

Suicide drowning in the non-coastal territory of Milan

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Abstract

Introduction A cadaver in water sets a relevant issue for the forensic pathologist, concerning the differential diagnosis between homicide, suicide, accidental event, and natural death in water. In the present study, the drowning suicides in a non-coastal territory are analyzed, discussing the main diagnostic difficulties, the preventive intervention, and the strategies for outlining the profile of a “mean victim” that is at risk of committing suicide by drowning.

Methods The cases of drowning suicide were extrapolated by the database of the 21,472 autopsies performed at the Civic Morgue of Milan, in the period between 1993 and 2013.

Results Drowning represents the fifth cause of suicide registered in Milan for the study period, with 139 cases (3.8 % of all suicides). Victims were mainly elderly males (61–80 years old) with a history of psychiatric diseases in pharmacological therapy; they committed suicide mainly during summer, in the rivers. The diatoms test was positive in 82 cases (59 %) and highlighted typical taxa of fresh water. Alcohol and illicit drugs were not noticed, at high levels.

Conclusion Drowning suicide occurs even in a non-coastal territory, far from the sea, if there is an easy access to the water: specifically, many natural and artificial waterways in the Milan district represent a high-risk factor predisposing the drowning suicide.

Keywords Suicide · Drowning · Autopsy ·
Forensic pathology

Introduction

The city of Milan, covering an area of 182.07 km² (<http://www.comuni-italiani.it>), is the second-most populous city in Italy (1,366,049 inhabitants) after Rome [1], and it is one of the metropolitan areas with the highest population in the world [2]. Its complex hydrographic net is due to its particular location in an articulated water maze whose length is 370 km [3], composed of natural and artificial water streams, most of them flowing in covered beds. Basins, irrigation ditches, streams, channels (among which there are the “Navigli” covered in 1929), towpaths, sluices, old docks, water networks, and big rivers such as Ticino in the West; Olona, Nirone, and Seveso in the North; Adda in the East; and Lambro in the South, marking its borders, give it the name of “aquatic town” [4]. Conspicuous water resources, especially if easily accessible, can be reasonably considered, even in a land which is far from the sea and from navigable rivers, a liable factor leading to choose drowning as a suicidal method [5]. These are lethal events which have been relatively little described [6], considered rare in no coastal areas [7] and, on the contrary, more frequent in the regions or countries overlooking seas and lakes of great dimension [8] or oceans [5]; indeed, in such regions, a higher inclination to suicide realized through this detrimental modality has been reported [9]. The data collected in the literature of the field referred to the drowning incidence among the different countries and, primarily, depending on the accessibility to water sources [8] are susceptible to wide variations, estimated from 3 to 26 % of the total amount of suicides [10]; however, we have also to consider that the number of reported cases is underestimated due to possibility of some errors in the classification of these lethal events, which establishes many diagnostic problems. International studies [11] underline that drowning is responsible of those deaths in which the death diagnosis lies ambiguous or, even, undetermined [12]; in these cases, the

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multidisciplinary evaluation of evidences can be really important to determine the cause and the modality of the death, a part from representing a benefit for the public health [13]. This report aims to study drowning driven by a suicidal intention in a population living in a no coastal geographic area; as far as this subject is concerned, pathological-forensic diagnostic issues and possible precautionary interventions, aimed to reduce the number of suicide cases, have been expressed together with the strategies used to create a profile of the average victim at risk of committing a suicidal drowning.

Materials and methods

The Department of Legal Medicine and Insurance of the University of Milan is daily involved in assisting and helping the Judicial Authority during the investigations concerning unexpected and violent deaths taking place in the city. In all these cases, running autopsy analysis, toxicological investigations, and an accurate examination of the crime scene are required to solve legal queries; normally, the results are written down at the end of the investigations and indefinitely kept in the General Archive of the Department but also in the Legal Offices in charge. The study is based on the retrospective analysis of the necropsy cases recorded from 1993 to 2013 by the Department of Legal Medicine and Insurance of the University of Milan and concerning those suicidal cases in which the autopsy has shown evidences highly indicating drowning. Ambiguous death causes, accidental events, and homicides have been excluded. The parameters of the victims taken into account have been referred to gender, age, pathological and pharmacologic anamnesis, previous trials and suicidal intentions, discovery place, autopsy, and toxicology evidences, in addition to circumstance data of the deadly events. In those cases presenting, in the archive, viscera fragments fixed in 10 % buffered formalin and biological liquids, the following histopathology investigations as well as diatoms extraction and toxicology legal tests have been conducted.

Results

Out of 21,472 autopsies conducted in the abovementioned time frame, 3,606 have been classified as suicides (16.8 %), and the most occurring self-suppression method is linkable to contusion damages (collision and falling from heights: 1,567 cases—43.5 %), followed by hanging (927 cases—25.7 %), chemical damaging (389—10.8 %), fire-arm damaging (352 cases—9.7 %), drowning (139 cases—3.8 %), stab and cut damaging (102 cases—2.8 %), plastic bag suffocation (94 cases—2.6 %), thermal damaging (28 cases—0.8 %), submission to electric current and self-choking, both having the same occurrence (4 cases—0.1 %). Suicide by drowning, occurred

in 139 cases, counted for 0.64 % of the total amount of the autopsy investigations which have been carried out, representing 3.8 % of the total amount of suicides occurred in the time frame that has been taken into account.

Epidemic data

After dividing victims according to their gender, data have showed that men (77 cases—55 %) slightly prevailed (+10 %) than women (62 cases—45 %); this result is different from what had been observed in other case studies stating, on the contrary, that female gender prevailed [14] in this kind of suicide. Population has been divided in decades of age (except for three unidentified victims, due to putrefactive phenomena; in these cases, the diagnosis of drowning death was made according only to the concordance of the recovery circumstances and the autopsy results) and a sharp predominance of adult/old people (61–80 years old) emerged, representing 23.02 % of cases, whereas the most extreme age groups of adolescent/young people and senile people were less in number. Reporting victims' age in relation to their gender in Fig. 1, the results have shown that men outnumber women in each decade, which is coherent to a total male predominance, except for the age groups of 61–70 (68.8 %) and 81–90 (58.3 %) years old, where females prevail in number.

Weights hung to the body and clothing

In order to ensure that the body certainly ended under the water level, a small number of cases (9 victims—6.5 %) fastened accessory loads to their neck or ankles: in particular, in 8 cases, they hung stones, while in the other one, they hung bricks, tightly linked to the body using rolling shutter cords, ropes, or electric cables. The majority of victims (106 cases—76 %) has been found with their clothes (shirt, skirt, or trousers) and underwear on, whereas 22 % (30 cases) of them were found



Fig. 1 Graphic correlation between the sex and the age of the victims

with only nightwear (pajama or nightdress, nightgown) and underwear on. The three victims (2 %) found in advanced stage of postmortem decomposition had no clothes on.

Time analysis

Although showing a fluctuating trend, the distribution of the number of suicides realized through drowning, in the stated period of time, has been generally decreasing with a high frequency of cases in the years 1994–1996, which have recorded the maximum peak of victims (15 and 14, respectively,) until 2013, when the number of suicides realized through drowning was two cases. The monthly trend, described in Fig. 2, showed a seasonal variation of this type of suicide, having a high occurrence in springtime/summertime, similarly to what has been stated in other reports [15], with a sharp decrease in fall/winter. Indeed, in the cold months (January, February, November, and December), suicides have been 26 (18.7 %), with the absolute minimum number in February; in mild months (March, April, September, and October), there have been 38 cases (27.3 %), whereas in hot months (May, June, July, and August), suicides have reached the highest number of occurrences (75 cases—54 %).

Pathological analysis

The majority of victims (106 cases—76 %) suffered from psychiatric diseases and from other forms of pathological illness: indeed, proof of psychic disorders have been found by documents attesting previous hospitalizations at psychiatric centers, psychic outpatient therapies, and clear deviant behaviors in 88 cases (83 %), with a sharp predominance of the depressive syndrome (91 %), followed by psychosis (9 %), among all the psychiatric pathologies. The 18 victims affected by no psychic pathological diseases mostly showed cardiovascular diseases (arterial hypertension: 27.7 %), hepatitis and

neoplasms (16.6 % each), drug addiction (11.11 %) and, lastly, spastic palsy, Alzheimer disease, diabetes, epilepsy, and asthma (5.5 % each category). In the population having a positive anamnesis, 24 cases (22.6 %) showed to be suffering from more than one disease (see Table 1) in particular: 23 (96 %) having psychiatric diseases (mainly depression, followed by anxiety syndrome) together with other pathological issues, followed by drug addiction associated to hepatitis C in one case (4 %).

Psychopathological analysis and state of mind

Reasons underlying self-suppression acts have been deduced from 99 (71.22 %) written farewell letters that the same victims had left in order to be found and to motivate their act, and they have been classified in five categories as follows:

1. Physical diseases: victims have been induced to commit suicide by the great physical and moral sufferance caused by the seriousness of their disturb
2. Tiredness of life: victims lived an existential condition of unhappiness caused by poverty, job loss, and/or loneliness
3. Serious family sorrows: victims were suffering because of the death/disease of one of their relatives or, also, because of serious health problems that had directly upset their family life or their sons one
4. Disappointed love: victims had experienced the break of a strong sentimental bond, like marriage or cohabitation
5. Serious fights in family interpersonal relationships: victims were affected by refusal attitude, scorn, or mistreatment

In the lacking 40 suicides (28.78 %), no contingent or remote reasons explaining the act have been observed. An accurate research has been carried out in order to verify the occurrence of victims having committed previous suicidal trials or having showed suicide intention: it showed that 36 cases (26 %) had already tried suicide and that there was a poor tendency (54 cases: 40 %) of showing self-injuring

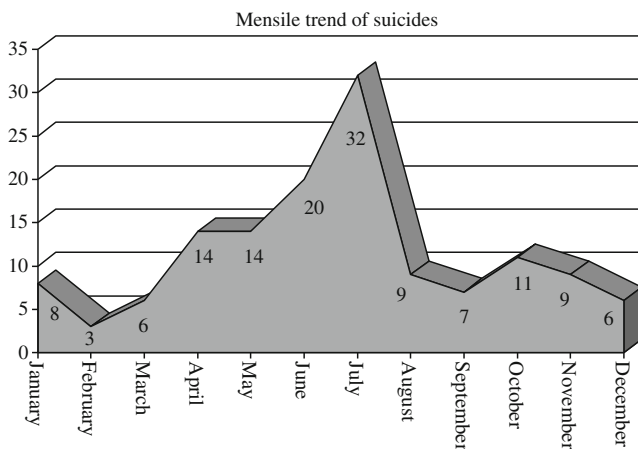


Fig. 2 Graphical vision of the temporal trend of suicides

Table 1 Cases showing an association of diseases

First disease	Second associated disease	Cases
Depression	Cardiopathy	12
	Psicosis	3
	Neoplasm	2
	Anxiety state	2
	Alzheimer disease	1
	Diabetes	1
	Alcoholism	1
Anxiety state	Cardiopathy	1
Drug addiction	Hepatitis C	1

propositions. Victims' assumption of drugs represented another critical aspect for the analysis: more than half of the victims (78 cases: 57 %) were under pharmacologic therapy, and, in particular, 64 victims were having a single pharmacological treatment, and 55 of them (69.6 %) were under psychiatric drugs (antidepressants: 39 cases, followed by anxiolytics: 10 cases, psychopharmacological drugs and antipsychotics: 3 cases each category); the lacking 9 victims (14.06 %) used drugs of other types (5 of them used anti-hypertension drugs, 2 used anti-epilepsy drugs, bronchodilators, and chemotherapy drugs in 1 case for each category). Fifteen (19 %) out of 79 victims, having a positive pharmacological anamnesis, used a combination of drugs (Table 2), in particular: 11 (73.4 %) were under psychiatric therapy (antidepressants or tranquilizers) in association with other pharmacological classes, while the lacking 4 (26.6 %) were having cardiotoxic, diuretic, or anti-epilepsy drugs, in addition to other treatments.

Death place

Due to the geographical location of Milan, a city very far from the sea, suicides have been strongly conditioned and limited only to natural water flows and waters of domestic/urban purpose, having an extremely low salinity level, that is to say salt-free waters. The majority of victims (84 cases—60.4 %) faced death in the rivers of the hinterland of the city, whereas 31 victims (22.3 %) faced death in the irrigated and ship canals known with the name of Navigli (Grande, Pavese, Martesana, Paderno, and Bereguardo) of Milan. Lakes of residential neighborhood and sport centers have rarely been chosen (only in 6 cases: 4.3 %), followed by other open spaces, which were less usual, in 4 cases (2.9 %): 2 cases of drowning in power plants, 1 in an irrigation ditch and 1 in a water system little well. A smaller number of victims (14 cases—10.1 %) being, in particular, 13 women and just 1 man, choose to commit suicide at their home, drowning in their bath tub, and they were discovered completely immersed in the water, with the respiratory orifices under the drowning

Table 2 Cases showing a pharmacological association

First drug	Second associated drug	Cases
Antidepressant	Tranquilizers	3
	Sedative	3
	Antihypertensive	2
	Antidiabetic	1
	Cardiotonic	1
Tranquillizers	Antiarrhythmic	1
Cardiotonic	Antidiabetic	2
Diuretic	Antineoplastic	1
Antiepileptic	Diuretic	1

means level. The trend showing the selection of the place according to their gender is in line with other reports [16], which explain that males prefer other places rather than their home to die.

Autoptical findings

External examination

At the external examination, cadavers were in tolerable conditions of conservation. Due to the permanence in water, it was not always possible to distinguish the hypostasis from the cutaneous congestion. The foam cone at nose and mouth was observed in 90 % of cases, and this finding was used as an indicative element for the medicolegal diagnosis of death by drowning because it is suggestive of pulmonary activity at the moment of water penetration. In a minority of cases (3 cases, 2.15 %), a strong cutaneous maceration of limbs was noticed.

Internal examination

The aperture of the rib cage showed the typical signs of drowning: the lungs were pale and hyperexpanded with an anterior overlap that is not so visible in other types of asphyxiation [17]; due to the hyperexpansion, the lungs also showed costal grooves on their surfaces. Diffuse subpleural petechiae were observed too, especially in the interscissural locations. Intense foam in the respiratory system and mucosal congestion at larynx/trachea were documented.

Histopathological findings

Though at the present knowledge there are no histopathological markers that make a certain diagnosis of drowning, histopathological analysis can provide a series of important elements concerning the drowned lung and the extraction of unicellular eukaryotic algae (diatoms) from the cadavers and from the environmental water, as bioindicator. Histopathological analysis was conducted with the use of the standard hematoxylin-eosin coloration and with the use of histochemical techniques for the connective tissue (Masson's trichrome stain) and for the elastic tissue (resorcin-fuchsin), that revealed nonspecific signs [18] such as: massive pulmonary oedema; interstitial and alveolar watery emphysema; septal, intra-alveolar, and interstitial hemorrhages.

Diatoms extractions

To validate the diagnosis of drowning, an extraction of unicellular eukaryotic algae belonging to the *Bacillariophyceae* was performed according to the so-called diatoms test, which

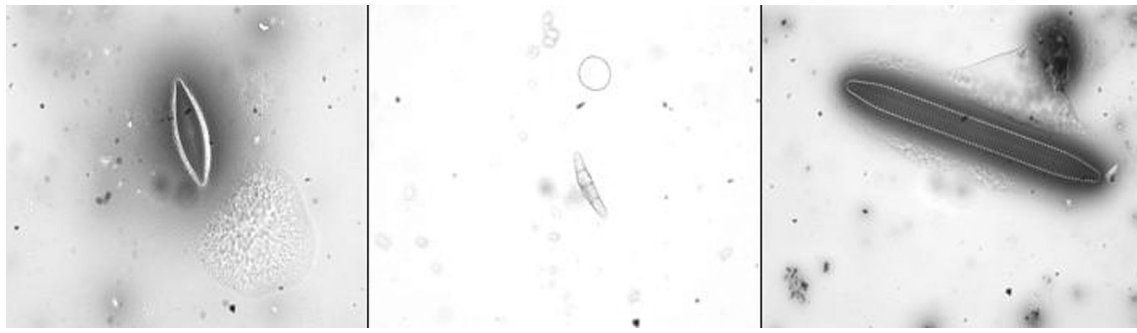


Fig. 3 Examples of diatoms extracted from liver (*left*), from femoral bone marrow (*center*) and lung (*right*)

is the gold standard for the drowning: it provides an auxiliary and highly indicative element [19] of drowning, though at present time, there is not a definitive and certain test for this diagnosis [20]. However, the scientific literature [21] considers the other digestion of organs method, such as enzymatic method that uses proteinase K, the most specific test for the detection of diatoms in the diagnosis of death by drowning, especially in cases involving putrefied bodies.

The water of the drowning surrounding the corpse, on the surface and in depth, was sampled for testing at the time of judicial inspection; it was placed in 1-l sterile containers and was kept in the fridge at around 4 °C to leave sediment. The supernatant was discarded and the remaining sediment was centrifuged several times to obtain 5-ml aliquots which were used for Diatoms test. Biological material (10 g of viscera: brain with meninx, lung, liver, kidney, and femoral bone marrow) and the water of the drowning (5 ml) were chemically digested by a mixture of strong acids (sulfuric acid at 98 % and nitric acid at 69 %), until to the complete destruction of biological matrix. The material was then concentrated by a CytoFuge® 2 centrifuge, mounted in synthetic resin and observed by optical and contrast phase microscopy with Leica DMR microscope to calculate numerically the presence of

vegetal plankton (Fig. 3). The scientific literature regarding the correct number of diatoms recovered from the organs in drowning deaths is variable, and in this report, the authors have considered positive samples of viscera with at least ten diatoms per histological slide. A total of 82 cases (59 %) resulted positive for diatoms in the drowning water and in viscera; the amount of diatoms detected in brain and meninx were lower, if compared to the other tested samples (Table 3). All the extracted diatoms (except for one *Cyclotella* sp.) were typical of [22] epiphytic habitat (growth on aquatic plants), benthic (growth on substrate), and epipelagic (growth on sediment), belonging to taxa showed in Table 4. A fair taxonomic and quantitative correspondence between the diatoms extracted from cadavers and the diatoms extracted from the environmental samples was noted (qualitative and quantitative correspondance) [18]; the species were characteristic of bottoms of rivers and lakes in floodplains, near the shore. This type of analysis permitted to propose, with an elevate probability, that in these cases, the cause of death was drowning.

Concerning the cases of drowning in the bathtub, the 71.4 % of victims (10 cases over 14) did not show positivity to the diatoms test. This fact is in agreement with some reports [23, 24]: they consider the study of diatoms as scarcely

Table 3 Concentration of the different diatoms shape per organ

N. victims	Diatoms shape	Organs*				
		Brain	Lung	Liver	Kidney	Bone marrow
13	Discoidal	8	13	11	10	9
9	Ribbed	9	14	10	10	10
8	Zigzag aligned	8	10	11	11	10
9	Stem shape	10	13	10	9	9
10	Navicular	9	13	12	12	12
6	Waved	8	10	11	11	10
14	Louse shape	10	12	10	11	11
9	Comb shape	9	14	12	9	9
4	Filiform	8	10	10	11	10

*Minimal number of diatoms per histological slide

Table 4 Diatoms taxa extracted from the cadavers and from the drowning waters

Diatoms shape	Taxon	Cadavers	Environmental sample		
			Water	Slime	Vegetation
Discoidal	<i>Cyclotella</i>	4		x	x
Ribbed	<i>Cymbella prostata</i>	6		x	x
	<i>Cymbella vetricosa</i>	3		x	x
	<i>Cymbella lanceolata</i>	2		x	x
	<i>Cymbella tumida</i>	7		x	x
	<i>Diatoma elongatum</i>	3		x	
Zigzag aligned	<i>Dimatoma vulgare</i>	5	x	x	x
	<i>Ghomphonema</i> sp.	5		x	x
Stem shape	<i>Ghomphonema olivacea</i>	4		x	
	<i>Navicula lanceolata</i>	6		x	x
Navicular	<i>Navicula viridula</i>	3		x	
	<i>Navicula</i> sp.	1		x	x
	<i>Caloneis amphisbaena</i>	4		x	x
Waved	<i>Caloneis ventricosa</i>	2		x	x
	<i>Cocconeis pediculus</i>	3			x
Louse shape	<i>Cocconeis placentula</i>	5		x	x
	<i>Cocconeis</i> sp.	6	x	x	x
	<i>Fragilaria crotonensis</i>	4	x		
Comb shape	<i>Fragilaria virescens</i>	5		x	x
	<i>Melosira</i> sp.	4	x	x	x

reliable in such cases due to the very low number of unicellular algae (in this contexts) that is not detectable by the actual techniques. Only a recent article [25] dealing with ten cases of death in the bathtub has demonstrated the presence of diatoms in lungs, where the passive concentration of algae from the water is easier, independently from the cause of death and not considering the diatoms test on femoral bone marrow. Similarly, an Italian study [26] concerning 33 cases of drowning in the bathtub highlighted the positivity to the diatoms in only 4 cases (12 %), thus demonstrating a poor detection of diatoms in this context: in the domestic water, filtration processes can reduce or reset the presence of diatoms that, however, could be present in the air and in the linen, polluting the bathroom fixture.

Toxicological analysis

Toxicological analysis were performed on cadaveric liquids (femoral and cardiac blood, urine, gastric contents), viscera (brain, lung, liver, kidney), and hair all sampled during the autopsies, in 136 cases. Three victims were excluded from the toxicological analysis due to the high degree of decomposition. The tests were conducted in the modality of a generic screening (for the research of every substance with a pharmacological activity) and in the modality of a specific screening, for the detection of the most common abuse substances: the research of these substances (opiates, cocaine, methadone,

cannabis, amphetamines, ecstasy, ketamine, benzodiazepines, and barbiturates) was conducted by immunoenzymatic techniques, EMIT on urine samples, and ELISA on blood samples. For the alcohol concentration and for the volatile substances, a chromatography was used with a headspace sampling (HPLC-MS), while the detection of nonvolatile substances was performed with the gas-chromatography combined with the mass spectrometry (GC-MS). Toxicological results are shown in the Table 5: 12 victims (9 %) used substances with toxicological activity, while the other victims were negative at the analysis.

Table 5 Toxicological findings

Age	Sex	BAC	Drug	Concentration
25	M	0.4 g/L		
62	M	0.15 g/L		
44	F	1.8 g/L		
37	M	0.7 g/L		
60	M	1.4 g/L		
22	F	0.24 g/L		
52	M	0.6 g/L		
84	M		Diazepam	Traces
39	F		Diazepam	Traces
27	M		Temazepam	1.22 mg/L
28	F		Diazepam	Traces
79	M		Alprazolam	0.60 mg/L

Alcohol was present in 7 cases, with a blood alcohol concentration (BAC) between 0.15 and 1.8 g/l, confirming that in this type of suicide the victims are almost always sober [27], differently from the accidental drowning, where the alcohol intoxication is very common [14] and detected in about 50 % of cases [28]: this fact seems also to correlate with the age of the victim because old persons usually do not use alcohol, which is otherwise used by young persons [29]. The other five victims showed a positivity for benzodiazepines.

Discussion

Drowning asphyxia represents an important topic for the public health [30, 31] because it is a numerically relevant cause of non-natural death in the world [32]. As a suicide method, in forensic pathology, drowning is known to be more common in territories with an easy access to water sources, like coastal territories. Whenever a cadaver is found in the water, the forensic literature suggests a range of circumstances (different from drowning) that must be taken into account to set the real cause of death [33]. The rapid onset of putrefactive phenomena, particularly after the recovery from water (especially if warm) [17], obscures the typical signs of drowning with relevant difficulties in the diagnosis of wounds. It also does not permit the identification of the victim; in these cases, the identification is performed by the personal belongings (clothes and jewels), scars, peculiar bodily traits, and finally by anthropologic and odontologic techniques. In these cases, it is also possible that the real manner of death (homicide, suicide, accident, or natural death in water) may remain uncertain [12]. The diagnosis of death by drowning is a product of a concordance of data concerning the victim, the circumstances of the recovery of cadavers, the autopsy [34], and the diatoms test [35], which is still considered the “gold standard” [20] if it is performed without contamination [36]. The fundamental principle of the diatoms test is based on the prerequisite that the diatoms are present in the drowning water: the inhalation of the water determines the diatoms penetration in the pulmonary alveolus and thus in blood, with subsequently deposition in the other organs (brain, liver, kidneys, and femoral bone marrow); this fact makes possible the extraction of diatoms from these organs. The qual/quantitative comparison between intracorporeal diatoms and environmental diatoms [18] provides useful data concerning the place of the drowning. Otherwise, in case of cadaver submersion (the submersion of a body that is already dead when sinks in water), the diatoms transport to the organs (with the exception of the lung, where the diatoms obviously enter passively through the respiratory airways) does not take place, as the circulatory function is absent.

In the present study, the circumstances of 139 cases of suicide by drowning in the non-coastal territory of Milan

during a period of over 20 years (1993–2013) were analyzed. This type of death is recognized as a relevant issue for global public health and it requires preventive interventions even in a region that is far from sea, like the region of Milan: in the present records, suicide drowning represents the 0.64 % of total performed autopsies and the 3.8 % of the suicides (the fifth way of suicide).

All the suicides by drowning took place in fresh water, far from the sea, and the victims were mostly elderly subjects; only a few young subjects chose to suicide by drowning: probably, it was easier to protect young persons from this type of suicide than elderly persons [37], which are scarcely subject to prevention [10].

Some recreational activities like swimming, fishing, and rowing (that are performed in water sources like seas, lakes, rivers, or in water sources of small entity like canals), together with the exposition to water in the domestic context (like the bathtub and the swimming pool) and with behavioral factor (abuse of alcohol, drugs, and illicit drugs), may constitute risk factors of suicide for those subjects that are psychologically vulnerable. They require urgently the beginning of preventive actions [31] through appropriate regulations and adequate safety measures. Lawmakers, security and public health professionals, and forensic pathologists should deal together the problems of risk factors associated with drowning in every specific region, taking into account the particular local situation and learning from the data and the knowledge derived by all the cases over a long period range. Suicide cases should require a continuous monitoring and surveillance of rivers and lakes shores by posts equipped with personnel that is an expert in immediate rescue and cardiopulmonary resuscitation and equipped with life vest and other flotation devices. Among the passive preventive measures, the installation of fencing with adequate height that obstructs the achievement of the shores and the water should be appropriate. Finally, education, knowledge, and training concerning the danger potentiality of water should be provided to people with a high risk of committing suicide, and might represent important items for the strong reduction of suicide drowning.

Actually, in forensic pathology, regardless the difficulties of interpretation [35] concerning the diatoms test, the diagnosis of drowning still continues to be one of the more complex diagnosis [38] because it is a diagnosis that should be made after the exclusion of other death causes and also in absence of significant toxicological results. Thus, every single case requires a deepened analysis that is based on the results of a careful inspection, autopsy, and microscopic observation.

Conclusion

In this report, the authors analyze drowning driven by a suicidal intention in a population living in a no coastal

geographic area like Milan and aim to identify a profile of the average victim at risk of committing a suicidal drowning and possible precautionary interventions to reduce the number of suicide cases.

The results of this study show that, even in a non-coastal territory and far from the sea, suicide by drowning occurs in places with an easy access to water sources, with an incidence of 3.8 %: in particular, the numerous natural and artificial water streams of the district of Milan represented a high-risk factor for suicide by drowning especially in older adult men, suffering from psychiatric diseases and then psychologically vulnerable.

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