ORIGINAL ARTICLE　　　　　　　　　　　　　　　　　　**Open Access**

Review of clinical non-medico-legal autopsy: a descriptive study in 747 patients

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Abstract

Background: Autopsies have been an essential element to healthcare professionals' training, as well as to research processes, education, and public health. In spite of the decline of clinical autopsy rate after the Joint Commission on the Accreditation of Hospitals eliminated the minimum autopsy rate required for accrediting hospitals, in Colombia, South America, we have seen that this practice has been reinitiated and our institution has performed more than 200 autopsies per year.

Objective: To describe the main causes of death among individuals to whom a clinical autopsy was practiced at a general hospital in Bogotá, Colombia.

Methods: A descriptive study of autopsy reports during the period between January 2012 and June 2015 was conducted.

Results: The study included 747 autopsies of which 58.2% were performed in males. The majority of deaths occurred among the 41 to 64 years (mean 32.53, SD 28.53) age group. The leading cause of death observed in young adults and middle-aged adults (18 to 64 years) was cardiac arrest (58.5%) associated with acute myocardial infarction, cardiomyopathies, or cardiovascular abnormalities, followed by respiratory conditions (42.6%) and cardiac sudden death as the second cause of death in young adults.

Conclusions: Studies based on clinical autopsies allow precise knowledge on the main underlying causes of death in a population, as well as, enable ideas based on key data obtained to be used in the development of cardiovascular prevention strategies for the different age groups thus preventing fatal outcomes in young adults who are the active working, productive population in society.

Keywords: Autopsy, Colombia, Latin America, Cardiac arrest, Pathology

Background

After 1964 autopsy rates have steadily declined in hospitals of the world. The autopsy rate has fallen from 41.1% in 1964 to only 5% or less in present days, after the Joint Commission on the Accreditation of Hospitals eliminated the minimum autopsy rate required for accrediting hospitals in the USA (25% for teaching hospitals, 20% for non-academic hospitals). In addition, contributing factors such as concern about legal actions if misdiagnosis is detected due to unexpected findings, higher expenses for the pathology services for these are high-cost procedures given the staff and supplies involved, failure to retrieve the autopsy report, and personal reasons such as social phobias, as well as, reluctance of relatives to give autopsy consent and social and cultural barriers, have generated a global trend resulting in a drop of present autopsy rates (Roberts 1978; Clayton and Sivak 1992; Petri 1993; Hasson and Schneiderman 1995; Horowitz and Naritoku 2007).

In the late nineteenth century and early twentieth century, various studies on mortality statistics based on autopsies were conducted in North and Central America. One of them was carried out by the Autopsy Committee of the College of American Pathologists (CAP) to improve performance and reporting of the autopsy and to promote the utilization of the autopsy for quality

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improvement, research, education, and public health (Autopsy Committee of the College of American Pathologists 2001). In Colombia, South America, some studies describing the demographic features of clinical autopsies and underlying major causes of death were conducted in central area between 1966 and 1991, and in the north-east on 2010, among other (Diaz-Perez and Melo-Uribe 2010; Bernal 2013).

Clinical autopsy practice is starting to re-emerge in our institution where the present study was carried out, Hospital de San José in Bogotá, Colombia, with more than 200 autopsies per year practiced during the last three years. However, in spite of conducting innovative studies on research and report very interesting cases (Mendoza et al. 2009; Sanchez et al. 2015; Moreno et al. 2016; Chaves et al. 2017; Parra-Medina et al. 2018) no complete statistical analysis of the practice of autopsies is yet available. Thus, the present study is aimed to describe the leading reasons of death in patients in whom a clinical autopsy was performed.

Materials and methods

This was a descriptive cross-sectional autopsy-based study which complied with Colombian regulations, conducted in patients who died for non-violent reasons in a high complexity hospital in the city of Bogotá, Colombia, during the period between January 2012 and June 2015. The relatives' autopsy consent was obtained as a routine procedure.

Five expert researchers on the study of autopsies, collected, extracted, and verified the data obtained from clinical autopsy reports completed by the pathology group. For analysis purposes, patients were distributed in the following age groups, fetal obitus (at 20 to 37 weeks of gestation) neonate (from newborn to one month old), infant (1 month to 1 year old), toddler (1 year to 2 years old) young child (aged 2–6 years), child (aged 6–13 years), adolescent (aged 14–17 years), young adult (aged 18–40 years), middle adulthood (aged 41–64 years), and old age (aged 65 years or older). The cases in which a major diagnosis was not provided in the autopsy report were excluded.

The information was classified and tabulated by analyzing the following variables in terms of age, sex, clinical antecedents, environmental circumstances regarding to the moment of death (defined as the circumstances surrounding a person's death), start time of symptoms and progression, main diagnosis, and secondary diagnosis and origin of the autopsy request (within or outside the institution). An audit of the database was then performed by selecting a representative sample to verify the accuracy of information.

Sudden cardiovascular death was classified as the primary diagnosis in the context of patients who were clinically healthy and presented sudden onset of symptoms less than an hour before their death, and when confirmation of heart disease was achieved by the histopathological study. This decision was discussed by the research group with the objective of achieving a consensus based on data found in the literature (Thiene 2014).

In order to facilitate the analysis of the pathologies that led to the death of the patients, it was decided to group them in a general manner into twelve groups with similar physiopathological mechanisms, because the list of diseases was very extensive and, in some cases, detailed. As an example, it is explained that all acute myocardial infarctions, regardless of the occluded coronary artery, anginal ischemic events, chronic ischemic cardiomyopathy, ruptures of aortic aneurysms, aortic dissections, rupture of the cardiac wall secondary to infarction, and other similar ones were grouped in the "cardiovascular" etiology, being clear that at the time of the autopsy, there were not enough clinical arguments to determine the cause of the deaths, since many of them had sudden death, reason that caused the treating doctors to refuse to fill out the official death certificate and the bodies were sent to the hospital for the clinical autopsy because they did not know the pathophysiological origin of the death.

Statistical analysis

A descriptive analysis was conducted calculating the relative frequencies, absolute frequencies, and central trend measures. The STATA13® program was used for the statistical analysis conducted by the FUCS research group.

Results

A total of 763 clinical autopsies were analyzed, of which 16 were excluded for not providing a diagnosis on the report. Of the 747 autopsies included in the analysis, we observed that most of the autopsies corresponding to 316 (42%) were performed in year 2014, showing a significant increase of 70% as compared with year 2013. Of the total number, 435 (58.2%) were men, 307 (41.1%) women, and 5 (0.67%) were fetus obits (Table 1).

The personal medical past history according to age recorded in the autopsy protocols evidenced that 397 reports had no data recorded (53.14%). For the fetus obits, newborns, and infants/toddlers groups, the main antecedents found were the mother-child past medical history, in 38.25%, 36.53%, and 10% respectively. In the young adults group, the antecedents identified were cardiovascular conditions such as hypertension, diabetes mellitus and smoking present in 7%. And in the 41 years or older age group, arterial hypertension in 49 (13.3%) subjects were the major antecedent, followed by smoking in 19 (5.16%) cases and diabetes mellitus in 7 (1.9%).

Table 1 Demographic characteristics of study population

	2012	2013	2014	2015	Total%	N
Sex						
Male	53	114	190	78	58.23%	435
Female	38	83	126	60	41.10%	307
Indeterminate	2	1	0	2	0.67%	5
Age						
Fetus obit	30	36	65	18	19.95	149
< 1 month	2	20	21	9	6.96	52
1–12 months	2	5	17	2	3.48	26
1–2 years	0	3	2	0	0.67	5
3–17 years	5	6	15	5	4.15	31
18–40 years	10	27	39	24	13.39	100
41–64 years	28	72	93	50	32.53	243
> 65 years	13	29	54	29	16.73	125
No data available	3	1	10	3	2.28	17
Place of death						
Hospital	49	63	145	76	44.58	333
Non hospital	21	36	87	35	24.10	180
No data available	22	99	83	29	31.33	234

The data on the symptoms experienced before death, absence of fetal movements was the primary symptom described (19.46%) in the obits group; dyspnea and other respiratory symptoms in newborns and infants/toddlers (55.76% and 56.66% respectively); in children, adolescents, and young adults, headache and other neurologic symptoms (6.8%) and in subjects 40 years or older symptoms were headache (17.39%), followed by dyspnea and other respiratory symptoms (16.03%); 149 (19.94%) cases did not have any recorded data.

In patients 18 years or older, 167 cases described death within less than 1 h from the onset of symptoms, in the fetus obits group the majority presented symptoms one hour to 24 h before death in 34 cases (22.81%); in infants, symptom onset before death of more than 24 h was observed in 9 cases (30%); and 10 cases (32.25%) of the 2 to 17 years age group described death less than 1 h from the start time of symptoms; there was no information available in 324 (43.3%) cases (Fig. 1).

Regarding the main cause of death in each age group, our findings evidenced that in the fetus obits group, congenital anomalies accounted for the leading cause of death in 54 cases, followed by placental diseases, in utero pneumonia and other respiratory alterations (18 and 6 cases respectively); neonates presented 20 cases of pneumonia and other respiratory disorders as the main cause of death and secondly prematurity in 12 cases; in 22 cases in infants the primary diagnosis was the same as in the neonates group; pneumonia and associated respiratory disease was the predominant diagnosis evidenced in 10 cases of the 2 to 17 years group followed by sudden death in 9 cases, and cerebrovascular events in 5 cases as the third cause of death.

Cardiac arrest was the leading cause of death in the young adult (18–40 years) group accounting for 26 cases, associated with acute myocardial infarction in 12 cases and with cardiomyopathies and cardiovascular abnormalities in 14 cases. Pneumonia and associated respiratory illnesses was the second cause of death (22 cases) and cerebrovascular events were the third cause of death (10 cases). In patients aged 41 to 64 years and 65 years and older, the main cause of death was cardiovascular disease in 136 and 64 cases, respectively, mainly associated with acute myocardial infarction (38%), followed by pneumonia in the middle-aged adult group (30 cases) (Table 2).
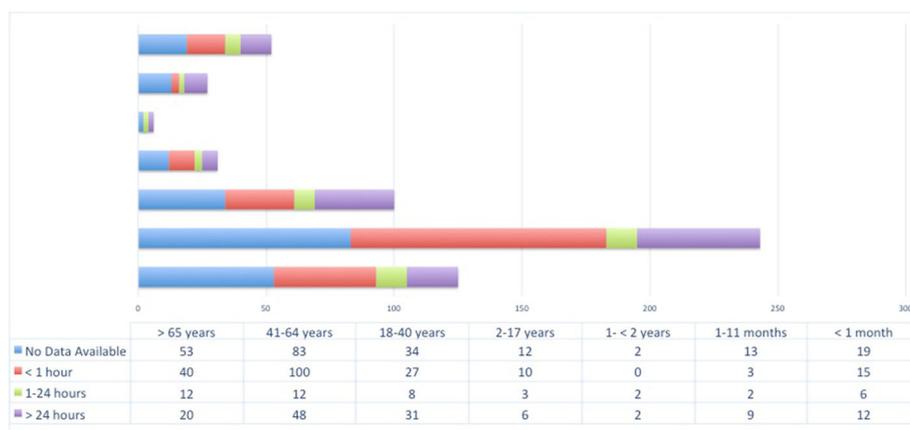

	> 65 years	41-64 years	18-40 years	2-17 years	1- < 2 years	1-11 months	< 1 month
No Data Available	53	83	34	12	2	13	19
< 1 hour	40	100	27	10	0	3	15
1-24 hours	12	12	8	3	2	2	6
> 24 hours	20	48	31	6	2	9	12

Fig. 1 Onset time of symptoms before death by age group

Table 2 Main anatomical pathology diagnoses by age group

Diagnosis	No data	Obit fetus	< 1 months	1–12 months	1–2 years	2–17 years	18–40 years	41–64 years	> 65 years	Total (%)
Acute myocardial infarction	3 (1)*	0	0	0	0	0	12 (8)*	92 (56)*	48 (22)*	155 (20.74)
Other entities (bronchoaspiration, sepsis secondary to urinary infections, gastrointestinal infections, and rare conditions)	2	66	5	2	0	5	17	14	15	126 (16.86)
Bacterial pneumonia and associated respiratory illnesses	3	6	21	18	4	10	22	30	11	122 (16.33)
Deaths related with other cardiovascular diseases (aortic dissection, aortic aneurism)	2 (1)*	0	2	1	0	5	14 (3)*	44 (31)*	16 (8)*	84 (11.24)
Deaths related with congenital malformations	5	54	11	0	0	2	0	0	0	72 (9.63)
Pulmonary thromboembolism	0	0	0	0	0	0	13	30	14	57 (7.63)
Deaths related with cerebral disorders (stroke, epilepsy, meningitis)	0	2	2	1	0	8	13	17	7	53 (7.09)
Deaths related with respiratory infections non bacterial	0	0	1	1	0	1	5	9	7	24 (3.21)
Deaths related with placental abnormalities	1	18	0	0	0	0	0	0	0	19 (2.54)
Deaths related with prematurity	1	3	12	1	0	0	0	0	1	18 (2.40)
Deaths related with neoplasias	0	0	0	0	0	0	3	7	6	16 (2.14)
Deaths related with metabolic disorders	0	0	0	0	0	0	1	0	0	1 (0.13)
Total	17	149	54	24	4	31	100	243	125	747

*In brackets sudden cardiovascular death cases

Cardiovascular disease was the most common cause of death in patients older than 18 years of age. Sudden cardiovascular death accounted for 133 (54.4%) cases, secondary to acute myocardial infarction (56.2%) or cardiomyopathies, and cardiovascular abnormalities such as aortic dissection or aortic aneurism (51.2%) (Table 2).

In relation to the environmental circumstances regarding the moment of death, 139 cases (18.61%) did not evidence information on the circumstances surrounding the person's death, 282 cases (37.75%) were hospitalized patients (excluding fetal obits and voluntary termination of pregnancy), 211 (25.25%) individuals were involved in daily routines at the moment of death, and only 3 (0.40%) subjects were engaged in physical activity (Fig. 2).

Discussion

This study analyzed the results of 747 autopsies practiced over a 3.5-year period at Hospital de San José in Bogotá, Colombia, observing an increase in the practice of this procedure and a greater number of cases to be analyzed, compared with other studies. The findings of the post-mortem diagnoses agree with data reported in other international studies, such as the study published in Cuba that included 5805 autopsies, evidencing important data such as the direct cause of death and

comorbidities. The two leading causes of death, listed according to frequency, were bronchopneumonia and acute myocardial infarction; however, it must be considered these patients were 60 years or older (Martínez Rodríguez et al. 2012). In contrast with our study in which the first cause was cardiovascular disease followed by respiratory conditions. Another retrospective study conducted in SC, United States of America in which 13,227 autopsy cases in patients aged 18 years or older were compiled, half of the cases of death were non-violent, and the main post-mortem diagnosis was acute myocardial infarction regardless of age group. However, it differs from our study on other major causes of death such as acquired immune deficiency syndrome (AIDS), infections and neoplasia (Christiansen and Collins 2007).

The present study as compared with other studies made in Colombia, represents one of the biggest studies conducted during the last decade given the number of autopsies it comprises over said period of time. Pointing out a study performed at the central area, where 160 cases were recorded during 25 years, between 1966 and 1991 stressing the value of autopsy for medical training, confirming clinical diagnosis and assessing the effects of treatment given (Bernal 2013). On the other hand, a study was carried out in the north-east in 2010, which

Fig. 2 Environmental circumstances regarding to the moment of death
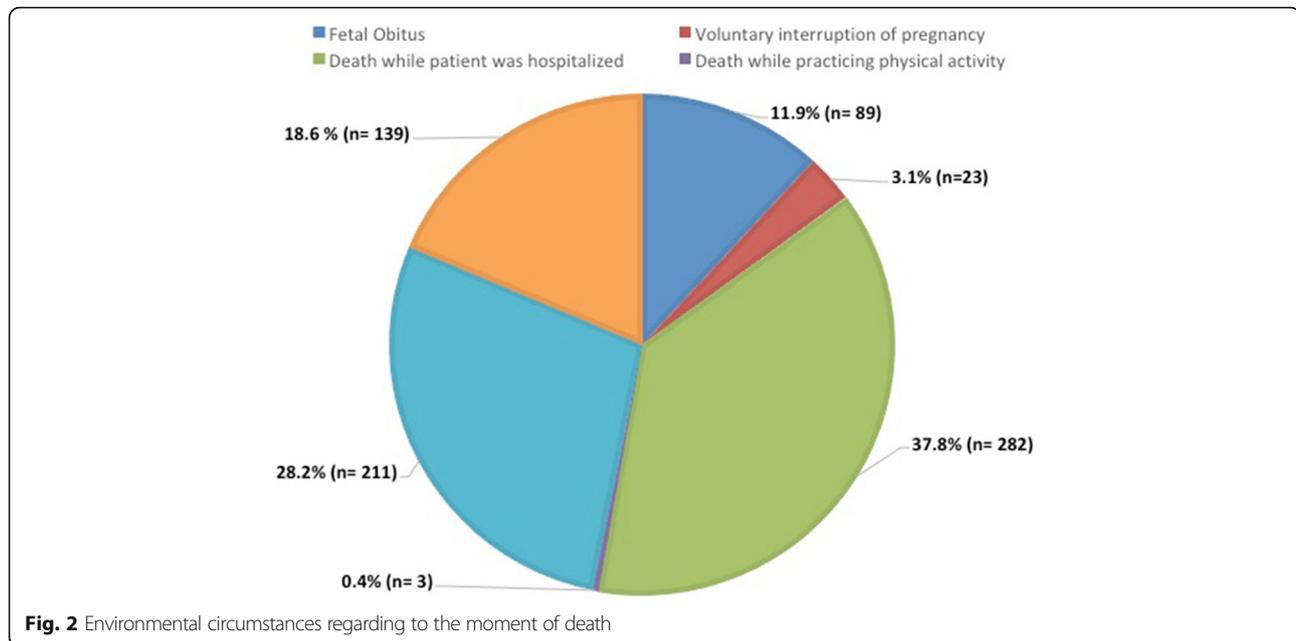
reports on 494 autopsies over a 4-year period through an analytical study of multiple diagnostic evaluations, correlating the pre-mortem clinical diagnosis and the pathological diagnosis (Diaz-Perez and Melo-Uribe 2010). Moreover, these two studies found that infectious diseases such as community-acquired pneumonia and tuberculosis are and continue to be the main causes of death in our country. These findings are similar to the results we obtained in the present study.

The most prevalent findings in fetus obits were congenital malformations, as well as, voluntary interruption of pregnancy, followed by placental abnormalities, predominantly chorioamnionitis, which are similar to those obtained by the Gynecology and Obstetrics Department of the University of Utah, where fetal death is emphasized as an important but barely studied problem which currently represents nearly 50% of overall perinatal deaths (Silver 2007). It is worth noting that the placenta was not available for pathology assessment in some cases of our study; therefore, it is most likely that if it had been available the incidence of placental pathologies would increase as a cause of fetal death. Thus, we consider it indispensable to be able to assess the fetus as well as the placenta in the total number of post-mortem studies undertaken in this age group.

Respiratory infections with onset of unspecific respiratory symptoms in the days before death are evidently the most common cause of mortality in newborns and toddlers, and as some are associated with prematurity which increases the adverse outcome risks and favors a high prevalence of serious morbidity and mortality, this contributes to the escalating costs of health care in our country. As an adequate control has not yet been achieved and they still represent a

great effort for health institutions for addressing these problems, adequate improvement of nutrition, development of education strategies, access to robust health prevention programs, and community work among other is required.

The leading diagnosis identified in our study among the infants/toddlers to young adult age group was respiratory illness. It is worth noting that the central area and north-east studies performed in Colombia also identified respiratory illness as the leading cause of death, in spite, promotion and prevention programs were established; these mortality values continue to be notoriously alarming in Colombia (Diaz-Perez and Melo-Uribe 2010; Bernal 2013).

Interestingly, 26 patients in the young adult age group (18 to 40 years) died due to cardiovascular disease. 42.3% presented sudden cardiac death, constituting the first cause of death in this population (Table 2); this is an important finding given the incidence of cardiac deaths in this age group reported in the global literature is 1 per 100,000 persons/year and increases in people older than 30 years, with a second maximum peak in subjects aged between 45 and 75 years (Morentin and Audicana 2011; Farioli et al. 2015; Mesrati et al. 2017) associated with risk factors, such as cardiovascular disease, arterial hypertension, diabetes mellitus, and smoking.

The latter becomes additionally relevant if the National Statistics Department of Colombia (DANE) (Colombian Department of Statistics) analysis is reckoned, for it estimates that by 2020 the base of the population structure in the capital of the country (Bogotá) will decline due to low birth rates. This may be influenced by the fact that in the past years, young adults died predominantly because of violent causes. As our results indicate that cardiac sudden death is

common in young adults and unless active promotion and prevention strategies are taken, the number of cases will progressively increase considering these individuals constitute the active workforce that establishes an opportunity environment and it may be likely that this phenomenon would affect the economic productivity of society.

Given that our research group found that sudden death is the main autopsy diagnosis in subjects 40 years and older, we recommend not only the development of effective cardiovascular diseases prevention strategies but also to stress the importance of creating heart disease awareness among people for a great number of patients in our study presented sudden onset of clinical symptoms, less than an hour before their death while in their daily activities, and did not receive medical care. Likewise, we consider it critical to count with the availability of equipment and trained personnel on basic life support skills, who may serve as first responders in high-traffic public areas, in order to reduce the mortality rate related to heart disease, as stated by the American Heart Association Guidelines for Cardiopulmonary Resuscitation which demonstrated evidence-based positive impact and benefits among patients (Olasveengen et al. 2017).

Conclusions

Clinical autopsy is an important tool in healthcare institutions for providing a post-mortem diagnosis, confirming the clinical diagnosis, assessing the effects of the treatment given, its usefulness to obtain important demographic data within the communities, and for enhancing medical training and research.

Sudden death is the main cause of death in patients aged more than 18 years; this leads us to recommend creating not only effective cardiovascular disease prevention strategies, but also developing heart disease awareness among people.

We consider it critical to count with the availability of equipment and trained personnel on basic life support skills in high-traffic public areas, in order to reduce the mortality rate related to heart disease, as stated in the American Heart Association Guidelines for Cardiopulmonary Resuscitation which demonstrated evidence-based positive impact and benefits among patients (Olasveengen et al. 2017).

Improvement of health policies on control of respiratory disease prevalence is required, for this condition continues to cause high mortality rates in all age groups.

Our institution, Hospital de San José is a reference center in Bogotá for this medical procedure generating impact through clinical-pathological correlations and interactions with other health institutions, increasing feedback aimed at improving quality and creating clinical health care protocols.

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