

Impact of clinical toxicology in emergency medicine in Spain: Literature survey of articles published in the journal EMERGENCIAS

Santiago Nogué^{1,2,*}, Montserrat Amigó^{1,2} and Oscar Miró^{1,2}

¹Clinical Toxicology Unit and Emergency Department, Hospital Clínic, Calle Villarroel 170, 08036 Barcelona, Spain; ²Research area: “Emergencies: Processes and pathologies”, IDIBAPS, Barcelona, Spain

ABSTRACT

Clinical toxicology, mainly the diagnosis and treatment of acute poisonings, represents 2-3% of hospital emergencies. We analysed the relationship between clinical toxicology and emergency medicine in Spain by reviewing toxicological articles published in EMERGENCIAS, the official journal of the Spanish Society of Emergency Medicine, in the last 25 years. After accessing the EMERGENCIAS website (http://www.semes.org/revista_EMERGENCIAS/english), we read all the titles of articles published between 1988 and 2013 and identified articles containing the words toxic, intoxication, poisoning or any potentially-poisonous source including medicines, drugs of abuse, domestic, agricultural or industrial products, plants, fungi and animals. Adverse reactions to medications and foodborne infections were excluded. We extracted the main characteristics of each article identified. Articles selected were grouped in five-year periods to analyse the temporal evolution. Twenty-five volumes (154 numbers) of EMERGENCIAS, with 2160 articles, were reviewed. We identified 192 (8.9%) articles on toxicology, including Letters to the Editor (57 documents), Original or Short original articles (54 documents) and Clinical notes (31 documents). There were no significant differences ($p > 0.05$) according to five-year periods, the proportion of toxicological articles published or

the type of article. Of the articles selected, 86.4% were of hospital origin, 9.4% involved nurses as authors, 9.6% were related to children and 47% came from Madrid or Barcelona. Intoxication due to medications and drugs of abuse were the most prevalent subjects. In recent years there has been a significant decline in articles on intoxication due to medications ($p < 0.001$), and there have been more articles on drugs of abuse and with the collaboration of ≥ 2 centres ($p < 0.001$). In conclusion, clinical toxicology has been uniformly represented in EMERGENCIAS in the last 25 years, confirming the ongoing relationship between Spanish toxicologists and emergency physicians. Most articles came from hospitals and referred to medications and drugs of abuse.

KEYWORDS: clinical toxicology, emergency department, bibliometrics

INTRODUCTION

Clinical toxicology (CT) is a medical specialty devoted to the diagnosis and treatment of acute and chronic poisonings. Acute poisonings are closely linked with emergency medicine (EM), as exemplified by Poison Control Centres, the first of which opened in November 1953 at Presbyterian-St Luke's Hospital in Chicago in order to aid paediatricians attending children with acute poisoning [1].

In Spain, the Poison Control Centre was created in February 1971 and receives more than 100,000

*Corresponding author: SNOGUE@clinic.uib.es

telephone inquiries about toxic exposures annually. In 1988, the Spanish Society of Emergency Medicine (SEMES) was created and the first issue of EMERGENCIAS, the SEMES journal, was published.

Studies have highlighted the interest of Spanish emergency physicians in CT and that of toxicologists, intensivists and other specialists in EM. Miró *et al.* showed that, between 2000 and 2004, toxicology and pharmacology were the third area of interest in scientific papers published by emergency physicians, behind only cardiovascular disease and infectious diseases [2]. Another study by Miró *et al.* which used the *Science Citation Index* to investigate the scientific production of Spanish emergency physicians between 1975 and 2004 found that toxicology was the fourth area of scientific production in terms of the number of documents, behind general internal medicine, intensive care and cardiovascular diseases [3].

The aim of this study was to investigate the representation of CT in EM in Spain by analysis of scientific papers on toxicology published in the journal EMERGENCIAS in the last 25 years.

MATERIALS AND METHODS

Through the website of the journal EMERGENCIAS (http://www.semes.org/revista_EMERGENCIAS/english/) we reviewed the indexes of all numbers published from volume 1 number 0 (May 1988) to volume 25 number 6 (December 2013). The indexes were reviewed between July 2013 and January 2014. EMERGENCIAS is the most-widely read Spanish journal in the field of EM. It is indexed by the Thomson Reuters Web of Science, has an impact factor (2012) of 2.572 and ranks in the first quartile (third place) of 24 emergency medicine journals.

We selected documents whose title contained the words toxic, toxicologist, toxicology, poisoning, poisoned, poison, overdose, body-packer, body-stuffer or the name of any product (medication, drug of abuse, domestic product, agricultural, industrial, plant, mushroom, terrestrial or marine animal) that may be toxic or poisonous. Of the papers selected, those judged to have no relationship to toxicology, such as allergic reactions, the side effects of medications used at therapeutic doses and articles on foodborne infections, were excluded, as were summaries of all communications and presentations at conferences.

For the documents finally included, we identified the year of publication, the article type and origin (inpatient/outpatient), subject and authors (inclusion or not of nurses and affiliation of the first author with respect to post and institution). We also evaluated whether the article included paediatric cases and if there was collaboration between centres and/or autonomous communities.

The 25-year period was divided into five-year periods. Since EMERGENCIAS started in mid-1988, the first period included 5½ years (1988-1993), and the rest exactly five years (1994-1998, 1999-2003, 2004-2008 and 2009-2013).

The data were incorporated into an SPSS database. Absolute values and percentage were used to describe qualitative variables, and means and standard deviations were used for quantitative variables. Qualitative variables were compared using the chi-square test and quantitative variables were compared using one-way variance. Changes over time were assessed using the chi-square test for linear trend. The level of statistical significance was established as $p < 0.05$.

RESULTS

The 25 volumes of EMERGENCIAS included 154 numbers and 2160 documents, of which 192 (8.9%) were concerned with toxicology, 94 of the 154 numbers (61%) contained at least one paper on toxicology or poisonings (Table 1). The most common types of toxicological document were Letters to the Editor (57 documents), followed by Originals or Brief Originals (54 documents) and Clinical Notes (31 documents). The most frequent subjects were the clinical manifestations of poisoning (98 documents), and treatment (35 documents, including 5 on digestive decontamination and 21 on the use of antidotes). The vast majority of documents referred to poisonings in adults but there were also 17 documents that included paediatric patients, of which 3 were exclusively paediatric. The evolution of these documents by five-year periods is shown in Table 2.

Institutionally, documents came from hospitals in 167 cases (87%), extra-hospital emergency services in 10 (5.2%) and other areas in 15 cases (Table 3). The most prominent affiliations of the first author were the Hospital Clinic and Hospital del Mar of Barcelona, the Hospital Universitario de Canarias,

Table 1. Type of toxicological document (n = 192).

Format	Number of documents (%)
Letter to the Editor	57 (29.7)
Original and Brief Original	54 (28.1)
Clinical note	31 (16.1)
Technical data sheet	23 (12.0)
Review	10 (5.2)
Editorial	8 (4.2)
Image	3 (1.6)
Other	6 (3.1)
Content	Number of documents (%)
Clinical manifestations	98 (51.0)
Treatment	35 (18.2)
Epidemiology	15 (7.8)
Complementary tests	12 (6.3)
Organization and logistics	6 (3.1)
Quality of care	6 (3.1)
Mortality	5 (2.6)
Physiopathology	2 (1.0)
Diagnostics	2 (1.0)
Toxicovigilance	2 (1.0)
Public health	2 (1.0)
Others	7 (3.6)

Table 2. 5-yearly evolution of toxicological documents (n = 192) published in EMERGENCIAS (1988-2013).

	1988-1993	1994-1998	1999-2003	2004-2008	2009-2013	Total	p
Documents published							
Documents published in EMERGENCIAS	318	283	452	447	660	2160	
Toxicological documents (% of total documents)	43 (13.52)	25 (7.94)	31 (7.07)	38 (8.50)	55 (8.08)	192 (8.9)	0.216
Toxicological documents partially or totally authored by nurses (% of total toxicological documents)	1 (2.3)	3 (12)	1 (3.2)	6 (15.8)	7 (12.7)	18 (9.4)	0.060
Toxicological documents including some or all paediatric cases (% of total toxicological documents)	1 (2.3)	4 (16)	1 (3.2)	4 (10.5)	7 (12.7)	17 (8.9)	0.150
Type of toxicological document							
Original research*	15	8	4	9	18	54	0.130
Clinical experience**	1	13	27	22	28	91	0.353
Review or Consensus***	26	3	0	5	4	38	0.194
Expert opinion****	1	1	0	2	5	9	0.196

Table 2 continued..

Type of toxicology principally referred to in documents							
Clinical toxicology	41	25	30	36	50	182	
Analytical toxicology	1	0	0	2	4	7	
Experimental toxicology	1	0	0	0	0	1	
Environmental toxicology	0	0	1	0	0	1	
Management/Quality	0	0	0	0	1	1	
Type of toxic agent principally referred to in documents							
Medications	24	5	7	3	9	48	0.001
Drugs of abuse	9	8	5	13	12	47	0.550
Household products	1	5	5	3	8	22	
Agricultural products	0	1	2	3	1	7	
Industrial products	0	1	4	6	5	16	
Plants	0	0	4	1	0	5	
Animals	0	1	2	4	1	8	
Fungi	1	0	0	0	1	2	
Epidemiology	1	0	1	3	6	11	
Foodstuffs	0	0	1	0	0	1	
General	7	4	0	2	12	25	
Collaboration in authorship in documents							
Collaboration between 2 or more centres (% of toxicological documents)	3 (7.0)	3 (12)	9 (29)	9 (23.7)	22 (40)	46 (24)	<0.001
Collaboration between 2 or more Autonomous Communities (% of toxicological documents)	2 (4.7)	1 (4)	0 (0)	4 (10.5)	10 (18.2)	17 (8.9)	0.008
One or more non-Spanish authors (% of toxicological documents)	0 (0)	0 (0)	0 (0)	6 (15.8)	3 (5.5)	9 (4.7)	0.02

*Includes Originals and Brief originals. **Includes Clinical notes, Letters to the Editor and Images. ***Includes Technical Data Sheets, Reviews and Consensus. ****Includes Editorials and Points of View.

the Hospital Clinic of Zaragoza and the Hospital of Palma de Mallorca which, together, accounted for 53 documents, that is, 28% of all toxicological documents and 32% of documents from hospitals. There was collaboration between ≥ 2 centres in 24% of the toxicological documents. Table 4 shows the medical service of the first author of documents from hospitals, which was the emergency department in 53.8% of cases.

The Autonomous Communities with the largest number of first authors were Catalonia (66 papers, 34.4%) and Madrid (25 papers, 13.0%). Overall,

8.9% of the toxicological documents involved collaborators from ≥ 2 communities. We also analysed whether ≥ 1 authors were working in other countries. There were no such authors during the first 15 years of the study period, but were present in 9.7% of toxicological documents in the last decade (Figure 1).

Nurses and/or paramedics were sole authors of two documents, while nurses were identified as authors together with physicians or other health professionals in another 16 documents. The highest number of documents with contributions by nurses (12.7%) was in the last five-year period (Table 1).

Table 3. Affiliation of first author and presence of collaborations in 192 toxicological documents.

Type of Institution	Name	Number of documents (% of total)
Hospital emergency services	H. Clínic (Barcelona)	28 (14.6)
	H. Mar (Barcelona)	8 (4.2)
	H. Universitario (Tenerife)	7 (3.6)
	H. Clínico (Zaragoza)	5 (2.6)
	H. Son Espases / Son Dureta (Palma)	5 (2.6)
	H. San Agustín (Avilés)	4 (2.1)
	H. Germans Trias i Pujol (Badalona)	4 (2.1)
	H. Naval de San Carlos (San Fernando)	4 (2.1)
	H. Río Hortega (Valladolid)	4 (2.1)
	65 hospitals with < 4 documents	98 (51.0)
Extra-hospital emergency services	SUMMA 112 / 061 Insalud (Madrid)	3 (1.6)
	SAMUR (Madrid)	2 (1.0)
	Fire service (Zaragoza)	1 (0.5)
	Las Lagunas (Mijas)	1 (0.5)
	Mobile UVI (Motilla del Palancar)	1 (0.5)
	SAMU 061 (Asturias)	1 (0.5)
	SAMU (Valencia)	1 (0.5)
Other services	Military Defence School	3 (1.6)
	University of Barcelona	3 (1.6)
	Other universities, Primary care, Public health agency, or not identified	9 (4.7)

Table 4. Type of service of first authors of toxicological documents generated in hospitals (n = 167).

Emergency department	91 (53.8%)
Intensive care unit	26 (15.4%)
Clinical toxicology unit	19 (11.2%)
Laboratory	6 (3.6%)
Anaesthesia	4 (2.4%)
Pharmacy	2 (1.2%)
Clinical pharmacy	2 (1.2%)
Other hospital services	17 (11.2%)

The main toxic products involved are shown in Table 5, with a high prevalence of benzodiazepines and paracetamol in the group of medications, cocaine and alcohol in the group of drugs of abuse and carbon monoxide and smoke from fires in the group of household products.

Figure 1 analyses the five-year trends of the study variables, and shows that there were no significant changes in the five periods studied with respect to the overall prevalence of toxicological documents, authorship by nurses, the inclusion of paediatric cases, and the presence of original research or articles on drug abuse. However, there was a significant decline in documents dealing with medication poisonings, increased collaboration between centres and Autonomous Communities, and a significant increase in international collaborations.

DISCUSSION

Clinical toxicology has been represented in the journal EMERGENCIAS in the past 25 years, with no significant differences according to five-year periods. Between 1988 and 1993, there was a higher prevalence of toxicological documents (13.5% of all articles), but this was mostly due to the publication of 23 safety data sheets in various numbers in this period.

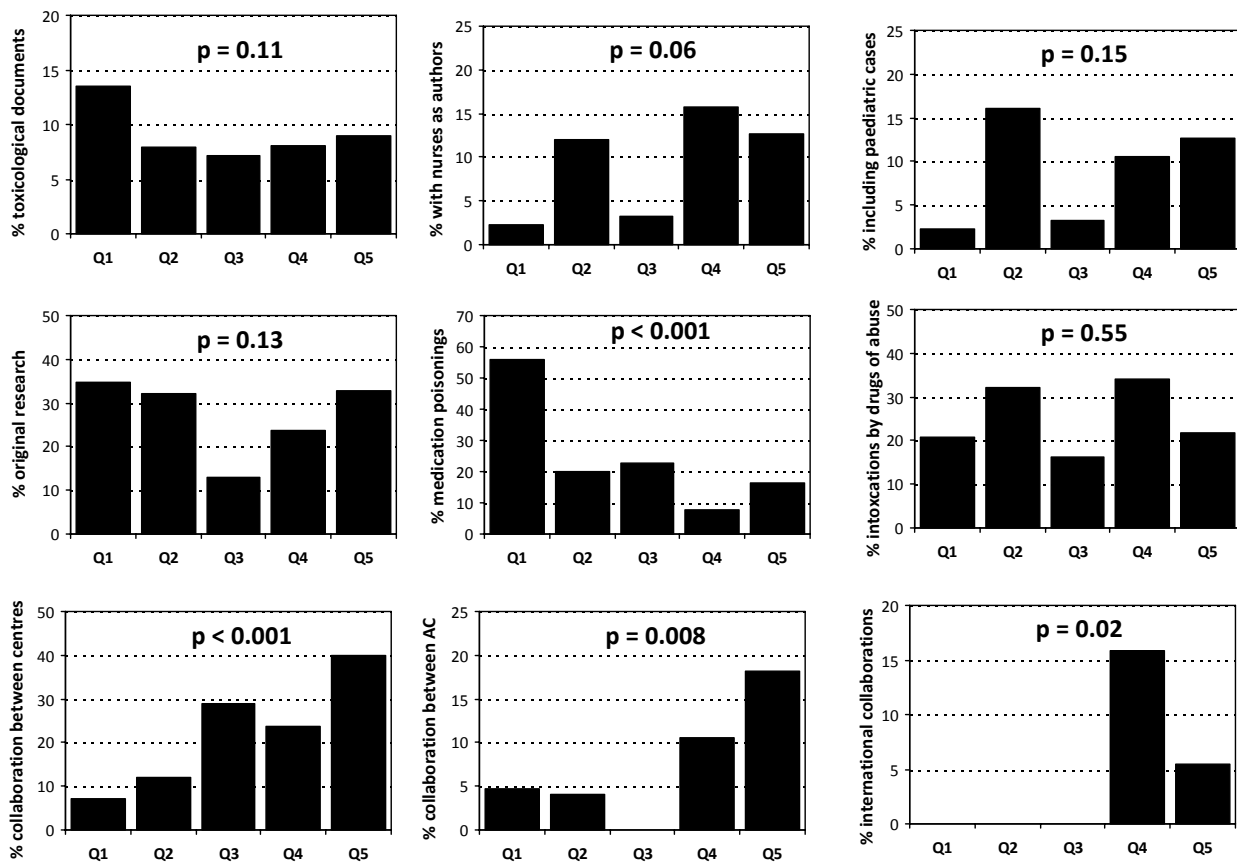


Figure 1. Evolution of toxicological documents published in EMERGENCIAS by five-year periods. From left to right, and from above to below the figure shows the percentage of toxicological documents published (with respect to the total), the participation of nurses, the inclusion of paediatric cases, original articles, documents on medications and drugs of abuse, and the collaboration between centres, Autonomous Communities and with other countries. Q1 = 1988-1993; Q2 = 1994-1998; Q3 = 1999-2003; Q4 = 2004-2008; Q5 = 2009-2013; AC = Autonomous Communities

Table 5. Main toxic agents involved in toxicological documents.

Type of toxic agent (Number of documents)	Agent (Number of documents)
Medications (48)	Benzodiazepines (5)
	Paracetamol (4)
	Oral antidiabetics (3)
	Digoxin (2)
	Cyclic antidepressant (2)
	Lithium (2)
	Isoniazid (2)
Drugs of abuse (47)	Cocaine (18)
	Alcohol (9)
	Amphetamine derivatives (5)
	Opiates (4)
	Body-packers (3)
	Cannabis (2)

Table 5 continued..

Household products (22)	Carbon monoxide (11) Smoke from fires (4) Methanol (3) Water (3) Coumarin rodenticide (2) Butane gas (1)
Industrial products (16)	Chemical weapons (3) Petrol/Kerosene (2) Magnesium fluorosilicate (1)
Agricultural products (7)	Organochlorine insecticide (2) Carbamate insecticide (1) Organophosphate insecticide (1)
Animals (8)	Fish or jellyfish (4) Spiders (2) Snakes (2)
Plants (5)	<i>Datura stramonium</i> (4) <i>Atropa belladonna</i> (1)
Fungi (2)	<i>Amanita phalloides</i> (1) <i>Morchella esculenta</i> (1)

In the subsequent five-year periods, the presence of toxicological articles remained stable (7-9%).

The wide difference between documents coming from hospitals (87%) and those coming from extra-hospital emergency services (5.2%) is very striking, but not exclusive to toxicology, as it affects all areas of research in the field of accidents and emergencies, as previously reported [4]. The difference may be attributed to the heterogeneity of the professionals comprising the latter group, their lack of education in research, lack of infrastructure, difficulties in data collection and the follow up of cases, and the absence of incentives, among other reasons.

Some of these factors may also explain the relatively-low participation of nurses in this type of document (9%). However, the perspectives for this group of professionals are more optimistic due to improvements in research training, their growing inclusion in multidisciplinary teams, and increasing professionalization of the nursing profession, in many health centres. Multidisciplinary research is increasingly recognized as the best option to achieve comprehensive knowledge of a problem, and therefore its future expansion is to be desired [5, 6].

The results show that the Hospital Clinic of Barcelona was the leading Spanish hospital included, accounting for 14.6% of all toxicological documents, and for the first affiliation in 15.2% of Original or Brief Original articles. This is undoubtedly related to the presence of a Clinical Toxicology Unit integrated within the Emergency Department [7].

However, toxicologists, in the strict sense of the word, were not responsible for the majority of this scientific production. Emergency physicians were the first authors in more than 53% of the documents, followed by intensivists. This may be a guarantee of future scientific production in the field of toxicology, regardless of any changes that may occur with respect to the presence of clinical toxicologists or functional toxicology units, although it would be desirable to retain the emergency physician-toxicologist alliance without excluding other professionals interested in this area [8].

CONCLUSION

Spanish clinical toxicology has maintained a stable and constant presence in the journal EMERGENCIAS in the last 25 years. Over this period there has been a reduction in the number of articles on medication poisonings and an increase in articles

on overdoses due to drugs of abuse. Recent years have seen greater collaboration between hospitals and between Autonomous Communities, and an increase in the participation of authors from other countries.

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CONFLICT OF INTEREST STATEMENT

The authors report no conflicts of interest.

ABBREVIATIONS

CT	:	Clinical toxicology
EM	:	Emergency medicine
EMERGENCIAS	:	The SEMES journal
SEMES	:	Spanish Society of Emergency Medicine

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