Aetiology and frequency of coma in Emergency department of the primary healthcare centre

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Abstract:

Background/Aim: Coma is the most severe disturbance of consciousness from which the patient cannot wake up and in which there is no verbal and motor response or opening of the eyes. The aim of the research was to establish the frequency of occurrence of coma and the aetiology of coma in the Banja Luka Emergency Department (ED). Also, the goal was to analyse the accuracy of the referral diagnosis and potential factors that can help the doctor in making a correct diagnosis. **Methods:** A retrospective cross-sectional study was conducted. In the ED database, in the period from January to September 2022, all patients diagnosed with coma have been found. The gender and age of the patient, vital parameters, performed diagnostic methods and therapy were recorded. The referral diagnosis, the department to which the patient was referred, as well as the final diagnosis determined in hospital conditions were recorded. **Results:** In the period from January to September 2022 there were 95 patients who were diagnosed with coma. The average age of the patients was 67.76 ± 16.56 years, there were 56 (58.9 %) men and 39 (41.1 %) women. Of that number, 41 (43.2 %) patients were diagnosed with hypoglycaemic coma and those patients were treated in the field. Out of 54 patients, 32 (59.3 %) patients had a confirmed referral diagnosis, while 22 (40.7 %) patients had another diagnosis established at the hospital. All patients with suspected intracranial bleeding or stroke were correctly diagnosed and adequately referred, while all patients with a confirmed diagnosis of sepsis and shock were incorrectly referred ($ch2 = 30.563$, $p < 0.001$). **Conclusion:** The most frequent were coma caused by hypoglycaemia and coma caused by brain ischaemia and non-traumatic bleeding, which were adequately recognised and treated and/or referred. Coma caused by sepsis and shock of different aetiology was not recognised as such and was referred to a neurologist, where precious time was wasted. In order to reduce errors in the field, it is necessary to pay more attention to the anamnestic data on diseases and perform a somatic and neurological examination adequately.

Keywords: coma; differential diagnosis; prehospital treatment; emergency department

INTRODUCTION

Coma is the most severe disorder of consciousness from which the patient cannot wake up and in which there is no verbal and motor response and opening of the eyes [1]. Coma is an emergency condition that implies the application of clearly defined therapeutic procedures immediately after examining the patient, in order to maintain vital functions and protect the brain from serious or irreversible damage [2].

Numerous structural damages [ischaemic insult or stroke in the upper part of the medulla oblongata, aneurysm rupture and subarachnoid haemorrhage, head trauma (concussion or contusion, epidural or subdural haematoma), hydrocephalus (acute), brain abscess, brain tumour] and global disorders [drugs and toxins (barbiturates, carbon monoxide, ethyl alcohol, methyl alcohol, opioids), hypothermia, infections (meningitis, encephalitis, sepsis), central nervous system vasculitis, metabolic disorders (eg, diabetic ketoacidosis, hepatic coma, hypoglycaemia, hyponatremia, hypoxia, uraemia] of the central nervous system cause coma [3].

According to the different causes of coma itself, several types of coma can be distinguished [4]:

a) Toxic-metabolic encephalopathy. This is an acute state of brain dysfunction with symptoms of confusion and/or delirium or coma. The condition is usually reversible. The causes of toxic-metabolic encephalopathy are different. They include systemic diseases, infections, organ failure and other conditions (eg, hepatic encephalopathy).

b) Persistent vegetative state. This is a state of severe unconsciousness. The person is not aware of his surroundings and is not capable of voluntary movement. With a persistent vegetative state, some patients may progress to wakefulness, but without improvement in higher brain functions. In the persistent vegetative state there are cycles of respiration, circulation and sleep and wakefulness.

c) Medically induced. This type of temporary coma is used to protect the brain from oedema after an injury. The patient receives a controlled dose of anaesthetic, which causes a lack of sensation or consciousness. Doctors then closely monitor the person's vital signs. This method of applying anaesthetics with the aim of inducing coma occurs only in hospital intensive care units.

The causes of coma are numerous and the recognised aetiological cause of coma in the field represents a real challenge for the doctor, because, from the aetiological cause of coma depends on whom we refer the patient to (neurologist, internist, toxicologist, neurosurgeon...), as well as the initial therapeutic treatment. Furthermore, the outcome of treatment of comatose patient is influenced by aetiology, because by wrong referral, the patient loses valuable time [5].

At the primary level, rating scales are applied, most often the Glasgow Coma Scale (GCS) and the "alert, verbal, pain, unresponsive" (AVPU) scale. Some of the confusing factors that can lead to misinterpretation of the results of these diagnostic tests, as well as in the application of rating scales, are: unpredictable changes in patient alertness, sensorimotor impairments and patient sedation [6].

The GCS was changed with the additions from 2014, because the GCS has limited application when the patient has immobilised limbs, when he has a spinal cord injury that leads to paralysis, when he has damage to the speech centres in the brain or is deaf [7], when he is intubated or has a tracheostomy that prevents speech, as well as bilateral damage to the third cranial nerve [8].

Therefore, in addition to the GCS, the Full Outline of Unresponsiveness Score (FOUR), a scale for assessing the degree of consciousness disorders intended for use in acute disorders of consciousness, regardless of the cause, is applied (Table 1) [9][10]. Lower scores indicate higher coma severity.

Table 1. Full Outline of Unresponsiveness Score - FOUR SCORE

Eye Response	Motor response (upper extremities)	Brainstem reflexes	Respiration pattern
Eyelids open or opened, tracking, or blinking to command (+4)	Thumbs-up, fist, or peace sign (+4)	Pupil and corneal reflexes present (+4)	Not intubated, regular breathing pattern (+4)
Eyelids open but not tracking (+3)	Localising to pain (+3)	One pupil wide and fixed (+3)	Not intubated, Cheyne-Stokes breathing pattern (+3)
Eyelids closed but open to loudvoice (+2)	Flexion response to pain (+2)	Pupil OR corneal reflex absent (+2)	Not intubated, irregular breathing (+2)
Eyelids closed but open to pain (+1)	Extension response to pain (+1)	Pupil AND corneal reflexes absent (+1)	Breathes above ventilatory rate (+1)
Eyelids remain closed with pain (0)	No response to pain orgeneralised myoclonus status (0)	Absent pupil, corneal, and cough reflexes (0)	Breathes at ventilator rate or apnoea (0)

The aim of the research was to establish the frequency of occurrence of coma and the aetiology of coma in the Banja Luka Emergency Department (ED). Also, the goal was to analyse the accuracy of the referral diagnosis and potential factors that can help the doctor in making a correct diagnosis.

METHODS

A retrospective cross-sectional study was conducted. In the ED database, in the period between1 January 2022 and 1 October 2022, all patients diagnosed with coma were found (International Classification of Diseases (ICD): R40, E16, I63 and further listed). ED protocols, as well as the Emergency and Family Medicine Information Systems (*WebMedic*) of the Republic of Srpska database, were used. The gender and age of the patient, vital parameters, performed diagnostic methods and therapy were recorded. The referral diagnosis, the department to which the patient was referred, as well as the final diagnosis determined in hospital conditions were recorded.

Data were analysed using IMB SPSS for Windows v 18.0. The normality of the data distribution wasdetermined using the Kolmogorov-Smirnov test and based on the results, appropriate parametric/non-parametric statistical tests were applied: Chi-squared test, Student t-test/Man-Whitney U-test, ANOVA/Kruskal-Wallis test. The level of statistical significance was taken at $p < 0.05$.

RESULTS

In the period between 1 January 2022 and 1 October 2022 there were 95 patients who were diagnosed with coma. The average age of the patients was 67.76 ± 16.56 years, there were 56 (58.9 %) men and 39 (41.1 %) women.

Out of that number, 41 (43.2 %) patients were diagnosed with hypoglycaemic coma and those patients were treated in the field. There was no statistically significant difference in relation to gender (Fisher test: $\chi^2 = 0.834$, $p = 0.404$) and age of patients (Man-Whitney U-test: $U = 903.5$, $p = 0.264$) and whether it was hypoglycaemic coma or not. Those patients were not included in further analysis.

Of the remaining 54 patients, there were 34 (63.0 %) men and 20 (37.0 %) women. Basic descriptive data about the patients are shown in Table 2.

The frequency in relation to which specialist the patient was referred to is shown in Figure 1.

Table 2. Characteristics of patients diagnosed with coma

Parameter	Range	Minimum	Maximum	Average	Standard deviation	Variance
Age	94.00	6.00	100.00	65.76	65.76	372.74
Systolic BP	170.00	40.00	210.00	110.46	110.46	2014.06
Diastolic BP	120.00	0.00	120.00	55.11	55.11	1416.06
Pulse	160.00	0.00	160.00	80.53	80.53	942.64
SaO_2	100.00	0.00	100.00	79.77	79.77	1022.85
Blood glucose	27.90	1.10	29.00	8.46	8.46	25.15

Pulse: beats per minute; BP: blood pressure in mm Hg; SaO_2: arterial oxygen saturation percentage; Blood glucose in mmol/L: normal grange – between 3.9 mmol/L and 5.6 mmol/L.

Out of 54 patients, 32 (59.3 %) patients had a confirmed referral diagnosis, while 22 (40.7 %)patients had another diagnosis established at the hospital. Analysis of vital parameters did not reveal a statistically significant difference in relation to gender ($\chi^2 = 1.519$, $p = 0.262$) and age ($U = 304.0$, $p = 0.908$), as well as to any vital parameter and whether the patient was confirmed with a referral diagnosis or not (systolic blood pressure (BP): $U = 147.0$, $p = 0.065$; diastolic BP: $U = 148.0$, $p =$

0.064; pulse: U = 101.5, p = 0.933, SaO_2: U = 130.0, p = 0.086, glucose: U = 75.5, p = 0.143).

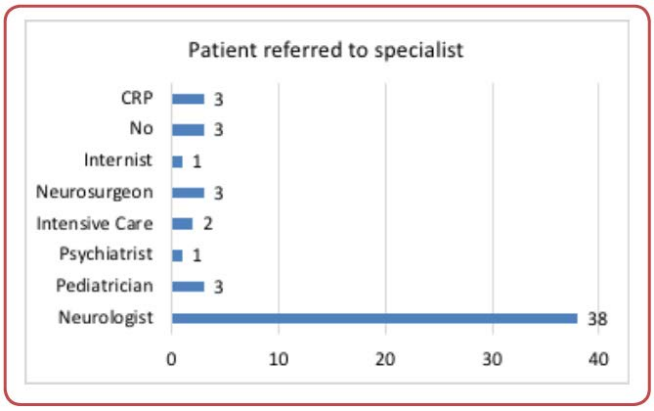

Figure 1.
Frequency of referral of patients with coma to a specific specialist

For easier analysis, confirmed diagnoses were grouped into the following categories: ICD I61-I63, ICD G40, sepsis and shock, head injuries and other diagnoses. The other diagnoses in two cases were cancer complications, complete AV block, acute respiratory insufficiency, acute poisoning, ventricular tachycardia and one case each of acute stress reaction, aortic dissection, meningoencephalitis. Their distribution is shown in Figure 2.

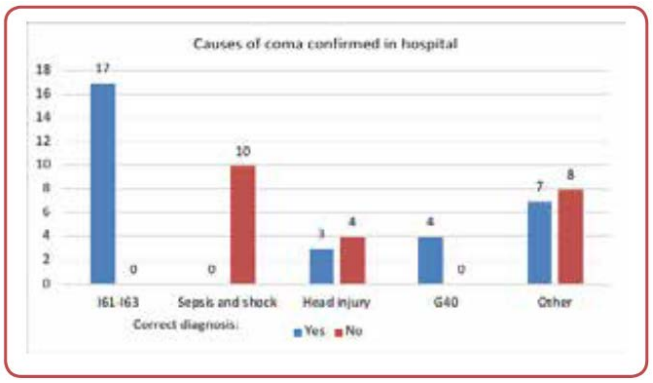

Figure 2.
Causes of coma confirmed in hospital

Significantly younger patients were diagnosed with epilepsy compared to other diagnoses (Kruskal-Wallis test: χ^2 = 10.766, p = 0.029). There was no significant difference in relation to gender and confirmed diagnosis (χ^2 = 8.208, p = 0.078). Systolic pressure was significantly lower in patients diagnosed with sepsis and shock compared to other diagnoses (χ^2 = 10.989, p = 0.027). Other parameters were not statistically significant (diastolic BP: χ^2 = 9.094, p = 0.059; pulse: χ^2 = 2.294, p = 0.682; SaO_2: χ^2 = 4.027, p = 0.402; Glucose: χ^2 = 3.301, p = 0.509).

The analysis revealed a significant difference between the initial diagnosis and the diagnosisconfirmed at the hospital (χ^2 = 30.563, p < 0.001).

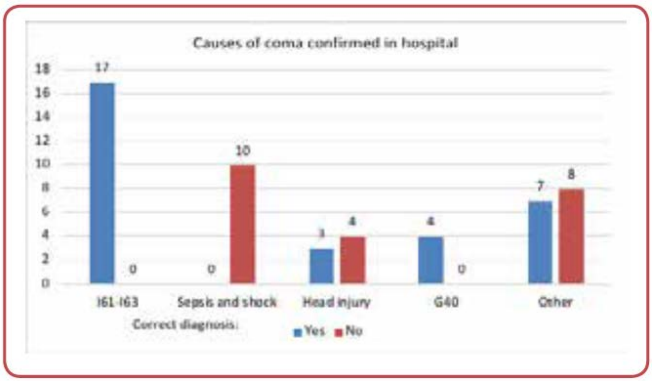

Figure 3.
Ratio of in-hospital confirmed pre-hospital diagnoses

Namely, all patients with diagnosed ICD I61-I63 were correctly diagnosed and adequately referred, while all patients with a confirmed diagnosis of sepsis and shock were incorrectly referred (Figure 3).

DISCUSSION

The results showed that the most common were coma caused by hypoglycaemia and coma caused by brain ischaemia and non-traumatic bleeding, which were adequately recognised based on the clinical picture and clinical examination and were adequately treated and/or referred. Coma caused by sepsis and shock of different aetiology, which was just behind in frequency, was not recognised as such and was referred to a neurologist, where precious time was wasted. The same was the case with coma caused by meningitis, poisoning, ventricular tachycardia (VT), complete atrioventricular block and conversion reaction.

From a practical point of view it is good that all patients were treated according to the principle of preventing hypoxia and maintaining perfusion, which in fact is common regardless of the presumed aetiologic agent. What is not good is that there was no recorded data about GCS and measured temperature. Also, inadequate taking of anamnestic data about previous diseases as well as symptoms that preceded the coma, which are closely related to the coma, were not adequately taken. Sometimes, pulse measurement were only by using a pulse oximeter.

The emphasis is on referring the vast majority of patients to a neurologist, which in itself suggeststhat often the factors that cause "non-neurological" coma are overlooked. "Non-neurological" causes of coma actually represent a challenge for doctors in the field and recognising them adequately effects the outcome.

Taking into account the frequency of aetiological causes of coma, the results of this retrospective study were compared with other studies. In the observational study by the author Forsberg and associates in which 938 patients participated, in 38 % of patients the aetiological cause of comawas poisoning, 24 % focal neurological lesion, 21 % metabolic disorders, 12 % epileptogenic causes, 12 % psychogenic [11]. It can be noted that in this study, poisoning as an etiological cause was found in a low percentage, statistically insignificant, while metabolic causes, including hypoglycaemia, sepsis, shock of various aetiologies, occupied the first place. The results of focal neurological lesions were similar in percentage.

In a study that dealt with the frequency and type of coma in the emergency department by the Forsberg and associates, where 875 patients participated and they were divided into two groups: one with metabolic 72 % and the other with structural damage 28 %. Similarity can also be seen in the aetiological causes of coma [12].

The limitation of this study is that it was a retrospective cross-sectional study, with a relatively small sample and only in one ED, so it is more difficult to extrapolate the data to the general population. This study can serve as a pilot study for a prospective study where better records of anamnestic data and performed diagnostic and therapeutic procedures would be performed.

CONCLUSION

Statistically, the most common were comas caused by hypoglycaemia and comas caused by brain ischaemia and non-traumatic bleeding, which were adequately recognised on the basis of the clinical picture and clinical examination and were adequately cared for and/or referred. Coma caused by sepsis and shock of different aetiology, which was just behind in frequency, was not recognised as such and was referred to a neurologist, where precious time was wasted. The same is the case with coma caused by meningitis, poisoning, VT, complete atrioventricular block and conversion reaction.

In order to reduce errors in the field, it is necessary to pay more attention to anamnestic data about diseases (kidney and liver insufficiency, endocrinological diseases, addiction diseases, symptoms that preceded coma, falls, especially in alcoholics, etc) and to perform a somatic and neurological examination adequately.

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Conflict of interest

None.

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