

Management of Syncope in the Emergency Department Without Hospital Admission: Usefulness of an Arrhythmia Unit Coordinated Protocol

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Introduction and objectives. The main aim of this study was to demonstrate that a protocol for managing syncope in the emergency department that is based on the early detection of heart disease enables patients to be diagnosed quickly and with few admissions, without there being a negative impact on prognosis.

Methods. The study was performed prospectively in 199 consecutive patients (54% male; mean age, 67 [17] years) who presented with syncope at the emergency department of our hospital during a 17-month period. A 2 step diagnostic algorithm was developed in which patients initially underwent clinical and electrocardiographic assessment, and thereafter were submitted to a diagnostic protocol that involved carrying out a sequence of diagnostic tests in the emergency room to avoid hospital admission.

Results. A presumptive diagnosis was established in 120 (60%) patients during the initial assessment. After completion of the diagnostic protocol, 78% of patients were given a clear diagnosis within a mean stay of 19 [15] h in the emergency department. Some 10% of patients were admitted. Three patients died during a mean follow-up period of 237 days.

Conclusions. Implementation of a protocol for managing syncope in the emergency department that was based on screening patients according to the presence of heart disease enabled a large percentage to receive a diagnosis. Moreover, the majority of patients could be discharged rapidly from the emergency department without there being any negative impact on medium-term prognosis.

Key words: *Syncope. Diagnosis. Prognosis.*

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Manejo del síncope en el servicio de urgencias sin ingreso hospitalario: utilidad de un protocolo coordinado con la unidad de arritmias

Introducción y objetivos. El principal objetivo de este estudio es demostrar que un protocolo para el manejo del síncope en el servicio de urgencias basado en la detección precoz de cardiopatía permite diagnosticar a los pacientes de forma rápida y con una baja proporción de ingresos, sin que ello repercuta de forma negativa en su pronóstico.

Métodos. El estudio se realizó de forma prospectiva en 199 pacientes consecutivos (54% varones; media de edad, 67 ± 17 años) que acudieron por síncope al servicio de urgencias de nuestro hospital en un período de 17 meses. Se desarrolló un algoritmo diagnóstico en dos pasos en el que los pacientes eran sometidos a una primera evaluación clínica y electrocardiográfica y posteriormente a un protocolo diagnóstico basado en la realización secuencial de pruebas diagnósticas en el servicio de urgencias, con lo que se evitó su ingreso hospitalario.

Resultados. Tras la valoración inicial, se diagnosticó a 120 (60%) pacientes. Después de completado el protocolo, se obtuvo clasificación diagnóstica del 78% de los pacientes, con una estancia media en el servicio de urgencias de 19 ± 15 h; se ingresó al 10% de los pacientes. Con un seguimiento medio de 237 días, fallecieron 3 pacientes.

Conclusiones. El manejo protocolizado del síncope en el servicio de urgencias basado en una estratificación de los pacientes según tengan o no cardiopatías permite el diagnóstico de una elevado porcentaje de pacientes y dar de alta a la mayoría de forma rápida desde el mismo servicio de urgencias, sin que ello repercuta de forma negativa en su pronóstico a medio plazo.

Palabras clave: *Síncope. Diagnóstico. Pronóstico.*

INTRODUCTION

Syncope is a common disorder which accounts for 3% of the consultations which take place in emergency

ABBREVIATIONS:

ECG: electrocardiogram.
 EPS: electrophysiological study.
 TT: tilt table test.

departments and 6% of hospitalisations.^{1,2} Despite important diagnostic advances introduced over the last few years, there are still a large number of patients for whom it is not possible to establish the cause of the syncope.³⁻⁵ The prognosis varies depending on its origin and particular subgroups run a higher risk of malignant arrhythmias or sudden death. This fact, together with the difficulty in establishing a definite diagnosis in the emergency department means that in many cases, the patient is hospitalised in order to complete its assessment. This high rate of hospitalisation requires the use of a lot of resources,⁶⁻⁸ although it has not been shown to necessarily affect patients' prognoses.

Over the last few years, the creation of arrhythmia units in cardiology departments has meant that the main techniques necessary for managing patients with syncope are all located in one area. An initial assessment of patients by the arrhythmia unit could improve their care in the emergency department and avoid unnecessary hospital admissions.

This study aims to assess a protocol for managing syncope in the emergency department based on a simple process for diagnosing and stratifying the risk, aiming to avoid hospital admissions. The purpose is to show that in a wide range of patients the non-hospitalisation strategy presents an adequate diagnostic result, without there being a negative impact on the patients' prognosis.

METHODS**Definition of Syncope**

Syncope is defined as the sudden and temporary loss of consciousness and postural tone following a transient interruption of cerebral perfusion.

Vasovagal syncope was considered when there were prodromes and/or a trigger factor in patients with no other symptoms suggesting any other type of etiology.

Patients

This study covers 199 consecutive patients who came to the emergency department of our hospital between February 2005 and August 2006 suffering from syncope. It is a tertiary hospital which covers emergency admissions over an area of approximately 230 000 inhabitants.

The study included all patients of age who came to the emergency department suffering from syncope and had not previously been examined for this reason.

Patients with any of the following characteristics were excluded from the study: *a)* serious accompanying illness; *b)* suspected acute ischemia; *c)* evident heart failure; and *d)* non-syncopal episodes (pre-syncope, stroke, shock, coma, etc).

Syncope Protocol

The syncope protocol is based on a multidisciplinary collaboration between medical personnel from the emergency department and the arrhythmia unit. To be applicable, there needs to be a number of beds available in a specific area of the emergency department where the patients can be monitored until they are discharged or admitted. All patients underwent initial clinical assessment which included anamnesis, physical assessment, electrocardiogram (ECG), orthostatic tests, and electrocardiographic monitoring for at least 8 hours (stage 1 of the protocol).

Over the following 24 hours, the patients were assessed by a cardiologist from the arrhythmia unit who analysed the data obtained in the initial clinical assessment and reviewed the monitoring. The patients who were diagnosed after this first stage were discharged or treated based on the syncope etiology and they were listed on a follow-up register.

After the first assessment, patients whose syncope was not diagnosed were moved on to the second phase of the protocol where they were assessed using an echocardiogram. If the echocardiogram ruled out structural heart disease and the basal ECG and monitoring did not show any abnormalities to suggest arrhythmic syncope, the patient was discharged and a tilt table test (TT) was carried out in the outpatients department. If abnormalities were recorded, then an electrophysiological study (EPS) was carried out. If a diagnosis was not reached after this, then a subcutaneous loop recorder (Reveal plus™ Medtronic®) was inserted to register any events. Figure 1 shows a diagram of the protocol used. All the diagnostic tests carried out for the protocol were performed in the arrhythmia unit.

Monitoring

The result of the monitoring was considered to be diagnostic if the patient experienced syncope during the protocol or if there was evidence of Mobitz II second or third degree atrioventricular block (AVB), pauses for more than 3 seconds, sustained supraventricular paroxysmal tachycardia or any wave of more than 10 beats of wide-QRS tachycardia compatible with ventricular tachycardia. During the monitoring, all patients received bilateral carotid sinus massage, and pauses of less than 3 seconds or systolic blood pressure decreases of 50 mm Hg were considered to be pathological.

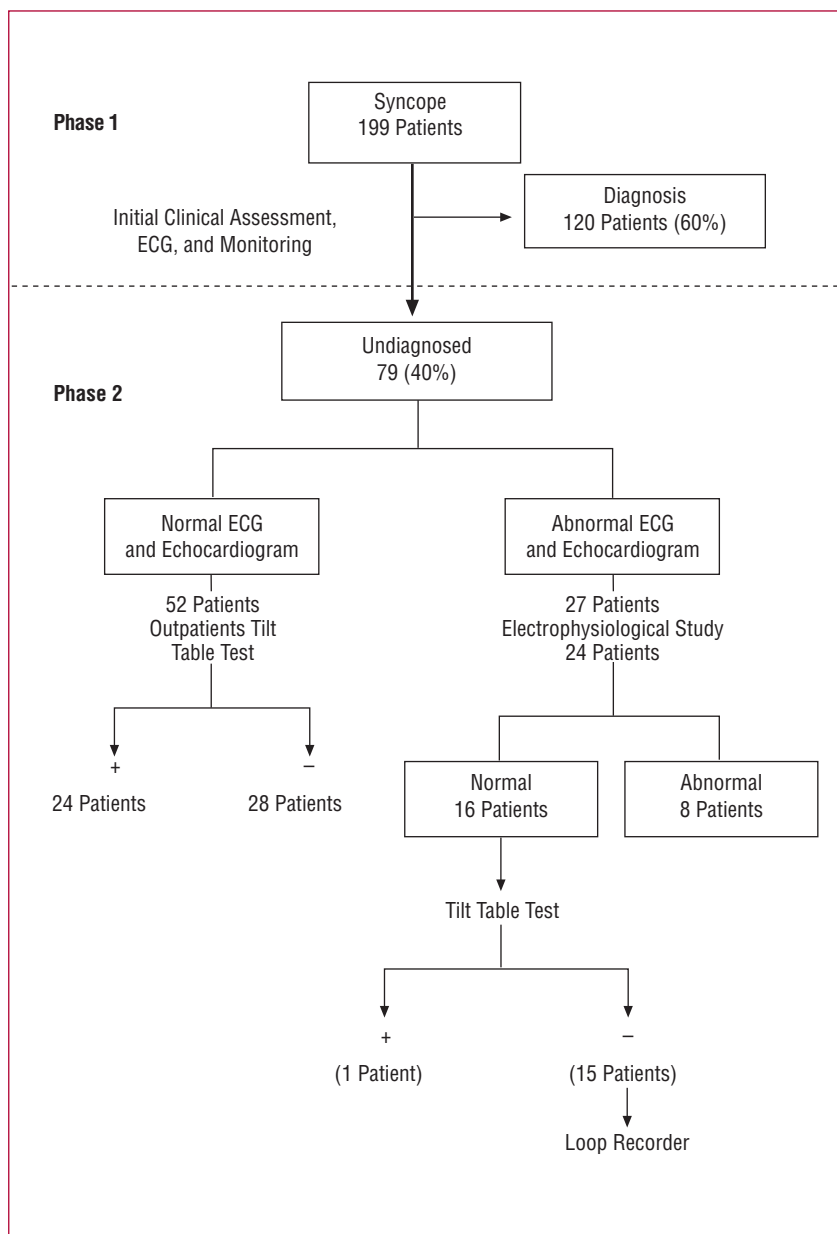


Figure 1. Diagram of the protocol. ECG indicates electrocardiogram.

Basal Electrocardiogram

The following abnormalities were considered as being an indication of possible cardiac arrhythmia: bifascicular block or other intraventricular conduction disorder; Mobitz I second degree AVB; unsustained runs of ventricular tachycardia; premature ventricular contractions; prolonged QT intervals; patterns showing compatibility with Brugada syndrome or arrhythmogenic right ventricular dysplasia.

Echocardiography

An echocardiogram was performed and the following were considered as being pathological: significant left ventricular hypertrophy, alterations in segmental

contractility or left ventricular dysfunction, alterations to the function or structure of the right ventricle, moderate or severe pulmonary hypertension, and/or some type of moderate or severe abnormality in valve function.

Electrophysiological Study

The following findings were considered to be pathological: a corrected sinus recovery time of ≥ 650 ms; an interval of HV ≥ 70 ms; the induction of second degree or higher intrahisian or infrahisian block with atrial frequencies < 150 lpm; the induction of sustained monomorphic ventricular tachycardia and the induction of supraventricular tachycardia with haemodynamic repercussion.

Tilt Table Test

The protocol was carried out on a motorised tilt table with foot rest. After being in a recumbent position for 5 minutes, the table is tilted 80° for 40 minutes or until syncope is induced. The result was considered positive when syncope was induced in the presence of hypotension, bradycardia, or both.

Admission to Hospital

The protocol was designed to be used without hospitalising the patient; hospital admissions only occurred in the case of: *a*) the patient requiring a diagnostic or therapeutic procedure, the nature of which required hospitalisation; *b*) serious trauma requiring hospitalisation; and *c*) patient's request.

RESULTS

In total, 199 patients were included in the study. The mean age (standard deviation) of the patients was 67 (17) years; 54% were male.

Phase 1

After an initial clinical assessment in the emergency department, 120 (60%) of the 199 patients were diagnosed; 72 patients were clinically diagnosed with vasovagal syncope; carotid sinus massage was diagnostic for 2 patients; 6 patients showed abnormal orthostatic tests; ECG and continuous monitoring allowed for 27 patients (22%) to be diagnosed, 25 of whom experienced slow rhythms (8 with trifascicular block or bifascicular block with long PR; 13 with advanced AVB; and 6 with sinus dysfunction), 2 with ventricular arrhythmias; 3 patients had known aortic stenosis and 10 presented other causes of syncope (Table).

Phase 2

After completing the first phase, 79 patients (40%) had not been diagnosed. Of those, 27 (30%) presented significant abnormalities in the basal ECG or in the echocardiogram; 3 of those had severe aortic stenosis and finished the study at this point. The 24 remaining patients underwent an EPS which resulted in 8 patients being diagnosed (6 showed conduction disorders or sinus dysfunction, in 1 patient supraventricular arrhythmia was induced, and in the other, ventricular arrhythmia). Of the 16 patients whose EPS was inconclusive, the TT test was diagnostic for 1 patient and the rest were fitted with an implantable loop recorder. Of the 52 patients with normal echocardiograms and ECG, 24 had positive TT results. The remaining 28 patients had clinical follow-up. After the second phase, 36 (45%) of the 79 patients included had been diagnosed.

TABLE 1. General Diagnoses and Diagnoses during Each Phase

Diagnoses	Phase 1	Phase 2	Total (n=199)
Vasovagal	72	25	97
Orthostatic	6	-	6
Carotid sinus hypersensitivity	2	-	2
Bradyarrhythmia	25	6	31
Tachyarrhythmia	2	2	4
Mechanical	3	3	6
Others	10 ^a	-	10
Total	120	36	156

^a3 with neurological processes, 2 with pulmonary embolism, 2 with pacemaker dysfunctions, 1 with vertigo, 1 with digestive haemorrhage, and 1 with neuropsychiatric disorder.

General Results

A final diagnosis was reached for 156 of the patients (78%). The final diagnoses are recorded in Table. Twenty patients (10%) were hospitalised; 12 to carry out the required procedures (3 with aortic stenosis, 3 with neurological procedures, 2 with pulmonary embolism, 3 for the implanting of devices, and 1 for digestive haemorrhage); 5 could not complete the protocol (2 due to them being anticoagulated and 3 for logistical reasons); 2 for serious trauma and 1 at their own request. The average stay of the non-hospitalised patients was of 19 (15) hours. Of the total patients included, 155 (78%) had a stay of <24 hours. As a consequence of these diagnoses, 36 pacemakers and 3 automatic defibrillators were fitted.

Follow-up

After an average follow-up period of 237 days, recurrent syncope was seen in 12 (6%) of the patients. Three patients died, none from cardiac causes. During the follow-up, no sudden deaths were recorded nor injuries as a cause of syncope.

During the follow-up, another 3 patients were diagnosed thanks to the loop recorder (1 patient had supraventricular tachycardia, 1 had sinus bradycardia, and the third showed normal sinus rhythm).

DISCUSSION

Principal Findings of the Study

The main objective of our study, based on a strategy of non-hospitalisation of patients, is to demonstrate the usefulness of a protocol management of patients who go to the emergency department because of syncope. Using a simple protocol based on the early detection of heart disease, the patients' risks can be diagnosed and stratified and in most cases, they can be managed in an outpatients department or with a short stay in the emergency department.

The main findings can be summarised by the following points: *a)* the protocol allows for the etiological diagnosis of a high percentage of patients who visit the emergency department because of this disorder, *b)* the large majority of these patients are diagnosed and treated staying a very reduced amount of time, and a high percentage do not require hospitalisation, and *c)* the management of these patients using this strategy of risk stratification does not have any negative impact on their long term prognosis, and morbidity/mortality during follow-up is rare.

Syncope Protocol

Syncope presents a diagnostic challenge, given its high incidence, sporadic nature, and the large number of illnesses which can cause it, the prognosis of which varies from totally benign processes to diseases which put the life of the patient at great risk.⁹

Despite the use of a great number of diagnostic procedures, a large proportion of patients remain undiagnosed. A high percentage of these patients can be diagnosed via initial clinical assessment.¹ The diagnostic output of the complementary tests is generally low and depends largely on the characteristics of the population being studied, although a large amount of tests are carried out.¹⁰

The difficulty of discriminating between the possible causes in the emergency department has led to many of the patients being hospitalised to complete their assessment, resulting in a subsequent use of resources.

Many clinical protocols and action guidelines have been published in an attempt to optimise the diagnosis of these patients,¹¹⁻¹⁵ although to date there is no common strategy. Our protocol was brought about in an attempt to unify the available tests for the diagnosis of syncope in an emergency department, to simplify its management and to reduce to a minimum the number of patients hospitalised. In order to do this, a simple management method has been established, founded on the sequential use of diagnostic methods and risk stratification based on determining heart disease data, together with a conservative management of patients not suspected of heart disease and a more aggressive management of those patients who present some indication of heart disease.

Heart disease is without doubt the most important factor for prognosis when managing syncope in the emergency department.¹⁶ Patients with heart disease have a much worse prognosis, irrespective of the cause of their particular syncope,¹⁷ and the fear of a possible malignant arrhythmia or sudden death is the main reason for their admission to hospital.¹⁸ However, data exists which would lead to the belief that perhaps such a conservative attitude is unnecessary. In a recent study it was pointed out that the absence of heart disease allows for a cardiac cause to be excluded in 97% of the cases of syncope.¹⁹ Also, attempts at establishing a prognosis for these patients in the emergency department

have shown that the use of simple risk markers, based on clinical and ECG data of cardiologic risk, leads to the discrimination of populations with very low risk of cardiovascular episodes or long term death. Colivicchi et al²⁰ analysed the characteristics of syncope patients assessed in the emergency department and after multivariate analysis, they found the significant risk factors to be patients over the age of 65, history of heart disease, syncope without prodromes, and an anomalous basal ECG. Mortality was 0% when there were less than 2 risk factors present. Another similar study²¹ found the risk factors to be abnormalities in basal ECG, a history of ventricular arrhythmias and congestive heart failure, and age over 45. In this case, the risk of death or malignant arrhythmias in the following year was 4.4% in patients with less than 2 of the risk factors. This data coincides with our results, as no adverse events were seen in the population that was initially considered to be low risk and was discharged from the emergency department, meaning this strategy can be considered to be reliable.

Higher risk patients are managed more aggressively, although the benefit of hospitalising these patients is not known nor is whether this management can have any repercussions on their long term prognosis.¹⁸ In fact, the implantation of subcutaneous loop recorders in patients with heart disease has shown that despite a high percentage of events being of arrhythmic etiology, the rate of serious events during follow-up is rare.²² In patients with heart disease, carrying out a previous EPS, as our protocol establishes, is accompanied with a lack of syncope-related morbidity and mortality during follow-up.²³ Also, the figures for hospital admissions as described in other studies are far higher than the hypothetical number of patients at high risk. In the study published by Shen et al,¹² which exclusively included patients considered to be at intermediate risk, the large majority of the patients were ultimately diagnosed as having syncope of a benign etiology, despite the fact the 43% of them were hospitalised. All this indicates that the syncope management is probably excessively conservative and it may not be necessary to have such a high level of hospital admissions.

The creation of arrhythmia units which has taken place over the last few years has led to specialisation in the management of this disorder and in many cases has allowed for the centralisation of integral assessment of syncope patients.

Thanks to this, there is now the possibility for emergency departments to apply similar protocols to those that are used with hospitalised patients.

In this study, the management of patients by using an arrhythmia unit coordinated protocol within the framework of an emergency department has achieved etiological diagnosis for 78% of them. The results are similar to those obtained by other units or action protocols which are applied in emergency departments and which very

between 77% and 82%.¹²⁻¹⁴ In a recent series, following the completion of the study, only 20% of patients remain undiagnosed.¹¹

Sixty per cent of patients are diagnosed via initial clinical assessment which included only anamnesis, physical examination, monitoring, and orthostatic tests. Amongst this group of patients there is a high prevalence of vasovagal syncope, similar to what has been observed in previous studies.¹²⁻¹⁴ Twenty-two per cent of patients diagnosed in this first phase showed rhythm abnormalities which were detected by ECG and continual monitoring, which suggested a diagnostic output quite superior to that observed in other series.¹² On the other hand, the systematic performance of carotid sinus massage to all the patients in the emergency department barely produced diagnostic results in our series, despite the average age being quite high.

In patients with syncope of an unknown etiology following the first phase of the study, 30% were considered to be at high risk as they presented abnormal ECG or echocardiogram. For this group, the EPS had a high diagnostic output, as it allowed the syncope etiology to be established in 8 of the 24 patients that underwent the test; the most frequent etiology of these was conduction disorder. However, in this group, the prevalence of vasovagal syncope was very small, in contrary to what had happened in other series.^{12,19} This may be due to there being a small number of patients in this group and the selection of people at high risk with an elevated proportion of cardiogenic syncope and rare vasovagal syncope. Of the patients who were not diagnosed following the first phase of the study and who were considered to be at low risk, the tilt table test was positive for half of them.

In most cases, this protocol allowed for a more rapid management of patients. Only 10% of the patients needed to be hospitalised and most had a stay of <24 hours.

This is one of the most original results obtained by this protocol, as it concerns a hospitalisation rate which is much lower than that published by other authors, which varies between 39% and 75%.¹²⁻¹⁵ In the study carried out by Shen et al,¹² managing the syncope patients using a syncope unit showed a lesser rate of hospitalisation than in conventional management, although 43% of the patients assessed by this unit were hospitalised. None of the patients who were diagnosed with vasovagal syncope were admitted to hospital whereas in other protocols the rate of patients' hospitalisation with suspected neurally mediated syncope varied between 30% and 58%.^{13,14}

The high rate of hospitalisation was to a great extent due to the difficulties in establishing an effective prognosis during the initial assessment of these patients.

Stratification of the risk, exclusively based on the presence of structural heart disease in the emergency department allows those patients who need to be managed more aggressively to be identified. Patients whose diagnosis was evident following a simple clinical

assessment resulted in being a group with good prognosis, with no increase in mortality using this management method. In patients whose etiology was unknown after this first stage, the use of echocardiographic and electrocardiographic abnormalities as a prognostic marker allowed on the one hand for a population with a good prognosis and a high incidence of vasovagal syncope and on the other, a population with a high incidence of rhythm disorders. Using this algorithm therefore allowed for a small group of people at high risk, who were acted upon accordingly, to be differentiated from the other patients, who could be managed in a conservative way without having any repercussions on the increase of adverse events in the long term.

We understand the relevance of this study lies in the fact that it shows that the application of a syncope protocol in the emergency department, based on early assessment by arrhythmia unit personnel and used together with rapid, simple risk stratification, allows for these patients to be managed mostly without the need for hospitalisation and above all it guarantees a good medium-term prognosis for the patients discharged.

Limitations of the Study

Despite being prospective, one of the main limitations of the study is the absence of a control group with which to compare the management of patients using this protocol and a "conventional" management method. Either way, the diagnostic results obtained can be superimposed on those obtained by other protocols and the absence of unfavourable events in the follow-up of the patients demonstrates its reliability.

In addition, it deals with the experience of only 1 centre where a protocol has been designed according to the availability of techniques used in the emergency department that usually require hospitalisation, and it may not be easy to implement these in other contexts. However, numerous hospitals now have an arrhythmia unit in which all the tests are available. Also, the diagnostic algorithm is relatively simple and the selective carrying out of different tests allows for patients to be managed using fewer tests, in a shorter time period and without excessively overloading the units. New studies will be necessary to establish its applicability in other contexts.

It also remains to be determined whether the management of patients using this method is cost efficient. Most of the expenditure on patients with syncope derives from their hospitalisation,⁸ and this also has repercussions in the carrying out of a large number of unnecessary tests,¹⁰ which suggests that this protocol should substantially reduce the expenditure. On the other hand, our protocol may involve the carrying out of a large number of tilt table tests on patients with no heart disease; however, performing these tests in an outpatients department is not particularly costly and the diagnostic

output obtained in this group of patients was high. New studies will need to be carried out which analyse these aspects.

CONCLUSIONS

The use of a syncope protocol which depends on the arrhythmia unit to handle this issue in the emergency department allows for the etiological diagnosis of a large number of patients. With this protocol, most patients can be discharged quickly from the emergency department and this can largely avoid the need for hospitalisation and, above all, this does not mean a higher incidence of adverse events during the follow-up period.

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