

RESEARCH ARTICLE

Fatal Road Traffic Accidents in Mureş County, Romania – A Retrospective Autopsy Based Study

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Objective: The main objective of this study is to evaluate the medico-legal aspects of fatal road traffic accidents. **Methods:** This is a retrospective study consisting of 80 forensic autopsies performed at the Institute of Legal Medicine – Tîrgu Mureş, Romania during a two years period, between January 1st, 2016 to December 31st, 2017. The information obtained was based on the medical records and the evaluation of autopsy reports. **Results:** Male victims involved in road traffic accidents were nearly three times more numerous than women (72.5% vs. 27.5%). Divided into 3 age groups (under 35 years old, 36-59 years old and over 60 years old) we noticed a relatively uniform distribution of the victims, with a slight dominance of the 36-59 age group and the over 60 years of age group. The highest number of victims was among the pedestrians (36.25%), followed in decreasing order by the drivers (33.75%), passengers (17.5%), cyclists (7.5%) and motorcyclists (5%). Positive alcohol testing was found in 14 of drivers (81 %). The analysis of lesions found during necropsies of the deceased at the scene of the accident highlights some particularly life-incompatible injuries that resemble any rescue effort on the part of the medical crew moved to the scene of the accident. **Conclusion:** Inappropriate road conditions and indiscipline in traffic of both drivers and pedestrians contribute to unacceptably high mortality.

Keywords: fatal road traffic accidents, autopsy, Mureş County

Received 2 September 2019 / Accepted 22 October 2019

Introduction

One of the major preventable public health problems worldwide is the road traffic accident (RTA) which is on the rise and can be attributed to the increasing number of vehicles, lifestyle changes, and high-risk attitudes. When referring to global mortality, fatal RTAs account 1.7%, and 91% of the world's fatalities on the roads occur in the low and middle-income countries [1]. By 2020, road traffic injuries are expected to take third place in the rank order of disease burden [2]. According to the World Health Organization (WHO), in 2010, 1.25 million persons died in road traffic accidents all over the world; that is a life lost every 25 seconds [3]. The last WHO report, in 2018, shows that the problem is getting worse. The number has increased to 1.35 million a year, meaning nearly 3 700 deaths/day [4].

The widely used term, 'accident', according to the 1956 definition, can suggest an inevitable and unpredictable situation – an event that cannot be avoided. Contrary, in 2004 WHO report on Road Traffic Injury Prevention, the term "crash" is preferred [5].

RTAs are considered to be part of the "development diseases" and usually occur as a result of the increase in the number of motor vehicles, population densities, environmental changes and pollution [6]. Road traffic accidents are a major but neglected public health problem that is associated with high rates of mortality and morbidity worldwide [7]. The objectives of this study are to evaluate the medico-legal aspects of fatal RTAs, by researching the

nature, type, and distribution of the traumatic lesions and establishing the most fatal injured body part.

Materials and Methods

This is a retrospective study consisting of 80 forensic autopsies performed at the Institute of Legal Medicine – Tîrgu Mureş, Romania, during a two years period, from January 1st, 2016 to December 31st, 2017. The information obtained was based on the medical records and on the evaluation of autopsy reports.

Results

From the total of 1802 forensic autopsies conducted in the study period, 80 (4.43%) were carried out for fatal road traffic accidents. In 2016, the total number of autopsies performed was 903 from which 44 (4.87%) for RTAs. In 2017, from a total number of 899 autopsies, 36 (4%) autopsies were carried out for RTAs.

From all the forensic autopsies performed for fatal RTAs, 58 (72.5%) were males and 22 (27.5%) were females.

The distribution by age group is relatively uniform: 24 (30%) cases under 35 years old and each 28 (35%) cases for the age group 36-59 years and over 60 years.

Among the categories of all traffic participants, pedestrians were the most involved and vulnerable in fatal RTAs, with a total number of 29 deaths (36.25%), followed by drivers with 27 deaths (33.75%), car passengers with 14 deaths (17.5%), bicyclists with 6 (7.5%) and with 4 deaths (5%) motorcyclists.

The majority of the subjects involved in RTA have died at the scene of the accident 44 (55%), followed by 18 (22.5%) which died one week or more after hospitaliza-

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tion, followed by 8 cases (10%) with 2-7 days survival; in 7 cases (8.75%), death occurred within the first 24 hours and in 3 cases (3.75%) death occurred during transport to a medical facility.

Depending on the categories of traffic participants, the highest proportion of deaths occurred at the scene of the accident: 75% of motorcyclists, 64.28% of passengers and 55.17% of pedestrians. Vehicle occupants died at the scene of the accident in a proportion of 65.85% (27 cases). From the group which was hospitalized over 1 week, 8 (66.66%) died due to infectious complications; from 3 victims with over 1 week of hospitalization organs for transplantation were prelevated. Most pedestrians, 20 cases (68.96%) died at the scene at the accident or in the first 24 hours; 8 (88.88%) of 9 patients with over 1 week of hospitalization died due to infectious complications.

Alcohol consumption among the victims was more frequently in pedestrians with 6 cases (20.68%), cyclists with 1 case (20%) and drivers with 4 cases (14.81%), with official measured alcohol values between 0.8 mg‰ to 1.4mg‰ for the involved drivers and up to values of 2.4 mg‰ for pedestrians (Table I).

Referring to the distribution of fatal accidents during the year, we observe a higher proportion in winter months (December-February): 11 driver deaths (45.83%) and pedestrians 24 deaths (82.75%). Accidents involving cyclists or motorcyclists prevailed in the spring-summer seasons with 3 cases (75%) for motorcyclists and 5 cases (83.33%) for cyclists.

Depending on the severity of the injuries that could have resulted in death, lesions of the cephalic extremity, including craniocerebral trauma (CCT) and craniofacial trauma (CFT) was found in 27 of the cases (33.75%), followed by polytrauma lesions in 25 of the cases (31.25%),

lesions of major vessels 12 (15%), spinal cord transections 7 (8.75%), severe thoracic trauma in 6 cases (7.5%) and abdominal injuries in 3 deaths (3.75%) (Table II).

From all of the deaths recorded, in 16 cases (20%) there were no recorded lesions in the cephalic area, in the rest of the cases studied, 64 (80%) head trauma was present as follows: in 36 cases (45%) intracranial lesions where also associated with skull fractures; in 21 cases (26.25%) we did not identify skull fractures, but associated intracranial hemorrhagic manifestations were found; and in 7 cases (8.75%) we found skull fractures without hemorrhagic events (Table III).

From the distribution of the main lesions encountered in the topographical areas, we noticed that the lesions of the cephalic extremity have been observed at 64 victims (80%), followed by lesions resulting from thoracic trauma in 62 cases (77.5%), abdominal lesions with 33 cases (41.25%), heart and major vessels ruptures in 27 cases (38%) and spinal cord transections in 10 cases (27.02%).

Analysis of severe injuries capable of causing the death of victims at the scene of the accident shows that many victims have suffered heart and major vessels ruptures (52.27%), severe CCT (68.18%) with or without the evisceration of the brain tissue, cervical spine transections or of the cerebral trunk (38.63%) and thoracic trauma (52.27%).

Among the causes of death occurred in more than a week of hospitalization, deaths through infectious complications draw attention (98.44%), bronchopneumonia being the main complication found at the autopsy. Purulent leptomeningitis and meningoencephalitis, cerebral abscess and cardiogenic shock were also noted. Each time these complications were associated with severe injuries (Table IV).

Table I. Distribution by gender, age, death interval and alcohol consumption

Road user	Gender		Age			Death on site	Death on the way to hospital	Death <24 h	Death in 2-7 days	Death over 1 week	Alcohol Test (+)	Alcohol Test (-)	Total
	Male	Female	<35 years	36-59 years	≥60 years								
Driver	24 (88.88%)	3 (11.12%)	8 (29.62%)	10 (37.03%)	9 (33.33%)	14 (51.85%)	1 (3.70%)	4 (14.81%)	4 (14.81%)	4 (14.81%)	4 (14.81%)	23 (85.19%)	27
Passenger	7 (50%)	7 (50%)	4 (28.57%)	6 (42.85%)	4 (28.57%)	9 (64.28%)	-	-	1 (7.14%)	4 (28.57%)	-	14 (100%)	14
Motorcyclist	4 (100%)	-	3 (75%)	1 (25%)	-	3 (75%)	-	1 (25%)	-	-	-	4 (100%)	4
Cyclist	6 (100%)	-	4 (66.66%)	-	2 (33.33%)	2 (33.33%)	-	-	2 (33.33%)	2 (33.33%)	1 (20%)	5 (80%)	6
Pedestrian	17 (58.62%)	12 (41.38%)	5 (17.24%)	11 (37.93%)	13 (44.82%)	16 (55.17%)	2 (6.89%)	2 (6.89%)	1 (3.44%)	8 (27.24%)	6 (20.68%)	23 (79.32%)	29
Total	58 (72.5%)	22 (27.5%)	24 (30%)	28 (35%)	28 (35%)	44 (55%)	3 (3.75%)	7 (8.75%)	8 (10%)	18 (22.5%)	11 (13.75%)	69 (86.25%)	80

Table II. Dominant lesions responsible for death

Type of injury	Number of cases	Percentage
CCT/CFT	27	33.75%
Polytrauma	25	31.25%
Major vessel injury	12	15%
Spinal cord transection	7	8.75%
Thoracic injuries	6	7.5%
Abdominal injuries	3	3.75%

Table III. Distribution of bone fractures and hemorrhagic lesions of the skull

Type of head trauma	No. of cases	Percentage
Skull fractures +hemorrhage	36	45%
Hemorrhage, no skull fracture	21	26.25%
Skull fracture, no hemorrhage	7	8.75%
No hemorrhage, no skull fractures	16	20%
Total	80	100%

Table IV. The main causes of death in victims hospitalized over one week

Cause of death	Main lesion	No. of cases
Bronchopneumonia-septic shock	Polytrauma	6
Bronchopneumonia, septic shock	CCT, CFT	4
Purulent leptomenigitis, septic shock	CCT	1
Purulent meningoen-cephalitis	Polytrauma with CCT	1
Cerebral abscess	CCT	3
Bronchopneumonia	CCT	1
Cardiogenic shock	Abdominal trauma with liver/spleen ruptures	1
	Polytrauma	1

Discussion

Romania is ranked first in a ranking of the European Union (EU) countries in terms of road fatalities, when considering the number of victims to the total population, according to European Commission data. In Romania, 1951 persons died in road traffic accidents in 2017, 2008 was the blackest of the last 17 years, with 3.065 deaths [8]. Within the European Union, Sweden, the United Kingdom, the Netherlands and Denmark reported in 2017 the lowest figures, with 25, 27, 31 and respectively 32 deaths/million inhabitants. On the opposite side, Romania has the most, 98 deaths/million inhabitants, which is twice the EU average (49 cases), followed by Bulgaria with 96. Romania and Bulgaria were the only EU countries where the report indicates over 80 dead to one million inhabitants [4]. The number of fatal road accidents in Romania recorded a slight increase in 2017 compared to 2016 [9,10]. According to the Romanian Criminal Investigation and Crime Prevention Institute and the Romanian Police Road Directorate, the main causes responsible for over 40% of the serious road accidents produced in Romania during the period 2013-2017 are pedestrians' inadequacies and excessive or inadequate speed to conditions traffic [10]. In our study, male victims involved in RTA were nearly three times more numerous than women (72.5% vs. 27.5%), the percentages were similar to other studies and explained by the male's social status in developing countries, male being the more active person [11-14]. Divided into 3 age groups, we noticed a relatively uniform distribution of the victims, with slight dominance of the 36-59 age group (passengers 42.85% and drivers 37.03%) and over 60 years of age group (pedestrians, 44.82%), making our data slight different compared to other reported data [11,15]; the first-mentioned group includes the majority of the socio-professionally active persons, which could explain the higher number of the victims being car occupants (driver/passenger), and in the group over 60 years the pedestrians predominate, probably due to lack of physical abilities and the deviations from the traffic safety rules, favored by the precarious condition of the local roads (lack of sidewalks and markings, insufficient lighting in the cities and absent outside them, often narrow runways and crowded). According to the Ministry of Internal Affairs (MIA), there

are three main causes of serious road accidents recorded between 2015 and 2017: pedestrian carelessness, speed (inadequate to road conditions or illegal) and failure to grant pedestrian crossing [9]. The small number of cyclists/motorcycle victims (6 and 4 cases respectively) does not involve statistical discussions; however, the majority of the victims are part of the age group up to 35 years, as suspected, because these means of locomotion are mainly used by the young population. In our study, the highest number of victims is among the pedestrians (36.25%), followed in decreasing order by the drivers (33.75%), passengers (17.5%), cyclists (7.5%) and motorcyclists (5%), as the aforementioned report of the MIA also states [9]. We highlight the much higher percentage of pedestrian victims in our study, 36.25% compared to the EU average of 21% [4]. The casualties among drivers together with passengers (51.25%) are the most numerous, surpassing the number of pedestrian victims (36.25% as mentioned above), also corresponding to a survey conducted by the Emergency Medical Services (EMS) in Tîrgu Mureş, but for a different period [16]. The WHO data for 2016 show that in road accidents over the EU, a high number of pedestrians are killed: in 2016, nearly 21.2% of all road fatalities were pedestrians. This rate is considerably variable between countries: from less than 8.3% in the Netherlands to above 35% in Estonia and Romania. Finally, while in the EU the pedestrians' fatalities are calculated at 10.8 deaths per million inhabitants, in Romania, Latvia and Lithuania the statistics show a 3 times higher number [17]. These data are close to our statistics referring to Mureş County. Positive alcohol testing was found in 14.81 % of drivers and was more common in pedestrians (20.68%) and bicyclists (20%). The fact that accidents with victims among drivers (45.83%) and pedestrians (82.75%) predominate in the winter months (December to February) is correlated with the main causes of their production, like excessive speed, lack of speed adaptation to driving conditions, inadequate road conditions for drivers, crossings through unmarked places and the use of the roadside for pedestrian traffic. Accidents involving bicyclists or motorcyclists were predominant in the spring-summer seasons, 75% for motorcyclists and 83.33% for bicyclists, due to the specificity of these means of travel, used predominantly in the warmer months. It is known that road traffic is higher in the summer months and especially in holiday months; the fact that this interval does not correspond to the peak of the accidents in our study, makes us believe that the inadequate condition of the roads contributes mainly to the occurrence of accidents and it may be the reason for Romania's ranking in 2017 in the first place in the European Union in the number of deaths in road accidents [4,11]. Between 2016 and 2017 there were 3864 road deaths in Romania, the 80 victims in Mureş County accounting for 2.07%. For the year 2016 in Romania, the average annual deaths per county was 46.66 compared to 44 in Mureş county and in 2017 was 47.58 versus 36 in Mureş county; we,

therefore, ascertain a positioning of Mureş county below the annual average, with a decreasing trend without having noticed significant improvements in the state of the roads [10].

The highest mortality was recorded in the pre-hospital, 58.75% of which 55% at the accident site and 3.75% on the way to the hospital, the remaining 41.25% of the deaths occurred in the hospital, which corresponds to other data from the literature when referring to pre-hospital deaths, but in our statistics, hospital deaths are significantly higher [11,18], probably suggesting a hospital incapacity in assessing complex cases of polytrauma.

The analysis of lesions found necroptically in the deceased at the scene of the accident, highlights some particularly life-incompatible injuries that resemble any rescue effort on the part of the medical crew moved to the scene of the accident, with: large vessels ruptures (52%), CCT and CFT with evisceration of the brain, cerebral trunk sections, massive intracranial hemorrhages (68.18%), abdominal trauma with multiple organ ruptures (liver, spleen, kidneys) or thoracic injuries with pulmonary rupture and asphyxia by obstruction of the airway with blood. Classification on anatomical regions with death-related injuries is more conventional (didactic) because in many cases multiple lesions are each capable of producing death.

Analyzing the causes of the deaths of hospitalized victims following serious injuries in road accidents, we notice that when hospitalizations extend over a week, deaths mostly result from infectious complications (98.44%), which should draw attention to treatment options for major trauma.

Conclusion

Romania has been in the top places in the EU for mortality by road traffic accidents for many years. Inappropriate road conditions and indiscipline in traffic of both drivers and pedestrians contribute to unacceptably high mortality. The lack of driving experience did not prove to be a favorable factor in producing fatal accidents, our data showing a higher death incidence in drivers over 35 years. Mortality at the scene of the accident is comparable to other EU countries and is due to life-threatening organic injuries and in no case to the incapacity of emergency crews. In-hospital mortality is much higher compared to other data in the literature, which denotes a deficiency of the medical system to assist large traumatized patients, with in-hospital infections being the leading cause of death. Road traffic accidents are a serious public health problem, not only considering the number of victims among drivers but also the collateral victims involved.

Authors' contribution

Cosmin Caraşca - Conceptualization; Data curation; Formal analysis; Funding acquisition; Investigation; Methodology; Project administration; Resources; Software; Supervision; Validation; Visualization; Writing – original draft; Writing – review & editing

Timur Hogeia - Data curation; Formal analysis; Software

Viorel Hădăreanu - Supervision; Validation

Conflict of interest

None to declare.

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