Evaluation of the discrepancy between clinical diagnostic hypotheses and anatomopathological diagnoses resulting from autopsies

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Discrepancy between clinical and autopsy diagnosis

Abstract

Introduction: One objective of clinical autopsies is determining the final cause of death and the pathological changes that may have triggered death. Despite advances in medicine, the level of discrepancy between clinical and autopsy diagnoses remains significant. Objectives: Comparison of data obtained from autopsies carried out at the São Bernardo do Campo/SP Death Verification Section with clinical diagnostic hypotheses proposed during medical care. Method: This was a retrospective study that have been made by comparison of the necroscopic reports issued by the São Bernardo do Campo/São Paulo Death Verification Section in the years 2014 and 2015 and the Cadaver Referral Guides completed by the attending physicians prior to the necroscopic examination. Results: A total of 465 cases have been analyzed. In general, discrepancies between the clinical diagnostic hypothesis and the autopsy diagnosis occurred in 28% of the cases. A logistic regression model, with diagnostic discrepancy as a response variable and sex, age, duration of care, type of institution and organ system as explanatory variables, was fit to the data, with the results indicating that all explanatory variables with the exception of the organ system are not significant ($p > 0.132$). Conclusions: Discrepancies between clinical diagnostic hypotheses and autopsy diagnoses continue to occur, despite the progress in complementary examinations and therapies. There is less chance of a discrepancy when the

patient presents diseases in the cardiac system and a greater chance of discrepancy when there are problems in the vascular, endocrine and neurological systems.

Keywords: autopsy, medical errors, cause of death, diagnosis

Introduction

Autopsies are traditionally useful to improve the quality of health care, as the conclusions obtained in the exams provide complementary information on the diseases, thus allowing improvement in the quality of the therapy that can be offered, the quality control in care provided and access to technological innovations in laboratory studies (1,2). Originally, autopsies were scientific examinations of corpses in which the whole body and all organs were exposed and examined to determine the cause of death and the circumstances related to it (3). In Brazil, these tests can be performed in cases of violent, suspicious or natural death. Violent death is the result of an external and harmful action, regardless of whether it is immediate or delayed; a suspicious death is one that presents the possibility of having occurred in a violent way, usually occurring suddenly and without evident cause; and natural deaths are due to morbid processes that are not related to exogenous factors (4). According to Ordinance No. 116 MS-SVS of February 11, 2009, the bodies of people who died due to natural causes without medical assistance or with a diagnosis of poorly defined death should be referred to the Death Verification Section for clinical autopsy. According to Mateos et al. (5), one objective of clinical autopsies is determining the final cause of death and the pathological changes that may have triggered death.

Errors in medical diagnosis are treated as impossible within the health system (6), as technological developments and the material published in the media in recent years have created a high expectation regarding the accuracy of medical work among the population (7). The professional involved may be subject to administrative, civil and even criminal charges when he or she cannot establish a precise medical diagnosis. However, the variables that surround the medical diagnosis are numerous and difficult to characterize, which makes it susceptible to error. Thus, the first step in reducing diagnostic errors is the awareness of professionals and the

population about the real possibility of their occurrence (8). Despite advances in medicine, the level of discrepancy between clinical and autopsy diagnoses remains approximately 10% to 20% (9). Therefore, it is critical that autopsies continue to be performed so that it is possible to detect possible failures in the diagnostic process and seek tools to minimize them.

In view of the relevance of the topic and the importance of the comparison between the clinical diagnostic hypotheses and the anatomopathological diagnoses obtained by autopsy, we aimed to compare data obtained in the autopsies performed at the São Bernardo do Campo/São Paulo Death Verification Section with diagnostic hypotheses proposed during medical care.

Materials and methods

This was a retrospective study aimed at comparing diagnoses obtained in two different situations: medical care and autopsy. The necroscopic reports issued by the São Bernardo do Campo/São Paulo Death Verification Section were analyzed in the years 2014 and 2015 together with the Cadaver Referral Guides completed by the attending physicians prior to the necroscopic examination, totaling 465 cases.

Data were stored in a spreadsheet with information on sex, age (years), time (h) between the beginning of care at the clinic and death, type of health facility (Emergency Care Units [ECUs] or hospital), clinical diagnosis (and organ system) obtained by the physician responsible for care and corresponding diagnosis obtained from the pathologist responsible for the autopsy.

To analyze the data, we used a logistic regression model, with diagnostic discrepancy as the response variable and sex, age, duration of care, type of institution and organ system diagnosed by the attending physician as explanatory variables.

Ethics

The research was approved by the CEP (opinion n ° 1,954,123), and the authors were exempt from obtaining Free and Informed Consent.

Results

The descriptive analysis of the data indicated a slight male predominance in the sample (53%). In addition, 59% of the bodies were referred from hospitals, and 41% were referred from ECUs. Age was grouped according to published articles with similar themes (Table 1). The same type of grouping was considered for the frequency of duration of care (Table 2).

The most frequent diagnosis assigned by the attending physician was acute myocardial infarction (AMI), followed by sepsis (inflammatory reaction secondary to the presence of an infectious focus). The frequency of diagnoses is shown in Table 3.

The clinical diagnoses were grouped into organ systems (e.g., cardiac, digestive, respiratory). The frequency of the organ systems, according to the assisting physician's diagnosis, is shown in Table 4.

The most frequent diagnosis suggested by the pathologist was AMI, followed by pulmonary thromboembolism (PTE) and bronchopneumonia (Table 5).

The diagnoses were grouped according to the same organ systems used in the analysis of the attending physicians' diagnoses. The frequencies of diagnoses according to organ system based on the pathologist's diagnosis resulting from the autopsy are indicated in Table 6.

The joint distribution of frequencies of the clinical diagnoses and autopsy diagnoses is provided in Table 7.

The descriptive analysis suggests that the cardiac system presented the highest diagnostic agreement among all the organ systems. In general, a discrepancy between the clinical diagnosis and the autopsy diagnosis occurred in 28% of the cases (Table 8).

A logistic regression model (10) with diagnostic discrepancy as a response variable and sex, age, duration of care, type of institution and organ system as explanatory variables was fit to the data and indicated that no explanatory variables, except for organ system, were significant ($p > 0.132$). One case involving the lymphatic system (where there was agreement) and two cases involving the urinary system (where there was disagreement) were eliminated from the analysis to improve the fit of a model in which only the diagnosis-associated system was considered an explanatory variable. The model can be represented as

$$\log(\text{Odds of discrepancy}) = A + B(i) \times \text{Diagnostic system } (i)$$

where A corresponds to the odds of diagnostic discrepancy for the cardiac system and B(i) is the odds ratio between the diagnostic discrepancy for the system i and the cardiac system (i=1: infectious, i=2: respiratory, i=3: digestive, i=4: neurological, i=5: endocrine and i=6: vascular).

According to this model, the odds of discrepancy and confidence intervals with a confidence coefficient of approximately 95% are shown in Table 9.

Discussion

The general discrepancy rate between the clinical diagnoses and the autopsy diagnoses was 28%, similar to those published in Spain (25.6%) (11) and England (28%) (12). Studies in other localities revealed higher rates, such as in the United States (44%) (13), or lower rates, such as in the Netherlands (18.1%) (14) and Switzerland (7%) (15).

Our results indicate that only the diagnosis-related system involved significantly influences the discrepancy between the clinical diagnosis and the autopsy diagnosis, which is in agreement with results published by Fares et al. (16), Aalten et al. (17) and Kotovicz et al. (18). However, some previously published articles stated that the discrepancy is related to the shorter duration of care (14,19-21) and sex and age differences (13,14).

The descriptive analysis allows us to conclude that the cardiac system presented the highest diagnostic agreement, with low odds of diagnostic discrepancy (0.172), followed by the infectious system (0.443) and respiratory system (0.463), which is in agreement with previously published studies; according to Kotovicz et al.(18), AMI, PTE and pneumonia diagnoses rarely present diagnostic discrepancy. In light of this result, it is possible to conclude that health institutions are prepared to perform cardiac diagnoses. However, the odds of discrepancy for the vascular (2.333), endocrine (2.000) and neurological (1.500) systems were extremely high, which is also in agreement with previous studies indicating that the vascular system presents the greatest odds of discrepancy (22). Thus, it is essential that attending physicians broaden the range of diagnostic possibilities at the time of care, remembering the possibility of dissecting or ruptured aneurysms and strokes, which were associated with greater probabilities of discrepancy.

It is important to emphasize that the complexity of health care institutions did not influence the diagnostic discrepancy rates, as the values were similar between primary, secondary and tertiary institutions. According to Espinosa-Brito et al. (23) and Kuijpers et al. (14), the significant use of complementary exams or new technologies has not been able to reduce diagnostic discrepancy rates, which clearly demonstrates that the physician's most powerful diagnostic tool is his or her semiology. One of the pillars of medicine is the semiological examination, which may make the request for complementary exams unnecessary

in some situations. For example, a well-performed anamnesis provides approximately 60% of the correct clinical diagnoses; when combined with the physical examination, the accuracy increases to nearly 80% (24).

Conclusion

Discrepancies between clinical diagnoses and autopsy diagnoses continue to occur, despite the progress of complementary examinations and therapies. In this study, discrepancy occurred in 28% of the analyzed cases, with lower odds of discrepancy in patients with diseases of the cardiac system and greater odds of discrepancy in patients with problems in the vascular, endocrine and neurological systems. Thus, it is essential that the attending physician perform a thorough semiotechnical examination during care so that he or she can consider the range of diagnostic possibilities.

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Tables

Table 1. Frequencies by age.

Age	Frequency observed	Relative frequency (%)
0-14	17	4
15-24	6	1
25-34	14	3
35-44	31	6
45-54	59	13
55-64	93	20
65-74	101	22
75+	144	31
Total	465	100

Table 2. Frequencies by duration of care.

Duration of care (h)	Frequency observed	Relative frequency (%)
0-1.0	130	28
1.1-5.0	106	23
5.1-36.0	113	24
36.1+	116	25
Total	465	100

Table 3. Frequencies of clinical diagnostic hypotheses.

Clinical diagnostic hypothesis	Frequency	
	Observed relative frequency (%)	
Acute abdomen	6	1.3
Metabolic acidosis	3	0.6
Ruptured aortic aneurysm	2	0.4
Cardiac arrhythmia	24	5.2
Hemorrhagic stroke	13	2.8
Ischemic stroke	8	1.7
Bronchoaspiration	15	3.2
Bronchopneumonia	14	3.0
Bronchiolitis	1	0.2
Pancreatic carcinoma	1	0.2
Carcinomatosis	1	0.2
Dilated cardiomyopathy	2	0.4
Hypertensive cardiomyopathy	1	0.2
Ischemic heart disease	2	0.4
Diabetic ketoacidosis	3	0.6
Cardiogenic shock	23	4.9
Hypovolemic shock	6	1.3
Mixed shock	2	0.4
Neurogenic shock	2	0.4
Refractory shock	2	0.4
Dissection of the aorta	1	0.2
Chronic obstructive pulmonary disease	1	0.2
Acute pulmonary edema	16	3.4
Hepatic encephalopathy	1	0.2
Hypoxic encephalopathy	1	0.2
Epilepsy	3	0.6
Rocky Mountain spotted fever	1	0.2
Alveolar hemorrhage	1	0.2
Upper GI bleeding	13	2.8
Incisional bleeding	1	0.2
Hepatitis	1	0.2
Intracranial hypertension	1	0.2
Pulmonary hypoplasia	1	0.2
Hypoxia	1	0.2
Subarachnoid	2	0.4

hemorrhage		
Acute myocardial infarction	115	24.7
Jaundice	1	0.2
Surgical site infection	1	0.2
Liver failure	7	1.5
Kidney failure	2	0.4
Respiratory failure	25	5.3
Mesenteric ischemia	3	0.6
Leptospirosis	2	0.4
Lymphoma	1	0.2
Abdominal mass	1	0.2
Meningitis	5	1.1
Meningococcemia	1	0.2
Meningoencephalitis	1	0.2
Metastasis	1	0.2
Pulmonary metastasis	1	0.2
Biliary neoplasia	1	0.2
Esophageal neoplasia	1	0.2
Pneumonia	4	0.9
Sepsis	77	16.6
Neonatal sepsis	2	0.4
Consumptive syndrome	1	0.2
Cardiac tamponade	1	0.2
Traumatic brain injury	2	0.4
Pulmonary thromboembolism	30	6.5
Coronary thrombosis	1	0.2
Pulmonary thrombosis	1	0.2
Tuberculosis	1	0.2
Total	465	100

Table 4. Frequencies of diagnoses per organ system.

Organ system	Frequency observed	Relative frequency (%)
Cardiac	184	39.6
Digestive	36	7.7
Endocrine	6	1.3
Infectious	88	18.9
Lymphatic	1	0.2
Neurological	40	8.6
Respiratory	98	21.1
Urinary	2	0.4
Vascular	10	2.2
Total	465	100

Table 5. Autopsy diagnostic frequencies.

Diagnosis	Frequency observed	Relative frequency (%)
Acute abdomen	4	0.9
Brain abscess	1	0.2
Metabolic acidosis	1	0.2
Anencephaly	1	0.2
Dissecting aortic aneurysm	7	1.5
Ruptured aortic aneurysm	7	1.5
Pulmonary atelectasis	1	0.2
Hemorrhagic stroke	12	2.6
Bronchoaspiration	3	0.6
Bronchodysplasia	1	0.2
Bronchopneumonia	45	9.7
Infected bronchiectasis	1	0.2
Bronchiolitis	1	0.2
Carcinomatosis	1	0.2
Dilated cardiomyopathy	6	1.3
Hypertrophic cardiomyopathy	1	0.2
Ischemic heart disease	12	2.6
Biliary cirrhosis	1	0.2
Hepatic cirrhosis	5	1.1
Diffuse alveolar damage	4	0.9
Hyaline membrane disease	2	0.4
Chronic obstructive pulmonary disease	4	0.9
Acute pulmonary edema	44	9.5
Brain edema	7	1.5
Tuberculoid encephalitis	1	0.2
H1N1 infection	1	0.2
Hemoperitoneum	1	0.2
Upper GI bleeding	11	2.4
Hydrocephalus	1	0.2
Intracranial hypertension	2	0.4
Pulmonary hypoplasia	1	0.2
Acute myocardial infarction	150	32.3
Pulmonary infarction	1	0.2
Influenza A	1	0.2
Heart failure	3	0.6
Liver failure	3	0.6
Respiratory failure	2	0.4
Mesenteric ischemia	5	1.1
Leptospirosis	1	0.2
Lymphoma	1	0.2
Meningitis	1	0.2
Hepatic necrosis	3	0.6
Pulmonary malignant	1	0.2

neoplasm		
Hemorrhagic pancreatitis	1	0.2
Necrotizing papillitis	1	0.2
Pericarditis	1	0.2
Acute peritonitis	3	0.6
Pneumonia	9	1.9
Sepsis	37	8.0
Cardiac tamponade	4	0.9
Pulmonary thromboembolism	47	10.1
Total	465	100

Table 6. Frequencies of autopsy diagnoses per organ system.

Organ system	Frequency observed	Relative frequency (%)
Cardiac	208	44.7
Digestive	37	8.0
Endocrine	2	0.4
Infectious	64	13.8
Lymphatic	1	0.2
Neurological	25	5.4
Respiratory	113	24.3
Vascular	15	3.2
Total	465	100

Table 7. Joint organ system diagnosis distribution.

Clinical diagnosis	Diagnosis on autopsy								
	Cardiac	Digestive	Endocrine	Infectious	Lymphatic	Neurological	Respiratory	Vascular	Total
Cardiac	157	3	0	0	0	2	14	8	184
Digestive	5	25	0	0	0	0	6	0	36
Endocrine	1	1	2	0	0	0	2	0	6
Infectious	10	3	0	63	0	0	12	0	88
Lymphatic	0	0	0	0	1	0	0	0	1
Neurological	12	0	0	0	0	17	8	3	40
Respiratory	18	4	0	1	0	5	68	2	98
Urinary	1	1	0	0	0	0	0	0	2
Vascular	4	0	0	0	0	1	3	2	10
Total	208	37	2	64	1	25	113	15	465

Table 8. Discrepancy frequencies in the explanatory variables with the exception of organ system are not significant ($p > 0.132$).

Discrepancy	Frequency observed	Relative frequency (%)
No	334	72
Yes	131	28
Total	465	100

Table 9. Discrepancy odds and confidence intervals with a confidence coefficient of approximately 95%.

Diagnosis-related system	Odds of discrepancy	Confidence interval (95%)	
		Lower limit	Upper limit
Cardiac	0.172	0.114	0.259
Infectious	0.443	0.281	0.696
Respiratory	0.463	0.289	0.708
Digestive	0.500	0.250	1.000
Neurological	1.500	0.797	2.824
Endocrine	2.000	0.366	10.920
Vascular	2.333	0.114	9.025

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Running title: Discrepancy between clinical and autopsy diagnosis

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The authorship contribution for the present article occurred as follow:

- Talita Zerbini: Conception and design of the work, data collection and draft of the article;
- Julio Singer: Responsible for the data analysis;
- Vilma Leyton: draft of the article.

Conflict of interest

The authors have no conflicts of interest to declare.

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