

Original article

ESTIMATION OF CEREBROVASCULAR INSULT FREQUENCY IN EMERGENCY PATIENTS AT THE CLINICAL HOSPITAL CENTRE RIJEKA

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ABSTRACT

Purpose: Cerebrovascular stroke is defined as a sudden focal neurologic deficit caused by cerebrovascular disease lasting longer than 24 hours. Cerebrovascular insult (CVI) is divided into ischemic and hemorrhagic. Along with heart disease and malignancies, cerebrovascular disease is the most common cause of mortality and disability in the modern world, attributing to this disease being the leading cause of disability across the globe. Diagnosis and identification of the type of stroke requires imaging examination with computed tomography. A detailed history and imaging usually rule out the impersonation of a stroke. Computed tomography (CT) is one of the first diagnostic modalities used to image the brain to identify the difference between ischemic and hemorrhagic stroke. The aim of this retrospective analysis was to estimate the incidence of cerebrovascular insult in patients who underwent CT brain examination in the Clinical Department

of Radiology at Clinical Hospital Centre (CHC) Rijeka in the period from January 1, 2020, to December 31, 2020.

Materials and methods: During this period, 255 data sets from patients' medical records were anonymously collected. The data search included patients who underwent CT of the brain with a clinical question about CVI.

Results: The data analysis at CHC Rijeka showed that the incidence of CVI is slightly higher in the male population. It is commonly diagnosed in the population of 81-90 years. About half of the patients with suspected CVI had normal CT findings.

Conclusion: These results could serve as a guideline for targeting groups in preventive healthcare interventions and education.

Keywords: computed tomography, cerebrovascular insult, ischemic stroke, hemorrhagic stroke

INTRODUCTION

The World Health Organization has defined stroke as „a clinical syndrome of vascular etiology manifested by the sudden onset of a focal or global brain defect lasting more than 24 hours or leading to death“ (1). The severity of disability of the survivors is a major and very difficult problem, not only in medical terms but also in socioeconomic terms. The mortality rate ranges from 63.5 to 273.4 deaths per 100,000 population per year (2). Therefore, it is crucial to detect stroke early and treat it quickly to reduce morbidity and mortality. In preventing morbidity and mortality, rapid and accurate diagnosis through various modalities plays an important role. One of them is computed tomography (CT). CT imaging is widely available, accessible, noninvasive, and the relatively most accurate investigation used in stroke, and the modality of choice is the initial investigation in a stroke patient. The purpose of CT is to differentiate ischemic stroke from intracranial hemorrhage

and to rule out other pathologic processes, such as tumors and vascular malformations that may clinically mimic stroke (1).

A stroke occurs when certain areas of the brain suddenly lose blood flow, depriving brain tissue of oxygen and nutrients. The brain cells begin to die within minutes. There are two main causes of stroke: occluded artery (ischemic stroke, Figure 1) or intraparenchymal bleeding (hemorrhagic stroke, Figure 2). A temporary disturbance of blood flow to the brain that leaves no permanent consequences is also called a transient ischemic attack (TIA) (3). Ischemic stroke is the most common type of stroke. It occurs when the blood vessels of the brain are blocked. This condition is caused by fatty deposits that accumulate in the blood vessels, blood clots, or other debris that travels through the bloodstream and accumulates in the blood vessels of the brain (3). Inadequate blood flow in a cerebral artery can often be compensated by an effective collateral system, particularly between the carotid and vertebral arteries via anastomoses in the ring of Willis and, to a

lesser extent, between the great arteries supplying the cerebral hemispheres. However, normal variations in the ring of Willis and the caliber of various collateral vessels, atherosclerosis, and other acquired arterial lesions can impair collateral vessel flow, increasing the possibility of occlusion of an artery, leading to cerebral ischemia (4). Hemorrhagic stroke occurs when an artery within the brain parenchyma ruptures. Bleeding in the brain can result from a variety of causes that involve blood vessels. Factors associated with hemorrhagic stroke include uncontrolled hypertension, excessive anticoagulant

treatment, aneurysms, trauma, cerebral amyloid angiopathy, etc. (3). A transient ischemic attack, sometimes called a „mini-stroke,” is a transient episode with symptoms that resemble a stroke. A TIA causes no permanent damage and is caused by a temporary interruption of blood flow to the brain that can last up to five minutes. Like an ischemic stroke, TIA occurs when a clot or debris reduces or blocks blood flow to a specific part of the central nervous system (3).

Risk factors for stroke are divided into variable factors and biological factors such as sex, age, race, and genetic inheritance. People above 55 years of age, men, black and Asian race have a higher risk of stroke. The first and most important factor that can be controlled is hypertension. A person with high blood pressure is three times more likely to have a stroke, and successful treatment reduces the likelihood of stroke by 50%. Heart fibrillation, which is another cause, increases the risk of stroke by 30% in people over the age of eighty. Taking anticoagulants reduces the risk by 70%. Other risk factors that are influenced by human behavior are cardiovascular disease, diabetes, smoking, dyslipidemia, etc. (4).

In patients with a clinical suspicion of stroke, rapid and accurate diagnosis is required, so several steps are taken. All patients with suspected acute cerebral infarction who are admitted to the hospital must undergo a physical examination, which includes taking a medical history or heteroanamnesis, determining neurological status, and performing laboratory tests. The patient then undergoes one of the radiological diagnostic imaging modalities to assess the stroke and determine its nature and duration (5).

One of the most important aspects in the evaluation of patients with acute ischemic stroke is CT (6). The CT description of stroke defines three main phases: acute (less than 24 hours), subacute (24 hours to 5 days), and chronic (after 5 days) (7). Acute stroke is cytotoxic edema, and the changes can be subtle but significant. In addition to the term acute stroke, terms such as „early ischemic change” are also used, and it used to be called „hyperacute”. Cytotoxic edema is an intracellular edema and results in the loss of the normal interface between gray and white matter (differentiation) and depletion of cortical furrows. Subacute stroke is a vasogenic edema with greater fat effect, hypoattenuation, and well-defined margins. The fat effect and risk of herniation are greatest at this stage. Chronic strokes are characterized by loss of brain tissue and hypoattenuation (8).

The aim of the study was to determine the frequency of cerebrovascular insults in patients who underwent a CT brain examination at the Clinical Department of Radiology at CHC Rijeka in the period from January 1, 2020 to December 31, 2020. In addition to the frequency, the incidence of cerebrovascular insult by gender and age, as well as the type of cerebrovascular insult based on the radiological findings were also investigated.

MATERIALS AND METHODS

The data required to conduct the study were collected in the CHC Rijeka by analyzing the data in PACS (Picture Archiving Communication Systems). The study included 225 patients who underwent CT at the Clinical Department of Radiology in Rijeka for suspected cerebrovascular insult between January 1, 2020 and December 31, 2020. The data search included

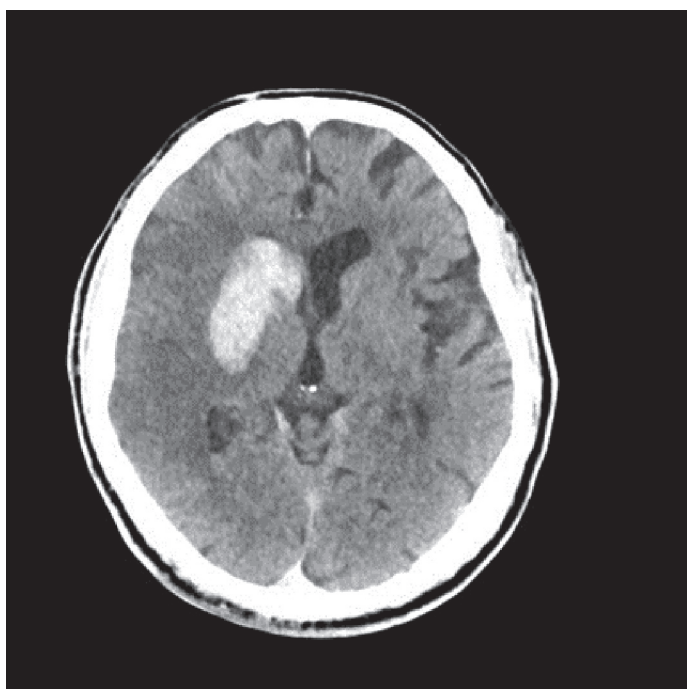


Figure 1: CT of the brain, axial section, view of hemorrhagic stroke. Source: CHC Rijeka database (retrieved June 30, 2021)

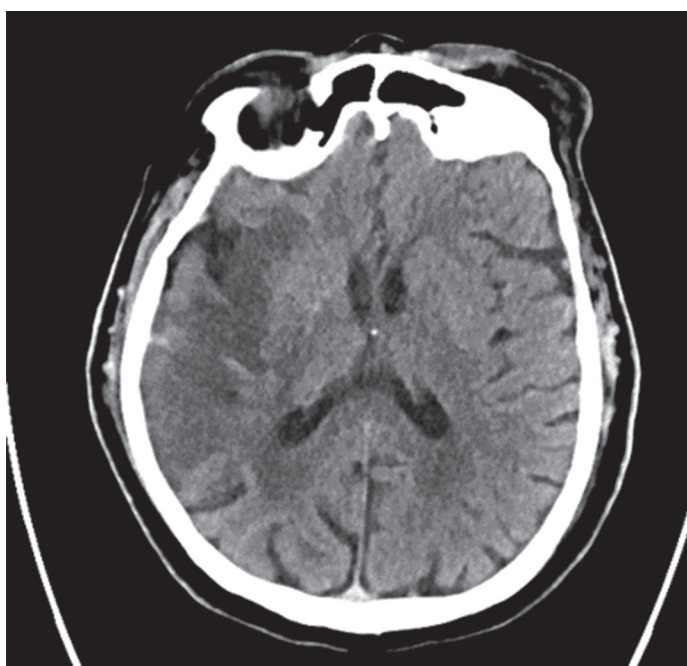


Figure 2: CT of the brain, axial section, view of ischemic stroke. Source: CHC Rijeka database (retrieved June 30, 2021)

patients who underwent CT of the brain with a clinical question about CVI.

The data analysis refers to referral diagnoses and clinical questions exclusively under the keywords "CVI" and cerebrovascular insult. All other instructions for diagnoses and clinical questions were excluded from the analysis. Data on patient acquisition and gender were also collected in the same way. Based on the data obtained and to assess the difference in the incidence of CVI according to sex and age, the patients were divided into 10 age groups and the age of the youngest and oldest patients was determined. In the study of CT findings in 225 patients, the number of detected pathological changes of the brain and normal findings without signs of CVI were analyzed. The obtained data were divided according to gender and age.

RESULTS

Of the total of 225 patients, 126 or 56% were men and 99 or 44% were women (Figure 3).

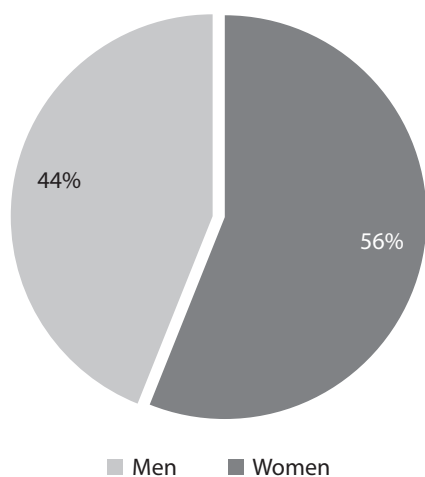


Figure 3: Gender distribution of patients who underwent CT-examination of the brain with clinical suspicion of CVI in the Clinical Department of Radiology in Rijeka in the period from January 1, 2020 to December 31, 2020

Patients included in this study were divided into age groups in addition to gender. The average age of the patients is 72 years, with the youngest patient being 13 years old and the oldest 96 years old. The largest proportion consists of patients in the age group of 81 to 90 years, 72 or 32.0% of them, then 58 or 25.8% in the age group of 61 to 70 years and 51 patients or 22.7% of them, aged 71 to 80 years. As for gender, the largest proportion in the group of women is 81 to 90 years old, with 43.4% (43 women), while in the group of men the largest number of patients is in the age group of 61 to 70 years, with a total of 38 patients or 30,2%. In the younger age groups, a much smaller number of patients was expected, so in the group of 51 to 60 years there were 27 patients or 12.0%, with twice as many men as women in the group. In the 41 to 50 age group, there were 6 patients or 2.7%, most of whom were also men. In the 31 to 40 age group, all patients treated were male and accounted for 1.8%. The youngest patients, up to 30 years old, were 2 or 0.9% (Figure 4).

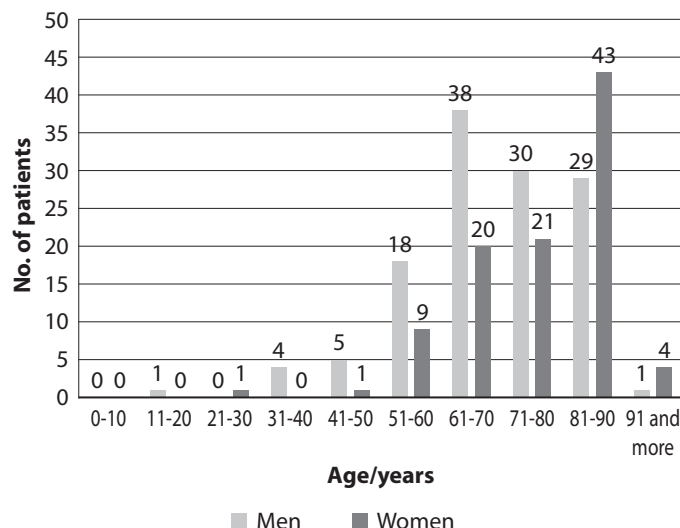


Figure 4: Representation of patients by age and gender who underwent CT examination of the brain with clinical suspicion of CVI in the Clinical Department of Radiology in Rijeka in the period from January 1, 2020 to December 31, 2020

Of the total patients examined for suspected cerebrovascular insult who underwent CT, 101 or 44.9% had normal morphologic CT findings without evidence of ischemic stroke or without definite ischemic or hemorrhagic changes and without the presence of a tumor mass. There were 54 patients or 24.0% diagnosed with a chronic ischemic lesion on CT. 30 patients or 13.3% were diagnosed with an acute ischemic lesion. Intracerebral hemorrhage was diagnosed in 20 patients or 8.9%. 20 patients or 8.9% were categorized as others (patients diagnosed with a tumor who underwent CT examination for control) (Figure 5).

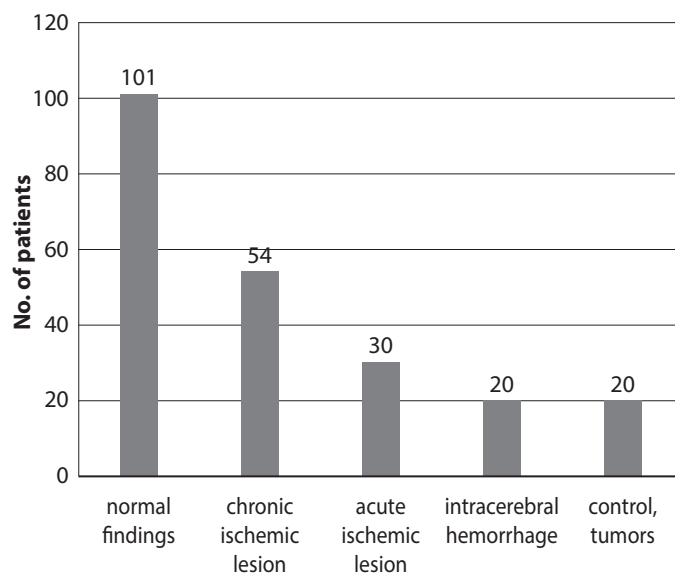


Figure 5: Frequency of pathological changes in the radiological findings of the brain CT in patients investigated in the Clinical Department of Radiology, locality of Rijeka, in the period from January 1, 2020 to December 31, 2020

Of the total number of patients (99), 44 or 44.4% had no detectable signs of acute stroke on CT scan, 25 or 25.3% had signs of chronic ischemia, and 16 or 16.2% had signs of acute ischemic lesion. We found 7 patients with intracerebral hemorrhage, and 14 patients with a tumor or follow up scans (Figure 6). In the group of treated male patients (126), 57 or 45.2% were normal, 29 or 23.0% had the described chronic ischemia, and 14 or 11.1% had the described acute ischemic lesion. There were 13 or 10.3% of patients with an intracerebral hemorrhage, and 13 or 10.3% of patients were diagnosed with a tumor or were undergoing control (Figure 7).

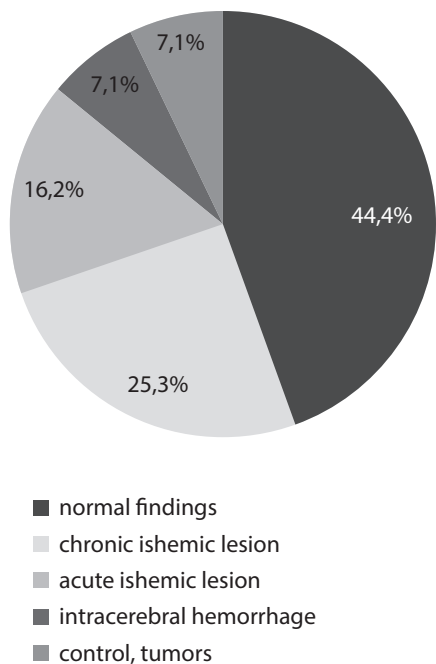


Figure 6: Frequency of pathological changes in radiological findings of the brain CT in female patients who were in the Clinical Department of Radiology in Rijeka in the period from January 1, 2020 to December 31, 2020

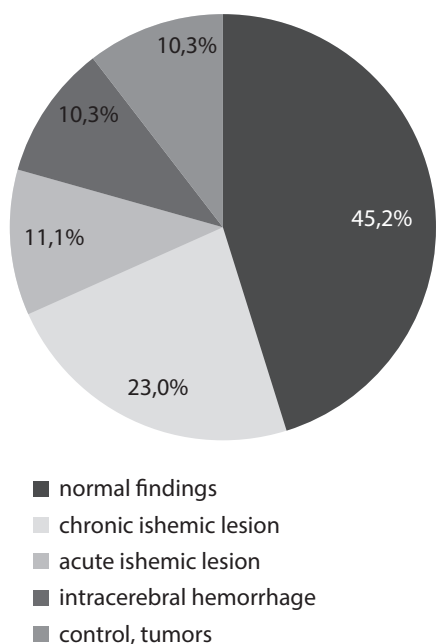


Figure 7: Incidence of pathological changes in radiological findings of the brain CT in male patients who were in the Clinical Department of Radiology in Rijeka, in the period from January 1, 2020 to December 31, 2020

There were more male patients with no evidence of CVI, 57 or 56.4%. Of the total number of patients with described ischemia (chronic and acute) and intracerebral hemorrhage, 56 or 53.8% were male patients and 48 or 46.2% were female patients, while 13 or 65% were male patients with a diagnosed tumor or were undergoing a follow-up scan (Figure 8).

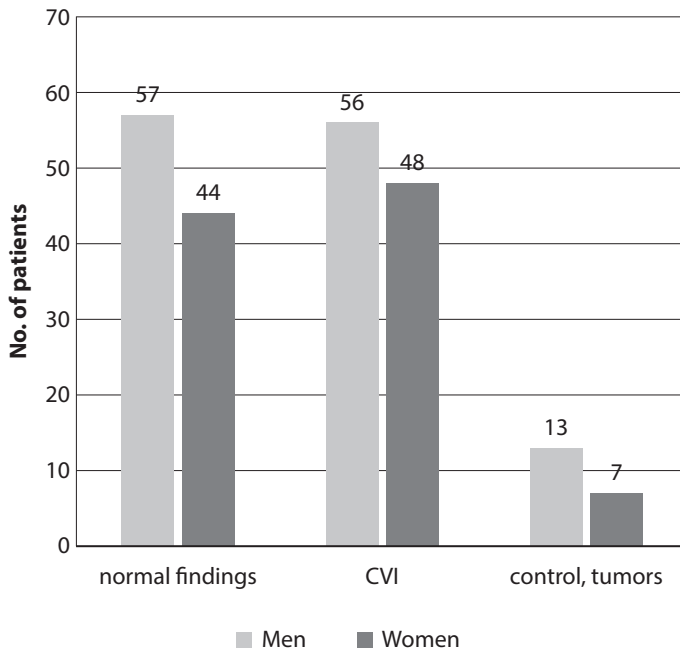


Figure 8: Gender representation of patients with pathological changes in the radiological findings of the brain CT who underwent CT at the Clinical Department of Radiology, Rijeka, in the period from January 1, 2020 to December 31, 2020

Among the patients with ischemia (acute and chronic) and intracerebral hemorrhage described in the CT report, the largest number is in the age group 81 to 90 years (45 or 43.3%), patients in the age group 61 to 70 years (25 or 24.0%), and patients aged 71 to 80 years (23 or 22.1%). The proportion of females with ischemia and intracerebral hemorrhage depends on the age. In older age groups, the proportion of women increases, while in the younger groups the majority are men (Figure 9).

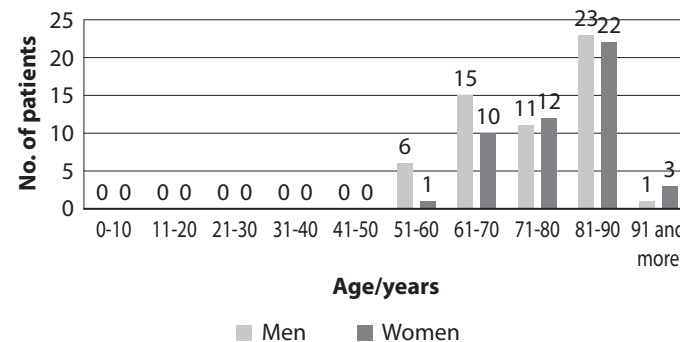


Figure 9: Representation of patients by age and gender with the findings of ischemia (chronic, acute) and intracerebral hemorrhage who underwent CT in the Clinical Department of Radiology in Rijeka, in the period from January 1, 2020 to December 31, 2020

DISCUSSION

The results of the analysis of patients with a finding of ischemia (chronic, acute) and intracerebral hemorrhage in suspected cerebrovascular insult cases (CVI) at the CT examination of the brain showed a slightly higher representation of male patients - 56 patients or 53.8%. Considering the very small difference between males and females, we can determine that it is an equal ratio of representation. According to a survey conducted in 2012 by the Department of Radiodiagnosis, College of Medical Sciences - Teaching Hospital, Bharatpur, out of 100 patients with a confirmed diagnosis, 72 (72%) were men and only 28 (28%) were women (9). In a study published in 2016 to assess stroke subtypes and risk factors in patients admitted to Sayad Shirazi Hospital, Gorgan, 218 (58.19%) males and 157 females (41.90%) with a confirmed diagnosis were recorded (10).

Amongst the age groups of patients with a confirmed diagnosis of cerebrovascular insult, most of them (45 or 43.2%) were between 81 and 90 years of age. However, some studies show that the mean of years with a positive finding is 57.29 years. A 2020 study showed that the most common age group affected by stroke is between 43 and 62 years (11). Furthermore, the results of a study conducted in 2015 at the Department of Radiology in the Nigerian Tertiary Hospital showed that the mean age was 55 years (12).

In addition to the analysis of gender and age, a statistical analysis of the frequency of morphologically ordinary findings without CVI was also performed in patients who were examined for suspected cerebrovascular insult with the CT scan. Out of a total of 225 patients, 101 showed no CT signs of CVI. This result confirms that the largest number of patients in whom CVI was suspected due to a clinical question, had CT with normal findings, i.e., it showed no changes in the morphology of the brain. In patients referred to the brain CT, the clinical findings are generally suggestive of stroke, but early CT scans often do not show the parenchymal changes that would define ischemic stroke. In a 2020 study, of the 100 cases examined, ischemic infarction was the most common (56%), followed by intracerebral hemorrhage (27%), and brain tumor and subdural hematoma (1%) were the least common. A normal CT finding accounted for only 5% of the total population (12). However, the results of the 2015 study show that of the 271 patients who underwent a CT brain scan for suspected cerebrovascular insult, 188 had normal findings or early ischemic changes, while 83 patients met the criteria for the study to be conducted. In it they were categorized as ischemic infarction and hemorrhagic infarction (12).

CONCLUSION

One of the most important aspects in the evaluation of patients with acute ischemic stroke is the CT scan. The data analysis at CHC Rijeka showed that CVI has a slightly higher incidence in the male population. It is commonly diagnosed in the population aged 81-90 years. About half of the patients with suspected CVI had normal CT findings. These results could serve as a guideline for targeting groups in preventive healthcare interventions and education.

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