CLINICAL, EPIDEMIOLOGICAL AND MESOLOGICAL CHARACTERISTICS OF AVOIDABLE DEATHS IN THE CASUISTRY OF FORENSIC SERVICE OF SIBIU COUNTY

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Abstract: *Forensic casuistry is an important source of cases that fall into avoidable deaths category; these include: deaths due to road accidents, sudden cardiac deaths, deaths due to hepatic cirrhosis, deaths in children under 1 year, maternal deaths etc. In the work carried out as a resident physician in forensics, I found a large, growing number of deaths due to diseases/accidents amenable to health care or primary prevention. The aim of this study was to identify the avoidable deaths from the forensic cases of Sibiu County and the clinical, epidemiological and mesological features thereof, with a thorough analysis of those caused by cardiovascular diseases. Specifically, it is a descriptive, analytical observational ambispective study conducted over a period of 10 years from 2006 to 2015. In the forensic casuistry of Sibiu, we identified 1178 avoidable deaths within 10 years, representing 40% of all forensic autopsies. In dynamics, their share of all forensic deaths increased up to 6% (in 2006, 37% of forensic deaths fell into the category of avoidable deaths, and in 2015, the share was of 43%). We found a much higher frequency of avoidable deaths in men and in people from urban areas, as well as the increase of the average age of victims of avoidable deaths by about five years in the ten years studied. Cardiovascular diseases caused around half of all avoidable deaths with forensic consequences (about 49%), and another 40% of them were due to traffic accidents, the forensic prerogative. The study found that most of the victims of avoidable deaths due to cardiovascular diseases with forensic consequences had the following characteristics: Romanian nationality, Orthodox religion, married or divorced, graduates of vocational schools, no occupation. On the one hand, this study provides an accurate assessment of the need for guidelines and protocols for primary, secondary and tertiary prevention, representing a foundation for the effective identification and monitoring of risk groups with different allocation of resources to priority areas of intervention. On the other hand, the study allows predictions on the dynamics of these types of deaths and therefore, on the dynamics of human resources in Romania.*

INTRODUCTION

The death of a person becomes a forensic case after the notification of the criminal investigators, if it fulfils the criteria provided by the law.(1,2) The situations in which death is a forensic case are the following: the violent death (mechanical, physical, biological or chemical), the cause of death is unknown and suspicious death.(3) Suspicious death also includes the death of a person who is in full state of apparent health, which often is the prerogative of cardiovascular disease, common causes of avoidable deaths.

Given that among the possible causes of deaths with forensic implications, there are found many of the causes of avoidable deaths in Romania (4,5), forensic casuistry is considered an important source of cases that comply with the criteria for inclusion in a study on avoidable deaths. Some examples would be: deaths due to road accidents, deaths due to cirrhotic liver, deaths in children under 1 year, maternal deaths, sudden cardiac deaths, deaths due to toxic-septic shock etc.

In the work carried out as a resident physician in forensics, I have found a large, growing number of deaths due to diseases/accidents amenable to health care or primary prevention. This was the impetus for the accomplishment of this laborious research in order to identify vulnerable population groups and the "risk factors" that amplify this phenomenon.

The forensic pathologist occupies a privileged position in terms of addressing the carers of a man who had an avoidable death, being able to obtain firsthand, useful information on the area of origin, religion, educational level, occupation, previous medical history, any medical examinations and/or hospitalization etc. of the deceased. Thus, the forensic pathologist corroborates the data obtained from carers with that indicated by the forensic necropsy. The close cooperation of the forensic pathologist with the criminal investigation bodies (research carried out on site, access to the entire case file) helps integrating information in a unified and complex vision.(6,7)

Another advantage of the forensic pathologist in identifying and elucidating these types of deaths is that he knows the autopsy final findings, established after the completion of all complementary examinations.

Typically, statistical information related to death has as a starting point the data mentioned in the Certificate of the Fact of Death, that are usually truthful.(8,9)

There are also situations when these attestations include the initial conclusions that can be disproved/corrected later, after conducting further examinations; these do not get to be recorded in the Certificate of the Fact of Death previously issued. This is why there is an underreporting of avoidable deaths.

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PURPOSE

The study aims at identifying avoidable deaths from the forensic cases of Sibiu County and the clinical and epidemiological features thereof.

The main objectives of this study were: assessing the extent of avoidable deaths from the forensic cases of Sibiu County, in order to clarify the magnitude of the phenomenon and the weight of these deaths in total deaths with forensic consequences, namely to establish the dynamics of avoidable deaths of forensic nature in Sibiu County, assessing their frequency and analyzing the determining causes.

MATERIALS AND METHODS

We conducted a descriptive observational ambispective study (10) for a period of 10 years (2006-2015) on all avoidable deaths with forensic consequences, in Sibiu County.

The material under study is represented by the entire deaths casuistry of Forensic Service of Sibiu County and Forensic Office of Mediaş from January 2006 - December 2015. We analyzed the forensic, necropsy reports, the Certificates of the Fact of Death, toxicological analysis bulletins, histopathology reports, medical documents related to the medical history of cases and, in some cases, the research records of the criminal investigation bodies.

RESULTS

Between 2006 and 2015, at the level of Sibiu County, there were performed 2931 autopsies within the Forensic Service of Sibiu County and in the Mediaş Forensic Office.

The annual average of forensic autopsies was 293. About half of the deaths that required forensic autopsy (1178 cases - 40.19%) were classified as avoidable deaths, their annual average being 118.

Annual percentage of avoidable deaths in all deaths with forensic implications, in the first year, respectively in the last year of the study period of time was of 37.25% (in 2006) respectively 43.00% (in 2015), highlighting an increase by about 6% in 2015, compared to 2006. The maximum percentage share was of 43.58% and it was recorded in 2009 (table no. 1).

Table no. 1. Annual distribution of forensic autopsies and distribution of avoidable deaths of forensic nature in Sibiu County, between 2006 and 2015

Year	No. of forensic autopsies	Avoidable deaths	
		no.	percentage- %
2006	357	133	37.25
2007	302	121	40.07
2008	305	119	39.01
2009	293	113	38.57
2010	264	98	37.12
2011	257	112	43.58
2012	290	123	42.41
2013	261	103	39.46
2014	302	127	42.05
2015	300	129	43.00
Total	**2931**	**1178**	**40.19**

Over three quarters (78.78%) of total avoidable deaths identified in total forensic autopsies performed in Sibiu County occurred in men, the percentage of women being of 21.22%. Although the dynamic analysis confirmed the predominance of males every year, there are significant annual differences between genders, such as: sex ratio - male:female in 2008 was 2.6:1, sex ratio in 2013 = 5.8:1. Overall, in the last period of study, namely between 2011 and 2015, gender difference increased along with the amplification of the phenomenon in men (table no. 2).

Analyzing the avoidable deaths identified in all forensic cases, from the point of view of the deceased's age, we observed annual variations of the average age, between 45, 65 years old, value recorded in 2006, and 51 years old, value recorded in 2013. Generally, the average age in case of avoidable deaths was 48.63 years and standard deviation - 15.51. We also highlighted the increase of the average age, from 45,65 years (in 2006) to about 51 years in 2012-2015 (table no. 3). Relating the avoidable deaths identified in the forensic casuistry of Sibiu County to the area of origin of the deceased, has revealed the higher frequency of urban area, 659 of the victims of avoidable deaths with forensic consequences (56%) were in urban areas, compared with 519 (44%) in rural areas. Over the studied years, the percentages on urban and rural areas have registered variations of about 10%; for example, in 2011, 52.68% of people presenting avoidable death were from urban areas and in 2013, this share was of 63.10% (table no.4, figure no. 1).

Table no. 2. Annual distribution of avoidable deaths by gender of the deceased in the period 2006-2015

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Men	103	94	86	92	78	92	99	88	98	98	928 **78.78%**
Females	30	27	33	21	20	19	24	15	29	31	250 **21.22%**
Total	133	121	119	113	98	111	123	103	127	129	1178

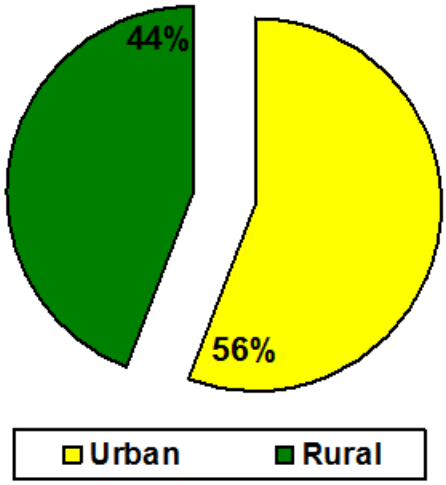
Table no. 3. The average age of victims of annual avoidable deaths, 2006-2015

Year	Average age (years) Standard deviation	Standard deviation	95% confidence interval of the difference		Minimum/maximum age (years)
			Lower	Upper	
2006	45.65 ±15.896	1.378	42.93	48.38	2/80
2007	46.68 ±14.406	1.310	44.08	49.27	17/82
2008	47.61 ±15.520	1.423	44.80	50.43	2/80
2009	45.69 ±15.603	1.468	42.78	48.60	0/84
2010	49.78 ±15.820	1.598	46.60	52.95	1/80
2011	49.12 ±16.716	1.579	45.99	52.25	0/89
2012	49.33 ±14.115	1.273	46.81	51.85	2/74
2013	51.00 ±16.122	1.589	47.85	54.15	0/89
2014	50.98 ±15.857	1.407	48.19	53.76	0/85
2015	50.87 ±14.442	1.272	48.35	53.38	0/84
Total	**48.63 ±15.515**	**1.452**	**47.74**	**49.52**	-

Table no. 4. Annual repartition of forensic avoidable deaths according to the area of origin of the victim

Year	Urban		Rural	
	No.	%	No.	%
2006	72	54.13	61	45.87
2007	68	56.20	53	43.80
2008	69	57.98	50	42.01
2009	62	54.87	51	45.13
2010	56	57.14	42	42.86
2011	59	52.68	53	47.32
2012	66	53.66	57	46.34
2013	65	63.10	38	36.90
2014	71	55.90	56	44.10
2015	71	55.04	58	44.96
Total	**659**	**55.94**	**519**	**44.06**

Figure no. 1. Annual repartition of forensic avoidable deaths according to the area of origin of the victim



Further on, we have divided avoidable deaths according to the place of occurrence of death, so we used three categories: "at home" - for the deaths which occurred at home; "at hospital" - for the deaths occurred during hospitalization or in the emergency rooms; "Other" - for deaths produced in locations other than those mentioned above. Through this analysis, we found that more than half (57.39%) of the forensic avoidable deaths were classified as "other". At home, there occurred 289 (24.53%) avoidable deaths, while at the level of medical units, 213 (18.08%) (table no. 5).

Table no. 5. Distribution of forensic avoidable deaths according to the place where death occurred, in 2006-2015

Place of death		At home	At hospital	Other	Total
Avoidable deaths	no.	289	213	676	1178
	%	24,53	18,08	57,39	100

Another parameter aimed at in the study was the time of death. In this regard, we classified avoidable deaths according to the season in which they were produced. Most avoidable deaths have occurred in autumn (28.18%) and summer (27.50%). At the opposite pole, the fewest avoidable deaths were recorded in spring (20.88%).

The small difference between the number of avoidable deaths produced in autumn and summer has been relatively constant over the study period, occupying alternatively the first place (table no. 6).

Table no. 6. Seasonality of avoidable deaths from the forensic cases, 2006-2015

Year	Number of avoidable deaths			
	Winter	Spring	Summer	Autumn
2006	32	23	45	33
2007	31	27	29	34
2008	26	29	27	37
2009	24	26	33	30
2010	20	14	28	36
2011	29	18	28	36
2012	28	31	30	34
2013	28	23	29	23
2014	27	27	42	31
2015	31	28	33	38
Total	**276**	**246**	**324**	**332**

Of the 1178 avoidable deaths identified in forensic casuistry of Sibiu County, in 2006-2015, less than 40% (495 of avoidable deaths) were classified as violent death, the main subject of the forensic activity; this category includes, in particular the deaths due to motor vehicle accidents and iatrogenic deaths. The other 58%, i.e. a total of 683 of avoidable deaths that have benefited from forensic autopsy belonged to the category of non-violent deaths (figure no. 2).

Figure no. 2. Distribution of avoidable deaths according to the type of death, 2006-2015

Distribution of casuistry according to the cause of avoidable death identified a predominance of avoidable deaths due to cardiovascular disease, namely a total of 572 avoidable deaths by these disorders, which represent about half of all analyzed cases. Avoidable deaths due to accidents caused by motor vehicles are also common, respectively 488 cases (41.42%). A significantly smaller number of avoidable deaths, namely 118 cases were due to other diseases included in the list of avoidable deaths presented in the first trial research. Thus, in the category of "other", we included the following diseases that caused avoidable deaths, discovered during the forensic autopsies performed in Sibiu County: hepatic cirrhosis, various forms of pulmonary tuberculosis, lung cancer, gastric/duodenal ulcer, pneumonia, therapeutic accident (only one case in ten years analyzed) and nephritis/nephrosis (table no. 7).

Table no. 7. Distribution of avoidable deaths according to the cause of death, 2006-2015

Cause of death		Cardio-vascular	Road accidents	Other
Avoidable deaths	No.	572	488	118
	%	48.56	41.42	10.02

DISCUSSIONS

Generally, avoidable deaths are not the subject of forensic autopsy, except for those due to traffic accidents, which are included in the category of violent deaths and benefit necessarily from autopsy. All the other causes of avoidable death (acute myocardial ischemia, cerebrovascular disease, cirrhosis, tuberculosis, malignancies etc.) typically cause non-violent deaths and are related to family medicine or anatomical pathology and only under certain conditions, they become medical-linked cases.(11,12) Thus, the results of this study through which we identified the phenomenon of avoidable death in the forensic casuistry of Sibiu County in the period 2006-2015 do not represent the total of the avoidable deaths at the level of Sibiu County within the study period. We mention this in order not to cause confusion concerning a false underreporting of the phenomenon.

About half of the autopsies performed within the Forensic Service of Sibiu County and Mediaş Forensic Office in the ten years of study addressed avoidable deaths (40.19%); Their annual average is 118 avoidable deaths per year. Dynamic analysis showed increases in the share of avoidable deaths in total forensic autopsies, so in 2006 it was 37.25% and in 2015, it was 43.00%. These percentages confirm the importance of identifying and researching this phenomenon in forensic casuistry.

Greater predominance in males of avoidable deaths resulting from the literature is also confirmed in the case of deaths with forensic consequences; over three quarters (78.78%) of these occurring in men.

In general, the share of men is higher in forensic casuistry, because, on one hand they are more exposed to risk factors that cause a violent death, and secondly addressing health services, especially addressing the family doctor is less, therefore, without periodic evaluations and without any evidence of pathology in the case of a death at home, the family doctor cannot issue the Certificate of the Fact of Death, autopsy being required.(13,14)

The average age of those who ended by an avoidable death was 45.65 years in 2006, respectively 51 years in 2013. We underline the increasing average age of victims of avoidable deaths, explained perhaps by raised life expectancy, but also by improving the performance of the health system, both primary prevention and the secondary prevention.

The share of victims of avoidable deaths with forensic implications coming from rural areas is higher than that of victims in rural areas (55.94% vs. 44.06%), but the percentage difference is not very important. The predominance of the urban area can be explained by the less healthy lifestyle in cities, higher degree of pollution, greater risk of traffic accidents, higher incidence of neoplasms in the economically developed areas.(15,16) On the other hand, at least theoretically, accessibility to health services and medical education levels are lower for those living in rural areas.

In the studied cases, avoidable death occurred in over half of cases elsewhere than at home or in a medical facility (57.39%), which proves the predominant sudden character of these deaths.

Only 18.08% of all cases have reached a pre-hospital or hospital unit, either voluntarily or brought in by relatives, but without being helped.

Analyzing the seasonality of avoidable deaths with forensic consequences, we found that most of these were produced in autumn (28.18%) and summer (27.50%); first position in the ranking is alternatively occupied by those two seasons. At the opposite pole, spring is the season when fewest avoidable deaths occur.

Of all avoidable deaths with forensic consequences, nearly half were due to cardiovascular diseases (48.56%), which represent the most common cause of avoidable death at international, national and regional level.

A significant percentage of deaths occurred due to traffic accidents (40%); mention must be made that all deaths produced under these circumstances are subject to forensic autopsy. Instead, avoidable deaths due to cardiovascular diseases, the common practice requires that the family physician issues the Certificate of the Fact of Death or performing autopsy by the pathologist for those who died in a medical unit. Therefore, the magnitude of avoidable deaths from cardiovascular cause revealed by this study is lower than in reality.

CONCLUSIONS

- In the forensic casuistry of Sibiu County, 1178 avoidable deaths were identified within 10 years (40% of forensic autopsies). In dynamics, their share of all forensic deaths increased up to 6% (in 2006, 37% of forensic deaths fell into the category of avoidable deaths, and in 2015, the percentage was of 43%).
- A higher frequency of avoidable deaths was recorded in men (about 80% of avoidable deaths with forensic implications occurred in males), the sex ratio male:female = 3.7:1.
- Over the studied period, the average age of those included in the survey increased by about 5 years (from 45.65 years in 2006 to 51 years in 2015).
- Percentage of victims of avoidable deaths coming from rural areas is higher than that of victims in rural areas (56% versus 44%); the ratio of urban and rural area of origin is 1.27:1.
- More than half of avoidable deaths which were subject to forensic autopsy occurred elsewhere than at home or in a medical unit. Less than a fifth of them occurred in the emergency room or during a hospital stay. Most frequently, avoidable deaths occurred in autumn and spring (60%).
- Cardiovascular diseases, the most common causes of avoidable death nationally and regionally, led to about half of the avoidable deaths avoidable with forensic consequences (about 49%). Another 40% of these deaths were due to traffic accidents, involving violent deaths, for which forensic autopsy is the rule. Hepatic cirrhosis, pulmonary tuberculosis, lung cancer, gastric/duodenal ulcer, pneumonia, therapeutic accident (one case in the ten analyzed years) and nephritis/nephrosis were among the causes of avoidable death within the forensic casuistry of Sibiu County, totalling 118 cases (10%).

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