

### RESUMEN

**Objetivo:** No está claro qué efecto tienen las drogas distintas del alcohol sobre la gravedad de los traumatismos. Los análisis incluidos en estudios previos, que agrupan sustancias con efectos opuestos sobre el sistema nervioso central (SNC), pueden haber enmascarado la influencia de estas sobre la gravedad. El objetivo fue analizar el efecto de las drogas alucinógenas, estimulantes y depresoras del SNC, diferentes del alcohol, sobre la gravedad de las lesiones en pacientes ingresados por traumatismos.

**Métodos:** Se analizó la presencia de alcohol, drogas estimulantes (cocaína, anfetaminas y metanfetaminas), depresoras (benzodiazepinas, opiáceos, metadona y barbitúricos) y alucinógenas (THC y PCP) en 1187 pacientes de entre 16 y 70 años de edad ingresados por traumatismo de noviembre de 2012 a junio de 2015. La gravedad del traumatismo se determinó prospectivamente mediante la *Injury Severity Score*. Se cuantificó la fuerza de la asociación entre la exposición a sustancias y la gravedad del traumatismo mediante un análisis multivariante, utilizando la presencia de alcohol como variable de estratificación.

#### Palabras clave:

Alcohol

Benzodiazepinas

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**Resultados:** Se encontraron drogas diferentes del alcohol en 371 pacientes (31,3%): 186 (15,3%) depresoras, 78 (6,6%) alucinógenas, 32 (2,7%) estimulantes y 75 (5,6%) combinadas. La presencia de sustancias depresoras del SNC se asoció con un aumento de la gravedad del traumatismo solo en pacientes también expuestos al alcohol, con una *odds ratio* ajustada de 4,63 (1,37-15,6) para lesiones moderadas y de 7,83 (2,53-24,21) para lesiones graves.

**Conclusión:** Las drogas depresoras del SNC tuvieron una fuerte influencia en la gravedad del traumatismo en los pacientes que además presentaban resultados positivos para consumo de alcohol.

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## Introduction

The role of alcohol as a major causal factor in trauma has been highlighted in several studies.<sup>1-5</sup> In recent years concern has spread to drugs other than alcohol,<sup>6-13</sup> including prescribed or nonprescribed psychotropic drugs.<sup>14,15</sup> Studies to date conclude that exposure to alcohol and drugs are associated with a higher risk of injury regardless of the mechanism of injury (traffic crashes, falls, etc.).

Although there appears to be agreement that alcohol and other drugs are important risk factors for injury, there is no consensus on the role of these substances in severity. Some studies found that the presence of these substances increases trauma severity,<sup>16-24</sup> whereas others found no such association.<sup>14,25-27</sup> However, studies that evaluated the effect of illicit or psychotropic drugs on trauma rarely focused on the use of these substances separately,<sup>14,24,27</sup> because the main focus of study was usually alcohol consumption. This leads to important methodological deficiencies in assessing the association between substances other than alcohol and injury severity. For example, drugs with different effects, including opposite effects, on the central nervous system (CNS) are usually pooled for statistical analysis.<sup>21-23,26</sup> Moreover, some studies systematically excluded patients with positive tests for benzodiazepines and opiates,<sup>21,24,26</sup> because these drugs are frequently used in prehospital care for trauma patients. This makes it impossible to analyze the role of these substances in trauma severity. To these limitations must be added the fact that these studies were frequently based on data obtained from national, regional or hospital-based trauma registries.<sup>16,19,21,22,27</sup> These registries record only patients whose medical care provider decided to request an alcohol and/or drug test at the time the patient was admitted to the emergency room.

The factors related to injury severity merit more in-depth analysis. Greater injury severity is strongly associated with increased mortality, more complications, longer hospital stays, and ultimately greater economic costs.<sup>28</sup> We believe it is worthwhile to investigate the specific roles of drugs in trauma severity, based on the hypothesis that a separate analysis of the effect of each substance on the CNS (depressants, stimulants and hallucinogens) will indicate a greater magnitude of association for the group of depressant substances, due to the reduced awareness and impaired cognitive and motor function that these agents cause.<sup>29</sup> The aims of the present study were thus to analyze the effect of stimulant, hallucinogenic and depressant drugs other than alcohol on injury severity in hospital patients admitted for trauma, and to determine the possible role of alcohol as a modifier of the effect of these drugs.

## Methods

### Environment

The data for this study were from a cohort of patients admitted for traumatic injuries. This cohort was created as part of a

Screening, Brief Intervention, and Referral to Treatment (SBIRT) project<sup>30</sup> designed for trauma patients (MOTIVA project). The MOTIVA project was approved by the Granada Provincial Research Ethics Committee and was active during the 31 nonconsecutive months during which it received financial support from the Regional Andalusian Government and the Spanish National Traffic Directorate: November 2011 to October 2012, June 2013 to November 2013, and June 2014 to June 2015 at the University Hospital Virgen de las Nieves of Granada, Spain. Our Hospital is a public tertiary-care hospital with a separate trauma center that covers a population of more than 600,000 inhabitants.

### Definition of exposure

The MOTIVA project involved screening for alcohol and drug use in all patients aged 16 to 70 years who were hospitalized for trauma independently of trauma severity. Informed consent was required before the screening. In sedated patients or unable to collaborate, informed consent was required when the clinical situation was reversed or, if it was not possible, to relatives.

Screening for drugs (tetrahydrocannabinol [THC], phenylclidine [PCP], cocaine, amphetamines, methamphetamines, benzodiazepines, opiates, methadone, barbiturates or tricyclic antidepressants) was done with urine testing by fluorescence immunoassay.<sup>31,32</sup> Review of the patient's medical record was used to rule out patients who tested positive for benzodiazepines and opioids as a result of emergency treatment of their injuries. Alcohol consumption was screened by blood testing, and was considered positive when the blood alcohol level was higher than 0.3 g/L (the same cutoff point established by the Spanish National Institute of Toxicology and Forensic Sciences)<sup>33</sup> at the time of hospitalization or, given the short window of detection (6 hours),<sup>34</sup> if the patient reported exposure on interview. Therefore, personal interviews were conducted to confirm the status of alcohol exposure in patients screened 6 hours after the trauma. The interviews were carried out at the moment in which the patients' clinical conditions permitted it. The remaining study variables were collected from the medical records prospectively.

### Definition of outcome

The MOTIVA project contemplated the injury codification based on the Abbreviated Injury Scale (AIS)<sup>35</sup> of all patients hospitalized with injury diagnosis (ICD9-CM). This anatomical-based coding system classifies injuries in each of nine body regions using an ordinal scale of 1-6, with 1 as least severe and 6 as most severe. For the present study, trauma severity was measured with the Injury Severity Score (ISS).<sup>36</sup> The ISS is determined by summing the squares of the highest AIS rating (up to 5) for each of the three most severely injured body areas. If any of the three scores is a 6, the score is automatically set at 75. Consequently, ISS can take values between 1 and 75. Scores were recorded during the patient's hospital stay.

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