

## CAUSES AND CHARACTERISTICS OF DIAGNOSIS DISCREPANCIES IN BRAIN INJURIES AND OTHER MECHANICAL TRAUMAS

Anatolii Bondarev\*, Andrei Pădure, Eduard Lungu, Petru Glavan

“Nicolae Testemitsanu” State University of Medicine and Pharmacy, Chisinau, Republic of Moldova

**Abstract:** The diagnostic process entails the accurate identification of diseases and traumas present in a patient and remains a paramount responsibility of the physician. The quality and correctness of the diagnosis depends not only on comprehensive investigations and symptom presence but also on the clinician's expertise in interpreting the clinical data, contextualizing findings, and objectively evaluating them. The current study is a focused retrospective analysis. A total number of 152 medico-legal records associated with died in hospitals patients, coupled with their medical records spanning 5 years (2009–2013), were critically reviewed. All post-mortem examinations were conducted at the regional divisions of the Center of Forensic Medicine from the Republic of Moldova. The study aimed to assess causes and occurrence conditions of discrepancies between clinical and medico-legal diagnoses in brain injuries and other mechanical traumas. Diagnosis discrepancies were influenced mostly by subjective causes than by objective ones. Among the objective causes, the most common were severe state of the patient, short in-hospital stay and the presence of atypical clinical symptoms or conditions that masked typical symptoms. The most frequently identified subjective causes were: underestimation of results from instrumental examinations; underestimation of clinical examination; over- and underestimation of patient's history. Brain injury is often under-diagnosed being combined with drunkenness as masking condition.

**Keywords:** clinical diagnosis, medico-legal diagnosis, medical care quality, discrepancy, subjective causes, objective causes, brain injury.

### INTRODUCTION

The diagnostic process entails the accurate identification of diseases and traumas present in a patient and remains a paramount responsibility of the physician. This is because the ensuing therapeutic approach is intrinsically linked to the precision of the diagnosis. As asserted by G.V. Siciugov *et al.* (2016), the clinical diagnosis represents the physician's perspective on the patient's disease or trauma. The physician's aptitude in arriving at accurate conclusions is contingent on their logical and gnoseological prowess, their capacity to meticulously analyze each symptom or investigative result, and to cohesively synthesize these findings to infer the nature of the pathological process, potential complications, and the prognosis [1, 2]. It's obvious that the quality and correctness of the diagnosis depends not only on comprehensive investigations and symptom presence but also on the

clinician's expertise in interpreting the clinical data, contextualizing findings, and objectively evaluating them. This underscores the quintessence of clinical thinking, a skill nurtured from early academic years.

Data from A. Pădure *et al.* (2011, 2022), indicate that shortcomings in clinical diagnostic processes were observed in  $55.17 \pm 7.18\%$  of cases. At the same time, nosological entities tend to be under-diagnosed more often than they are over-diagnosed [1, 3, 4]. Crucially, discerning the root causes of these diagnostic discrepancies is vital. Recognizing the underlying factors of a multifaceted problem enhances the likelihood of circumventing its recurrence.

### MATERIAL AND METHOD

The current study is a focused retrospective analysis. A total number of 152 medico-legal records associated with died in hospitals patients, coupled with

\*Correspondence to: Anatolii Bondarev, “Nicolae Testemitsanu” State University of Medicine and Pharmacy, Chisinau, Republic of Moldova, E-mail: anatolii.bondarev@usmf.md

their medical records spanning 5 years (2009–2013), were critically reviewed. Main inclusion criterium was discrepancy between clinical diagnosis and medico-legal one. At the same time, we included in the sample only cases that presented mechanical injuries in the medico-legal diagnosis (ex.: brain injury, chest injury, associated traumas etc.). All post-mortem examinations were conducted at the regional divisions of the Center of Forensic Medicine from the Republic of Moldova. For a comprehensive representation, the sample comprised death instances from hospitals across all tiers. In each case, not only one main cause, but all possible causes of the discrepancy were highlighted.

### PURPOSE

The study aimed to assess causes and occurrence conditions of discrepancies between clinical and medico-legal diagnoses in brain injuries and other mechanical traumas.

### RESULTS AND DISCUSSION

In the study sample, both objective and subjective causes were revealed, with notable diversity within each category. As indicated in Tables 1 and 2, subjective causes of discrepancies were more prevalent than objective ones. However, the significance of objective causes, despite their lower frequency, remains noteworthy.

The objective causes (Table 1) of discrepancies and, respectively, misdiagnosis are determined by a set of circumstances and factors, which do not depend on the physician's actions, inactions or capabilities, but are individual characteristics of the patient and the nosology. In the study sample there was a non-homogeneity in the frequency of different objective causes. The most frequent diagnostic difficulties were related to the serious state of the patient:  $41.45 \pm 6.21$  (95%, CI 31.85-53.03,  $p < 0.001$ ). We consider this observation to be explainable: mechanical trauma often causes changes of vital indices and, for this reason, generates aggravation of the patient's general condition.

In the same context, the second most frequent cause of discrepancy was the short in-hospital period:  $26.32 \pm 6.96$  (95% CI 18.8-35.83,  $p < 0.001$ ). Usually, this indicator is directly related to the patient's condition: death occurs in a short time (up to 72 hours), which determines the lack of time for the physician to make the clinical diagnosis.

Almost the same frequency was observed for such factors as atypical symptoms and masking conditions:  $25.00 \pm 7.02$  (95%, CI 17.69-34.31,  $p < 0.001$ ). In mechanical trauma, which is mainly a part of associated trauma, when clinical symptoms overlap, it is very difficult for the physician to establish the totality of diagnoses in the same patient, even if he does not suffer from pre-existing diseases. The situation becomes even more complicated in cases where the patient suffers from concomitant diseases, is in a state of alcoholic or narcotic intoxication. Brain injury is often under-diagnosed due to this background: in the study sample, atypical symptoms and masking conditions are the second most common cause of discrepancies in brain injury, and the short in-hospital period is the third most common. Chest trauma is frequently confused with specific and non-specific inflammatory processes of lung tissue or acute myocardial ischemic processes.

Situations of poor manifestation of the disease or trauma and rare nosologies had a lower frequency, being at the limit of statistical significance:  $15.13 \pm 7.47$  (95%, CI 9.59-22.7,  $p < 0.001$ ). It is well known that some traumas, e.g. head trauma with gradual formation of intracranial haematoma or abdominal traumas with subcapsular ruptures of the spleen, have a "lucid" period, when the lesional symptomatology is reduced or even absent. However, misdiagnosis due to this reason is not rare, with a 73.91% share in this group of factors. Rare nosology [5, 6] was recorded rather as an exception, only in 26.09% of cases. The last objective cause, which has a statistically insignificant frequency, is the lack of diagnostic conditions  $5.26 \pm 7.89$  (95%, CI 2.27-10.37,  $p < 0.001$ ) such as, for example, the lack of advanced diagnostic imaging methods in regional hospitals.

Whichever of the objective causes separately can have a decisive role in the patient's prognosis, but

**Table 1.** Frequency of objective causes for diagnosis discrepancies

| No. | Objective causes                       | Frequency |       | CI 95%      | p           |
|-----|--|-----------|-------|-------------|-------------|
|     |  | Abs.      | P     |             |             |
| 1.  | Severe state of the patient            | 63        | 41.45 | 31.85–53.03 | $p < 0.001$ |
| 2.  | Short in-hospital period               | 40        | 26.32 | 18.8–35.83  | $p < 0.001$ |
| 3.  | Atypical symptoms / Masking conditions | 38        | 25.00 | 17.69–34.31 | $p < 0.001$ |
| 4.  | Poor manifestation / Rare nosology     | 23        | 15.13 | 9.59–22.7   | $p < 0.001$ |
| 5.  | Lack of diagnostic conditions          | 8         | 5.26  | 2.27–10.37  | $p > 0.001$ |

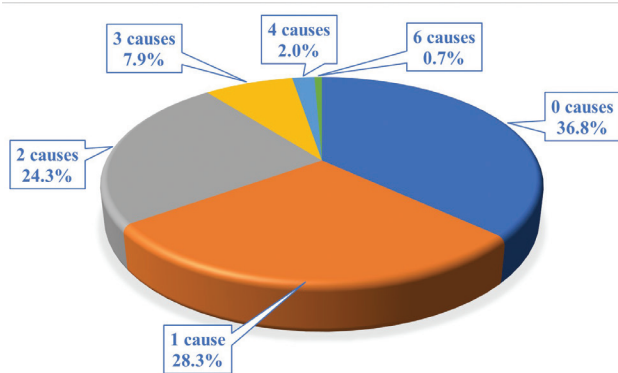
it is obvious that the probability of a lethal outcome increases proportionally with the combination of two or more causes.

Figure 1 is representative in this regard, illustrating that the share of divergences generated by just one objective cause is 28.3%, while all multi-causal divergences together constituted 34.9%. It is to highlight that the absolute majority of the multi-causal discrepancies are represented by bi-causal ones. At the same time, discrepancies due to objective reasons were not found in more than a third of cases (36.8%), indicating the exclusive role of subjective causes. Thus, the greatest danger of clinical misdiagnosis occurs when several objective causes overlap.

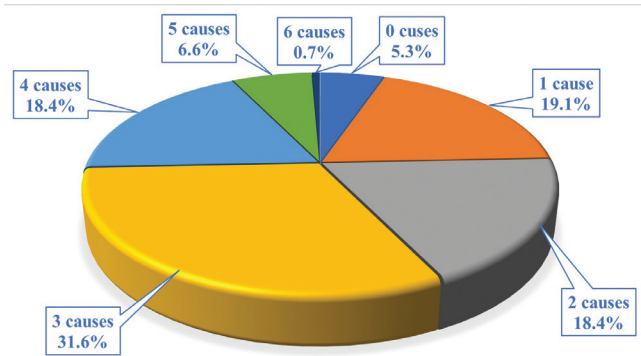
Subjective causes, influenced by physicians, primarily stem from their ability to effectively apply theoretical knowledge and practical experience. Unlike objective causes, these are directly under the physician's purview and should ideally be averted. Their presence often indicates shortcomings in the medical care. Each step in collecting patient data can be advantageous when interpreted correctly or, conversely, can lead to diagnostic discrepancies. Given their significance, we thoroughly analyzed all potential subjective causes within the study sample, aligned with the chronological sequence of clinical actions (Table 2).

The initial phase of a physician's interaction with a patient centers around gathering the medical history. Such pivotal data can be subject to both underestimation and overestimation. In our study sample, the frequency of anamnesis underestimation was  $25.00 \pm 7.02$  (95%, CI 17.69-34.31,  $p < 0.001$ ), while overestimation occurred at  $27.63 \pm 6.90$  (95%, CI 19.91-37.35,  $p < 0.001$ ). Both scenarios pose challenges for accurate diagnosis. Neglecting the anamnesis, especially in cases of mechanical trauma, can deprive clinicians of crucial information that could hint at the injury mechanism and potential lesion location. Conversely, placing undue emphasis on the anamnesis might mislead the clinician, resulting in misdirection and squandered time differentiating non-existent nosological entities.

After collecting the anamnestic data, the physician proceeds to the clinical examination of the patient, the underestimation of its results may also lead to discrepancies between diagnoses. In the study sample, this cause included situations of insufficient examination and inadequate interpretation of the information obtained. The considerable frequency of under- or overestimation of the physical examination  $45.39 \pm 5.99$  (95%, CI 35.32-57.45,  $p < 0.001$ ) was noticed, ranking second after underestimation of instrumental



**Figure 1.** Structure of diagnosis discrepancies according to the association of objective causes.



**Figure 2.** Structure of diagnosis discrepancies according to the association of subjective causes.

**Table 2.** Frequency of subjective causes for diagnosis discrepancies

| No. | Subjective causes                        | Frequency |       | CI 95%      | P           |
|-----|--|-----------|-------|-------------|-------------|
|     |  | Abs.      | P     |             |             |
| 1.  | Anamnesis underestimation                | 38        | 25.00 | 17.69–34.31 | $p < 0.001$ |
| 2.  | Anamnesis overestimation                 | 42        | 27.63 | 19.91–37.35 | $p < 0.001$ |
| 3.  | Physical examination underestimation     | 69        | 45.39 | 35.32–57.45 | $p < 0.001$ |
| 4.  | Laboratory data under- or overestimation | 29        | 19.08 | 12.78–27.4  | $p < 0.001$ |
| 5.  | Instrumental data underestimation        | 80        | 52.63 | 41.73–65.5  | $p < 0.001$ |
| 6.  | Instrumental data overestimation         | 36        | 23.68 | 16.59–32.79 | $p < 0.001$ |
| 7.  | Consultant conclusion underestimation    | 25        | 16.45 | 10.64–24.28 | $p < 0.001$ |
| 8.  | Consultant conclusion overestimation     | 34        | 22.37 | 15.49–31.26 | $p < 0.001$ |
| 9.  | Incorrect expression of the diagnosis    | 41        | 26.97 | 19.36–36.59 | $p < 0.001$ |

data. It should be mentioned that this major deficiency represents an artificial narrowing of the doctor's view, which leads to a reduced chance of a correct clinical diagnosis making. At the same time, from the legal point of view, insufficient examination of the patient is interpreted as a violation of the rules and methods of medical care [1].

In the group of subjective causes related to paraclinical investigations, one of the lowest frequencies has been recorded in cases of discrepancies due to under- or overestimation of laboratory data  $19.08 \pm 7.30$  (95%, CI 12.78-27.4,  $p < 0.001$ ). A higher, but still comparable, frequency was established in cases of overestimation of instrumental data -  $23.68 \pm 7.09$  (95%, CI 16.59-32.79,  $p < 0.001$ ). The highest frequency, and not only in the mentioned group, but also in the whole study sample, was in cases of underestimation of instrumental data -  $52.63 \pm 5.58$  (95%, CI 41.73-65.5,  $p < 0.001$ )! It is to underline that causes of underestimation of paraclinical investigations included such faults as omission, performing in smaller volume than necessary, as well as not including in the clinical diagnosis some nosologies established as a result of the mentioned findings but morphologically confirmed. In the category of overestimation were included all situations where the nosology, being suggested by paraclinical investigations, was included by the physician in the diagnosis, but was not confirmed by autopsy data nor cross-checked by data from other investigations or consultations. The frequency pattern is explained by the peculiarities of mechanical trauma diagnosis: laboratory data are usually more useful for diagnosing complications than the trauma itself, i.e. they have a low but statistically significant frequency in the study group. Instrumental investigations, especially imaging, are of choice for trauma assessment, for which reason it is difficult to overestimate them, which

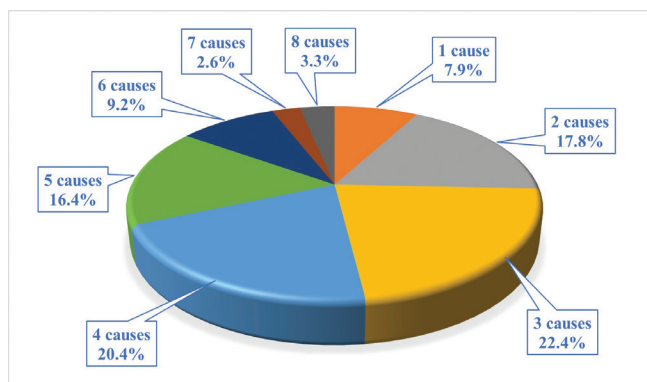
explains the similar frequency.

It is natural that underestimating the consultant's conclusions by omitting or neglecting them, as well as overestimating by automatically placing the consultant's intermediate diagnosis in the definitive one without any critical evaluation, affects the correctness of the clinical diagnosis. Both situations can generate discrepancies. In the study sample, the frequency of underestimation is the lowest  $16.45 \pm 7.41$  (95%, CI 10.64-24.28,  $p < 0.001$ ) of all subjective causes and then that of overestimation  $22.37 \pm 7.15$  (95%, CI 15.49-31.26,  $p < 0.001$ ) too. In our opinion, the consequences of consultant conclusion underestimating may be more serious, because a pathology or trauma diagnosed by the consultant but not taken into account by the physician will lead to the lack of treatment, while the overestimated one will cause some additional investigations and interventions, which will not, however, considerably affect the patient's condition.

The last subjective cause analysed is the incorrect expression of the diagnosis. This is the most "harmless" discrepancy for the patient, as it reflects only the physicians' knowledge of diagnosis making principles and their ability to group nosologies according to diagnostic compartments. This type of discrepancy affects neither curative tactics nor the quality of treatment, but it is nevertheless classified as a category II discrepancy, since unstructured, incorrectly expressed diagnoses cannot be compared, coded and statistically processed. In the study group, the frequency of incorrectly expressed diagnoses was  $26.97 \pm 6.93$  (95% CI 19.36-36.59,  $p < 0.001$ ).

The structure of subjective causes analysis, as well as that of objective ones, reflects generation of discrepancies by the association of up to 6 causes, but the proportion of each cause is different (Figure 2). Most discrepancies were due to the association of three subjective causes - 31.6%. The combination of two and four subjective causes had the same weight of 18.4%. Policausal mismatches with five or six objective causes were identified much less frequently - in 6.6% and 0.7% of cases respectively. By summing up the weights presented we can see that the absolute majority of discrepancies occur due to a combination of several causes - 75.6%. Only in 19.1% of cases just one subjective cause was found, and in 5.3% - none, which indicates discrepancies due to exclusively objective reasons.

The comparative analysis with the structure of discrepancies in objective causes (Fig. 1), revealed the following: the share of single-cause non-concurrences is lower by almost one third and constitutes 19.1%



**Figure 3.** Structure of diagnosis discrepancies according to the association of objective and subjective causes.

in subjective cases vs. 28.3% in objective cases; the discrepancies due to exclusively objective reasons are only 5.3%, i.e. almost 7 times less than those due exclusively to subjective reasons (36.8%); the most significant share belongs to discrepancies due to three subjective causes (31.6%), while the majority of discrepancies due to objective reasons were single-cause (28.3%); two-cause discrepancies had a comparable share (18.4%) to the similar share of objective causes (24.3%); the share of discrepancies based on 4 subjective causes (2%) is 9 times higher than that of 4 objective causes (18.4%). At the same time, the share of discrepancies due to 6 subjective causes is equal to the similar share of the objective group, being 0.7%. Thus, by comparative analysis, we can conclude that the objective reasons are not so diverse, they occur less frequently, in the structure of discrepancies there are mostly mono-, bi- and non-objective causes. At the same time, in case of subjective reasons, bi-, tri- and quadra- causal predominate.

Due to the fact that a separate analysis of subjective and objective causes of discrepancies has shown that they are predominantly associated within each group, we have hypothesized that causes from both groups could be associated too. According to Figure 3, compared to Figures 1 and 2, discrepancies were based on an association of up to 8 causes, which is a higher number than the maximum number of causes in each group (subjective - 6, objective - 6). This observation confirms the hypothesis on the subjective and objective multi-causal origin of discrepancies in the whole sample. Thus, the share of single-cause discrepancies was very small: 7.9% only. The analysis of multi-causal discrepancies showed that the largest share belonged to the tricausal - 22.4% and quadrausal - 20.4%, and the share of bicausal discrepancies - 17.8% was almost similar to that of the quincasual - 16.4%. Even discrepancies due to the association of 6 causes occurred more frequently than mono-causal ones, with a share of 9.2%! Much more rarely were recorded the mismatches generated by 7 and 8 causes, with a share of 2.6% and 3.3% respectively.

**In conclusion,** diagnosis discrepancies were influenced mostly by subjective causes than by objective ones. Objective causes can be classified into incidental ones, which encompass patient-related factors and unpredictable events, and institutional causes, which are related to the level of healthcare provision or facilities. Among the objective causes, the most common were severe state of the patient, short in-hospital stay and the presence of atypical clinical symptoms or conditions that masked typical symptoms. The most frequently identified subjective causes were: underestimation of results from instrumental examinations; underestimation of clinical examination; over- and underestimation of patient's history. It was noted that discrepancies arising from multiple causes were more common than those from a single cause. The highest proportion of diagnosis discrepancies arose from a combination of 2, 3, 4, or 5 causes. Brain injury is often under-diagnosed being combined with drunkenness as masking condition.

#### **Conflict of interest**

The authors declare that they have no conflict of interest.

#### **References**

1. Pădure A. Analiza medico-legală a deficiențelor admise în asistența medicală de profil chirurgical (teză de doctor habilitat în medicină). 2011. Romanian.
2. Sychugov GV, Divisenko AS, Shiman IN. Analiz nepravilnoy formulyrovky zakliuchitel'nogo diagnoza. In: Vestnik Severo-Zapadnogo GMU I.I. Mechnikov. 2016; 1 (8): 117-122.
3. Bondarev A, Pădure A, Lungu E. Characteristics of Clinical and Medico-Legal Diagnosis in Cases of Discrepancy. In: Romanian Journal of Legal Medicine. 2022; 4 (30): 264-267.
4. Pădure A, Baciu G, Bondarev A. Diagnostic mistakes in surgery and their impact. In: Folia Societatis Medicinæ Legalis Slovacæ. 2015; 1 (5): 34-38.
5. Sultanov II. O tak nazyvayemyh "redkih zabolevaniiah" v klinike vnutrennyh bolezneyei. In: Vestnik RUDN, seriya Meditsina. 2004; 3 (27): 53-55.
6. Schapkina NB, Sarkisyan BA. Sudebno-meditsynskaia otsenka kachestva okazaniya hirurghicheskoy pomoshy v Kemerovskoy oblasti. In: Aktualnye voprosy sudebnoy meditsyny i ekspertnoy praktiki na sovremenom etape. Moskva. 2006: 298-300.