

A comparison of the provisional clinical diagnosis of death with autopsy findings

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Abstract: Autopsy rates have been in decline for the last half of the century. On the other hand, advanced technology does not seem to have reduced clinical errors. Autopsy retains a role in the evaluation of clinical practice, but its value is under consideration. The aim of the study was to determine the rates of disparity between clinical diagnosis and autopsy findings.

Key Words: autopsy findings; clinical diagnosis of death; postmortem; clinical accuracy; hospital; cause of death

The word “autopsy” is from Greek (meaning to see oneself) and has come to refer to the systematic examination of a dead person for medical, legal and/or scientific purposes [1].

Two basic types of autopsy exist: the clinical autopsy and the forensic or medicolegal autopsy.

The first is performed at the request of the family of the deceased in order to provide correlations between clinical diagnosis and symptoms, determining the effectiveness of treatment, evaluating the course and the duration of the disorder processes and educating the medical personnel [2, 3]. The second is performed when the cause of death is not certain, usually in the case of unexplained, unexpected or unnatural deaths [3]. A medicolegal autopsy investigation can take place only after issuance of a pertinent order by the investigative authorities (prosecutor, police and investigative judge) [4].

Clinical autopsy rates have been in decrease for the last half of the century. The autopsy rates in American and European hospitals have been progressively declining, from approximately 60% in the 1960s to 10% or less today [5, 6]. Over the years many reasons have been cited for the autopsy rates' decrease including: a) the increased clinical confidence in ante-mortem diagnosis, resulting in fewer autopsies being requested; b) the public opposition to the dissection and examination of human body postmortem, possibly affected by the atrocious performance of autopsy in films; c) the technological evolution in diagnostic methods rendering the validity of postmortem examination controversial; d) economic reasons, as the autopsy not only costs but also it is not reimbursable; e) the perception that it is a “time-consuming chore”; f) legal reasons, such as the fear of revealing medical mistakes subjected to litigation, and finally g) the resistance in the credibility of the autopsy-based research [7, 8].

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Autopsy is a valuable tool in the discovery and description of new disorders and significantly aids in the evaluation of new methods in the surgical and diagnostic field, implantable devices and drugs [9-12].

Furthermore, autopsy records have direct access to tissue archives appropriate for research in numerous scientific areas, such as classical morphological studies, immunohistochemistry, medical genetics and toxicology [13-15]. Last but not least, postmortem studies may uncover the ways via which the environment affects the diseases [16].

Recent studies have stressed the role of autopsy in the audit of medical care in hospitals [12, 17-22]. Autopsy gives the clinician and the pathologist the opportunity to compare and correlate antemortem clinical findings with morphology presented postmortem. Educationally speaking, the clinicians via autopsy may affirm their medical choices that led them to a correct diagnosis and identify the false path through which were directed in a wrong one [23].

The aim of this study was to determine the extent of agreement or disagreement between the provisional clinical diagnosis and autopsy findings in a series of deaths occurring in hospital.

Methods

This retrospective study examined data from consecutive autopsies performed in the Department of Forensic Medicine and Toxicology, University of Ioannina, Greece, over the 13-year period from January 1998 to December 2010. The department performs medicolegal autopsies on deaths occurring at the local general hospitals in the region of Epirus, including the multidisciplinary teaching hospital attached to the Faculty of Medical School of the University of Ioannina. Epirus consists of four prefectures, each one of which is covered by a local general hospital respectively, and its total population was 353,820 inhabitants in 2001 (almost 3.1% of the total population of Greece) [24]. The stability of its population renders Epirus an appropriate area for epidemiological studies.

We recorded the age, gender, duration of admission and clinical and autopsy diagnoses for each patient. Provisional clinical diagnoses were defined as those listed by the clinician on the autopsy request form. Diagnoses were classified according to organ system. Deaths caused by trauma, other unnatural causes or iatrogenic complications were excluded from the study. Individuals younger than 15 years of age were also excluded. All autopsies were complete and were performed according to the same protocol, including relevant histological and toxicological evaluation. Autopsy diagnoses were those listed on the final report.

We classified the cases into six groups according to the level of agreement between clinical and postmortem diagnoses: (I) death upon arrival at the emergency department; (II) total agreement between clinical and postmortem diagnosis; (III) partial agreement between clinical and postmortem diagnosis (a generally correct but non-specific provisional diagnosis, e.g. cardiac disease for hypertrophic cardiomyopathy); (IV) total disagreement between clinical and autopsy diagnosis; (V) more than two diagnoses suggested by the clinicians; and (VI) cause of death not suggested by the clinicians.

Results were statistically analyzed using SPSS for Windows (version 15) and $p < 0.05$ was considered significant.

Results

During the study period, 448 deaths, that met the inclusion criteria, occurred at the general hospitals of the region of Epirus and underwent autopsy. There were 289 (64.5%) men and 159 (35.5%) women. Age ranged from 15 to 97 years (mean 63.7 ± 15.5 years) (Figure 1). Out of the total, 171 (38.1%) individuals (122 male, 49 female; age range 15 to 97 years) were pronounced dead in the Emergency Department (ED) with no evidence of pulse activity on arrival.

The rest of 277 individuals (168 men, 109 women, male/female ratio 1.54; age range 20 to 93, mean 64.7 ± 15.4 years) were hospitalized. Among them, 152 (54.9%) survived less than 24 hours and 125 (45.1%) at least 24 hours after admission. In 51 cases (18.4%) there was a total agreement between autopsy findings and clinical diagnosis. In 32 cases (11.6%) postmortem diagnosis was in partial agreement with the suggested clinical one. Fifty-one cases (18.4%) showed total disagreement between clinical diagnosis and postmortem findings.

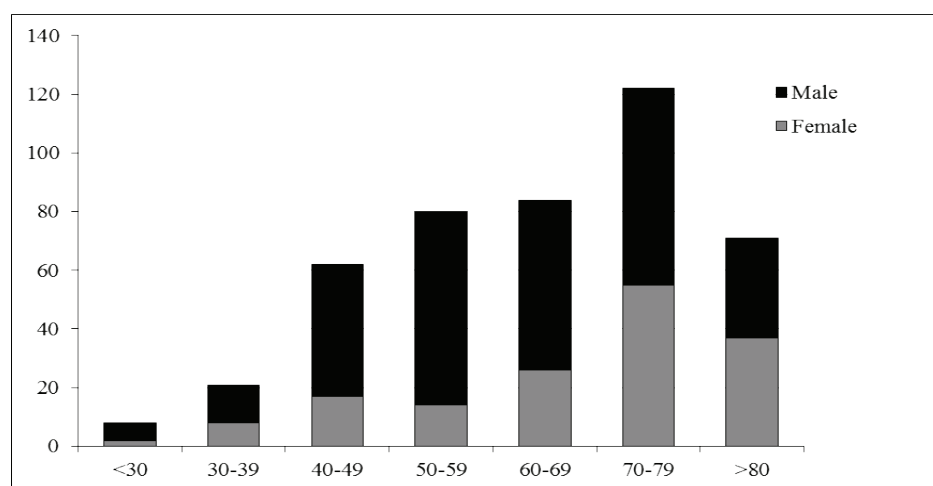


Figure 1. Age distribution in the total population of the study (n=448)

Table 1. Classification of the 227 cases hospitalized, according to the level of agreement between provisional and postmortem diagnoses

Groups	Cases (%)
Total agreement	51 (18.4%)
Partial agreement	32 (11.6%)
Total disagreement	51 (18.4%)
More than two diagnoses	23 (8.3%)
No clinical diagnosis proposed	120 (43.3%)
Total	277

and cardiomyopathies (5.3%).

Among the 277 cases that were hospitalized, the causes of death that appeared most commonly were cardiovascular diseases (188 cases, 67.9%), respiratory infections (26 cases, 9.4%) and gastrointestinal diseases (26 cases, 9.4%). Among all cases of cardiovascular diseases, myocardial infarction was the most frequent postmortem diagnosis (35%), followed by pulmonary embolism (18.4%) and rupture of aortic aneurysm (5.4%).

Regarding myocardial infarction, in 15.5 % of the cases postmortem findings completely agreed with the diagnosis suggested by the clinicians, in 18.6% they totally disagreed, whereas in the 45.4% of the cases there was no clinical diagnosis proposed. In the total disagreement cases (18 cases), clinicians diagnosed multisystemic insufficiency, pulmonary embolism, rupture of aortic aneurysm, lobular pneumonia and cerebral stroke.

Pulmonary embolism was diagnosed postmortem in 51 (18.4%) cases. Total agreement with the provisional diagnosis was observed in 8 (15.7%) cases, complete disagreement in 11 (21.6%) cases and in 27 cases (52.9%) no clinical diagnosis was suggested. Clinicians diagnosed myocardial infarction, respiratory infection, stroke and intestinal ischemia in the cases of total disagreement.

Among the cases where autopsy diagnosis was respiratory infection (26 cases), in 50% no clinical diagnosis was established, whereas in 19% there was total disagreement between autopsy and antemortem diagnosis and in 15% postmortem diagnosis completely agreed with the provisional one. In disagreement cases, clinicians suggested sepsis, myocarditis and pulmonary embolism as possible diagnoses.

Gastrointestinal diseases were diagnosed in 26 cases, including intestinal ischemia (10 cases), gastric hemorrhage (13 cases) and pancreatitis (3 cases). In 7 cases (26.9%) there was total agreement between clinical and autopsy diagnosis, in 4 cases there was complete disagreement (15.4%) and in 9 cases (34.6%) there was no suggested clinical diagnosis. The discordant cases concerned mainly intestinal ischemia (3 out of 4 cases) and the proposed diagnoses in that occasions were myocardial infarction, cerebral stroke, sepsis and pulmonary embolism, respectively.

In 23 (8.3%) cases more than two diagnoses were presumed by the clinicians. Finally, in 120 cases (43.3%) no provisional diagnosis was proposed by the clinicians (Table 1). Among all cases of total disagreement between clinical and autopsy diagnosis, the majority (68.6%) concerned cardiovascular diseases, followed by the figure of 9.4% concerning respiratory infections.

Gender, age or length of hospitalization did not show statistically significant correlation with the occurrence of total disagreement between postmortem and clinical diagnosis ($p=0.466$, $p=0.548$ and $p=0.521$, respectively).

The most common causes of death among individuals that died upon arrival at the ED were ischemic heart disease (72.4%), pulmonary embolism (7.6%)

Among cases of neoplastic disease (16 cases, 5.8%), newly diagnosed malignant tumors were revealed at autopsy in 3 cases (18.3 %), where carcinoma of the pancreas (2 cases) and lung tumor (1 case) were uncovered.

The most common diagnosis introduced by the clinicians was sepsis in 26.5% of the cases where a diagnosis was made. Clinicians established the correct diagnosis in 10% of those cases, whereas in the majority (66.7%) were completely discordant. Among the cases of the latter group, autopsy revealed most frequently myocardial infarction (23.3%) and pulmonary embolism (16.7%).

Discussion

The overall rate of disagreement between clinical diagnosis and postmortem findings in our study was 18.4%. The rate of concordance was low, barely touching 18.4%. A previous study in Greece showed a similar disparity rate of 18% and a higher rate of concordance (29%) [25]. Recent studies reported a diagnosis disagreement of 17.2% and 48.4%, respectively [26]. A systematic analysis that reviewed 45 studies reporting 53 autopsy series published during a 40-year period, showed a median error rate of 23.5% (ranging from 4.1% to 49.8%) [27]. Published studies on discrepancies between clinical and autopsy diagnoses have used a wide spectrum of categorization systems in order to classify and “measure” the diagnostic accuracy, thus making the comparison of the disparity rates rather difficult. Age of individuals, length of assistance, autopsy rates and location of death represent some additional factors that complicate further the evaluation of disagreement rates among different studies [8, 28-33]. Although an impressive evolution in diagnostic technology has been noted, the discrepancy rate between clinical and postmortem diagnosis has not declined over the last three decades [34, 35]. Possible explanation for this paradox may well lie in the overestimation of the technological equipment and the underestimation of the traditional clinical methods, e.g. medical history and laboratory profile [36]. The selection of cases for postmortem examination in which physicians are uncertain about the diagnosis may also shed light to the persistently elevated rates of clinical errors.

Undoubtedly, autopsy rate affect different studies and the reported discrepancy rates. In a recent long-period systematic review it has been reported that major errors decreased over time at a rate of 14.4% for every 10% increase in autopsy rates [27]. Over the last decades there has been a significant decline in the number of autopsies performed in patients dying in hospitals. In the United States is estimated that autopsy rates have presented a rapidly progressive decrease [37], as well as in France and UK [38, 39]. In Greece, the rate of autopsy is currently low and along with the phenomenon of sampling in the number of autopsies performed in hospital-deaths, makes the true rate of clinical misdiagnosis indefinable.

The “death upon arrival” cases in our study represent a special group in which the value of autopsy is unambiguous. That group stands for the 38.1% of the cases dying in the local hospitals. In those cases no specific data about previous medical history or the circumstances leading to death was known and no time for clinical evaluation was available.

We observed no statistically significant relationship between the length of hospitalization and the disparity rate, although it is difficult for the clinicians to correctly diagnose patients who died within a short time interval from arrival at hospital. Our finding is in accordance with some previous reports [17, 25, 40, 41], whereas others quote an increased rate of disagreement in relation either to the decreased duration of assistance [32] or to the increased duration of hospitalization [8, 30, 31]. In the latter case the high frequency of acquired and overlooked infections as well as the diverted priority to other patients may play a role [42].

Increasing age has been reported to affect negatively the diagnostic accuracy [17, 23] and the atypical disease presentation along with the fact that the elderly usually suffer from multiorgan diseases may explain that influence. A previous report showed that the rate of misdiagnosis at autopsy was high in adults younger than 40 and in those older than 65 years old [8]. However, the present study showed no significant correlation between discrepancy rate and ongoing age, partially because of the relative homogeneity in our population. Of the individuals we studied, 66.5% were over 65 years of age and only the 7.6% was under 40.

Interestingly, in our study there was a significantly high representation of the cases where no clinical diagnosis was proposed by the clinicians (43.3%). Previous studies have reported respective figures of 8.2% [9] and 42% [25]. This category reflects the absence of confidence of physicians in the accuracy and

the appropriate interpretation of their findings. Probably the lack of time in some instances and the diverted attention to more urgent cases may be factors explaining that result [43].

Our data indicate that the most frequently missed diagnosis was pulmonary embolism (74.5%), a finding that is consistent with other reports showing rates of disagreement ranging from 46.8% to 93% [5, 8, 17, 25, 31, 34, 44]. Pulmonary embolism remains an entity frequently missed in spite of the improved diagnostic technology. Its difficulty in detection may probably lie on the suddenness of appearance in the context of a low index of suspicion and the absence of sensitive and fast diagnostic tools [45, 46]. The degree of clinical accuracy regarding respiratory infections quoted in the literature varies widely.

Some authors [47] report 16% discordance rate for pneumonia whereas others [9] show that in 67.5% pneumonia was overlooked. In our study, 69% of the respiratory infections were missed. The clinical signs and symptoms in cases of such infections are usually masked by other critical conditions.

Respiratory infections frequently emerge at a second time as a complication of another main disorder, thus making their diagnosis problematic [9]. In a considerably high percentage (64%) myocardial infarction was missed. That finding is considerably high in comparison with previous studies showing figures of 17-24% [9,36] for myocardial infarction but lower than the high rate of 84% in a Greek study [25]. Those differences may be attributed to the variety and the extent of usage of the enhanced diagnostic options in various institutions.

In the present study, a neoplasia was newly diagnosed in 18.3% of the cases. Respective percentages of 27-42% [5, 25, 48, 49] have been described previously. Recently, a figure of only 4% [50] of previously undetected tumors has been reported. Obviously, the evolution in diagnostic imaging and the accuracy in laboratory markers have improved the detection of carcinomas.

Our data showed that among clinical diagnoses proposed by the clinicians, sepsis was the most commonly encountered, in 26.5%. In only 10% of those cases autopsy confirmed the diagnosis. In the rest, most individuals were found to have died from myocardial infarction and pulmonary embolism. The long duration of assistance in some cases along with the possibility of the patient acquiring an opportunistic infection and the clinical diagnosis of congestive heart failure may mask other entities and mislead the clinicians regarding the final diagnosis [44].

Among 4 cases of intestinal ischemia the 3 were missed by the clinicians. The symptomatology of intestinal ischemia is rather atypical, especially in older individuals who have a different tolerance and perception of pain, and the disease itself lacks specific signs [51]. Thus, it may be easily mistaken for other disease, such as myocardial infarction or sepsis, as occurred in the present study.

Conclusions

The present study showed low rate of total agreement and relatively high rate of discrepancy between provisional diagnoses and autopsy findings, respectively. Therefore, our retrospective study supports previous statements regarding autopsy's utility, underlining its importance in evaluating the clinical accuracy. Even if the steady decline in autopsy rates lead to a significant bias in estimating the true discrepancy rates, autopsy remains an effective tool for the detection of clinicopathologic correlations [5]. Postmortem investigation is valuable for returning the lessons learned at bedside [52]. Via autopsy the clinicians can review both the correct and false decisions they made through the clinical practice. We believe that postmortem studies are still very valuable for the audit of the clinical work. That does not mean that the knowledge of the misdiagnoses will affect the prognosis or the patients' mortality. Nevertheless, autopsy continues to represent an "educational tool in clinicians' hands" and play a role in the evaluation of the quality of medical service.

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