# THE DIFFERENTIAL DIAGNOSIS AND PHYSIOTHERAPEUTIC TREATMENT OF PIRIFORMIS SYNDROME: A SYSTEMATIC REVIEW

ABSTRACT

Piriformis syndrome is a neuromuscular pathology that occurs when the piriformis muscle compresses the sciatic nerve, causing it to become irritated. The piriformis muscle is located in the gluteal region and originates in the anterior part of the sacrum, so piriformis syndrome is characterized by pain in the gluteal region, which can radiate to the lower limbs, being confused with symptoms of other pathologies such as herniated discs and sciatica. Piriformis syndrome can occur due to various factors, including muscle spasms, trauma, anatomical abnormalities and excessive activity. The main symptoms of this pathology include unilateral pain in the gluteal region which can radiate to the lower limb, causing muscle weakness and numbness in the affected lower limb. Diagnosing this condition is challenging, as the symptoms overlap with other musculoskeletal conditions. However, with orthopedic tests and muscle stretches, clinical examinations and imaging tests such as magnetic resonance imaging, a diagnosis can be made. Therefore, this syndrome is a condition that can affect the quality of life of affected patients, which is why physiotherapy plays an extremely important role in the treatment of this syndrome through specific therapeutic plans for each patient. This article, therefore, aims to contribute significantly to knowledge of the importance of physiotherapy in the diagnosis and treatment of piriformis syndrome, in a systematic review.

**Keywords:** Piriformis Syndrome, Diagnosis, Physiotherapy, Therapeutic Plan, Systematic Review.



## INTRODUCTION

Piriformis syndrome is a pathology caused by pain located in the lumbar region with symptoms of tingling, and numbness that mainly affects the lower limbs (lower limbs) and in other cases hands and arms that make the path of the sciatic nerve (SANTOS, OLIVEIRA & PEREIRA., 2019). However, the piriformis muscle is located on the anterior surface of the

sacrum and runs posterolaterally through the ischial groove, inserting itself over the greater trochanter of the femur as it passes over the sciatic nerve in most cases (SANTOS, OLIVEIRA & PEREIRA., 2019). The prevalence of piriformis syndrome depends upon the diagnostic criteria being used and the population studied but is estimated by some to be 5%-6% in all cases of low back, buttock, and leg pain and up to 17% of patients with chronic low back pain (Lo, 2024).

Piriformis muscle's syndrome is caused by sciatic nerve compression in the infrapiriformis canal (Michel et al., 2013). The piriformis muscle's primary function is to externally rotate the hip in a neutral position and to abduct the hip when it is flexed in open and closed kinetic chains, acting as an extensor and external rotator of the hip. The piriformis muscle is related to the sciatic nerve, which enables the trauma and inflammation that allow symptoms of sciatica to present clinically (SANTOS, OLIVEIRA & PEREIRA., 2019).

The syndrome is known by the term that applies to a type of sciatica that is related to a condition of spasm or hypertrophy of the piriformis muscle. However, there is no common cause that determines the onset of this syndrome, as there are multiple etiologies that include hypertrophy of the piriformis muscle such as pseudoaneurysm of the inferior gluteal artery, excessive exercise, repetitive strain, inflammation, spasms of the piriformis muscle, direct and indirect trauma to the sacroiliac or gluteal regions, muscle contracture in hip flexion, infection and anatomical variations. This syndrome is characterized by sensory and motor disturbances in the area where the sciatic nerve is distributed, so the symptoms persist mainly in low back pain which extends throughout the lower limb and can cause gluteal atrophy and alteration of the Achilles reflex, paresthesia on the affected side and compromising functional capacity, such as walking. According to Vicente et al. (2007) began a study with 20 adult cadavers of both sexes, in which the sciatic nerve and piriformis muscle were dissected, measured and photo-documented. In 85% of cases, there was a non-variant anatomical relationship between the sciatic nerve and the piriformis muscle, in which the sciatic nerve emerged in the gluteal region as a single branch passing through the inferior border of the piriformis muscle, in 15% a variant relationship in which the nerve emerged in the gluteal region divided with the common fibular portion, which crosses the piriformis muscle and the tibial portion passing through the inferior border of the muscle.

The piriform nerve is often pierced by branches of the sacral plexus and those that form the sciatic nerve. This relationship shows that individuals who practice sporting activities that require excessive use of the gluteal muscles or in patients with some postural alteration located in the lumbar region and pelvic girdle are more exposed to acquiring this

nerve compression syndrome, since hypertrophy and shortening of this piriformis muscle lead to pressure on the sciatic nerve (VICENTE et al., 2007). The diagnosis of Piriformis Syndrome is problematic to define in the face of various evidence about the source of the pain, due to the similarity of symptoms with other pathologies, such as disc herniation, lumbar canal stenosis, and neurogenic pain, among others. Therefore, a detailed assessment of the patient is essential for diagnosis (SANTOS, OLIVEIRA & PEREIRA., 2019).

## BACKGROUND

Piriformis syndrome is often misunderstood and underdiagnosed in clinical practice, which can result in prolonged periods of disability and pain in patients, as well as inadequate treatment. In addition, there are other conditions that have symptoms that are similar to piriformis syndrome, which delays diagnosis and the therapeutic plan for effective treatment. Therefore, it is extremely important to raise awareness of this syndrome, highlighting its clinical importance with clear guidelines to define a diagnosis, the appropriate therapeutic plan, and know the anatomical structure, as Aragão et.al., (2022) highlighted the importance of knowledge of anatomical variations by the professional for more effective intervention, diagnosis and treatment of Piriformis Syndrome. They also discussed the most common morphological type of sciatic nerve which compresses the piriformis muscle, causing the condition.

This article sought to fill knowledge gaps with a comprehensive overview of piriformis syndrome and therapeutic plans, as well as associating massage with rehabilitation exercises for the treatment and prevention of piriformis syndrome, according to the authors Almeida, Dumas & Mello (2014), who, in their research results, carried out an exercise program for runners, in which they affirmed the importance of physiotherapy in the treatment of piriformis syndrome, highlighting the extreme importance of physiotherapy for the treatment of the syndrome, a pathology that results in lumbar and ischial pain. Physiotherapy treatment includes strengthening exercises, muscle stretching and manipulation to relieve the compression caused by the sciatic nerve, mobilization techniques and postural re-education, says (DAMASCENO & MALTA., 2022).

## THEORETICAL FRAMEWORK

The theoretical framework for this article was formatted as a systematic review. Each subtopic was summarized from scientific articles, each with different perspectives on Piriformis Syndrome. Ten main topics have been selected below, covering the subject from the perspectives and contributions of the selected authors:

SÍNDROME DO PIRIFORME: ESTADO DA ARTE

According to Santos, Oliveira & Pereira (2018), low back pain can be associated with herniated discs, but in some cases, this pain is caused by piriformis syndrome. In addition, the authors pointed out the need for new studies on this syndrome, studies that present risk and epidemiological factors in order to carry out an appropriate therapeutic plan that meets the needs of the affected patient:

> "There is still a need for prospective and randomized studies on aspects of the syndrome that have not yet been clarified, such as diagnostic criteria that support a gold standard. Conservative treatment has been the first option and shows satisfactory results, with surgical treatment being an exception (SANTOS, OLIVEIRA & PEREIRA 2018)."

This study also showed the fundamental importance of a multidisciplinary approach to patient rehabilitation.

**ANATOMICAL VARIATIONS OF THE SCIATIC NERVE ASSOCIATED WITH THE PIRIFORMIS MUSCLE IN FETUSES AND CHILDREN UP TO 1 YEAR OF POSTNATAL LIFE**

Knowledge of the anatomical variations of the sciatic nerve is important in order to carry out a proper assessment of motor disorders caused by compression or lesions of the peripheral nerves, as well as proper planning for surgical approaches (GRECO et al., 2017).

**ANATOMICAL VARIATION OF THE PIRIFORMIS MUSCLE AS A CAUSE OF DEEP GLUTEAL PAIN: DIAGNOSIS BY MRI NEUROGRAPHY AND ITS TREATMENT.**

Anatomical variations between the piriformis muscle and the sciatic nerve are related to the appearance of piriformis syndrome, which causes motor, trophic and sensory disturbances in the sciatic nerve. According to research, the prevalence of this syndrome in the population is only 6%, and it is more common among women than men (POLESELLO 2013).

**PHYSIOTHERAPY IN PIRIFORMIS MUSCLE SYNDROME: A LITERATURE REVIEW.**

According to Schmitt & Hahn (2013), it is important for physiotherapists to know the anatomical changes between the sciatic nerve and the piriformis muscle in order to

differentiate between the symptoms of piriformis syndrome and herniated discs for a proper diagnosis. In addition, the study presented therapies that can complement treatment, such as shiatsu and acupuncture.

**PIRIFORMIS SYNDROME: DIAGNOSIS AND TREATMENT: A RETROSPECTIVE STUDY.**

Loures et al. (2022) stated that in the presence of continuous or intermittent sciatic pain without signs of radicular manifestations or lumbar disc herniation, piriformis syndrome should be considered as a possible clinical diagnosis and exclusion.

**PIRIFORMIS SYNDROME, LOW BACK PAIN OR LUMBOSCIATALGIA: IS THERE A DIFFERENCE?**

According to Abreu et al. (2015), they concluded that piriformis syndrome is rare and has no clear cause, and its clinical diagnosis is controversial even with complementary tests. The anatomical variations of the sciatic nerve in relation to the piriformis muscle may not be the only cause. A detailed anamnesis, thorough physical examination, physiotherapeutic tests and complementary exams are recommended for an accurate diagnosis. Furthermore, research is suggested to clarify the etiology, symptomatology and differential diagnosis of these conditions.

**ANALYSIS OF THE EFFECTS OF AN EXERCISE PROGRAM ASSOCIATED WITH MASSAGE AS PREVENTIVE MEASURE FOR PIRIFORMIS SYNDROME IN LONG-DISTANCE RUNNERS**

According to Almeida, Dumas & Mello (2014), an exercise program associated with massage improves athletes' performance. This program restored hip range of motion and spinal flexibility, preventing piriformis syndrome, which affects many long-distance runners, and reducing the dropout rate due to musculoskeletal injuries.

**KINESIOTHERAPY IN PIRIFORMIS SYNDROME**

In a historical summary, the first to describe the piriformis muscle was Yeoman in 1928 as a factor in lumbosciatalgia and sciatica. In 1947 Robinson characterized the compression of the sciatic nerve by the Piriformis muscle, thus calling it piriformis syndrome. Compression can occur due to a number of factors, including contractures or hypertrophy of the Piriformis muscle, trauma, presenting clinical signs and symptoms such as pain in the gluteal region, paresthesia radiating to the thigh and leg, as well as pain on palpation (DAMASCENO & MALTA 2022). They also concluded that piriformis syndrome is caused by two main factors, pressure and tension. Pain is conducted by nerve fibers, and pressure on the nerve root, nerve endings and trunk can be caused by adjacent structures, with the

muscle tensed, causing piriformis syndrome, which causes nerve irritation by tensing the muscle (DAMASCENO & MALTA 2022).

## CONTRIBUTION TO THE ANATOMICAL KNOWLEDGE OF PIRIFORMIS MUSCLE SYNDROME

According to Cunha *et al*., (2008) stated that a detailed understanding of the anatomy of the sciatic nerve, its variations, path and relationship with the piriformis muscle is crucial. This knowledge allows for a proper clinical diagnosis, based on the morphological and metric data obtained in the research.

## PIRIFORMIS SYNDROME: A CAUSE OF SCIATICA

Both authors Oliveira & Carmezim (2019) stated that piriformis syndrome is a neuromuscular pathology, responsible for around 6% of sciatica cases. Therefore, the aim of the study was to provide information to help family doctors recognize the typical symptoms and signs of the syndrome, enabling an appropriate and timely approach.

The 10 subtopics in this section form the basis of this article's theoretical framework, highlighting research on the subject of Piriformis Syndrome and assessment and rehabilitation methods. The national studies selected offered a unique perspective, together with international studies, which were cited in the results and discussions, contributing to an understanding of the subject.

## MATERIALS AND METHODS

This topic presents the procedures and methods adopted to carry out this systematic review on the subject of Differential Diagnosis and Physiotherapeutic Treatment of Piriformis Syndrome: A Systematic Review. The methodology presented below was designed to guarantee the veracity, rigor and validity of the study.

### Definition of inclusion and exclusion criteria

The analysis of the articles consisted of a careful definition of inclusion and exclusion. Only relevant studies that addressed the proposed theme The Differential Diagnosis and Physiotherapeutic Treatment of Piriformis Syndrome: A Systematic Review were considered, taking into account the 4 pillars of research observed in articles published in indexed scientific journals, theses, dissertations, and the justification section, as well as other

documents relevant to the research. Papers that were not available in full, did not have a clear methodology and did not address the subject were excluded from the research.

**Systematic Literature Search**

The systematic literature search was based on scientific data from recognized scientific journals such as Scielo Brasil, PubMed and Google Scholar. The papers used included terms related to piriformis syndrome, physiotherapy and the therapeutic plan for treating the syndrome. The selection of articles followed previously established research protocols, with the aim of covering relevant scientific research in the field of physiotherapy.

**Study selection**

After analyzing the inclusion and exclusion criteria for the articles, the selected studies were analyzed in more detail. In order to assess the veracity, quality and consistency of the information and evidence presented in each article, information such as authors, methodology applied, results presented and conclusions were recorded, as well as the year of publication, thus ensuring the reliability of the data presented.

**Synthesis of Results and Preparation of the Systematic Review**

Based on the data collection, the results found in the selected articles were produced, which involved integrating and comparing the information obtained, allowing for divergences, identification of patterns and gaps in the literature. Based on the analysis obtained, this systematic review was drawn up, and structured according to the objectives of this review. The methodology used to conduct this systematic review was The Differential Diagnosis and Physiotherapeutic Treatment of Piriformis Syndrome: A Systematic Review. The systematic approach of this study aimed to affirm the validity and reliability of the results obtained, thus contributing to a detailed understanding of the subject, and underpinning the results presented throughout the article.

**RESULTS**

Forty-two studies were found using the expression Piriformis Syndrome on Google Scholar, the PubMed Portal and the Scielo Brasil databases. Of the 42 studies, 17 were related to Google Scholar, 15 to PubMed and 10 to Scielo Brasil. Full reading criteria were

established for the selected articles, which were published between 2007 and 2023 and dealt with the topic of Piriformis Syndrome. After a detailed analysis of these studies with the application of exclusion criteria, 8 articles were selected from Google Scholar, 4 from Scielo Brazil, 3 from PubMed, totaling 14 articles of interest. The methodology used included 6 cross-sectional quantitative studies, 5 non-randomized controlled studies, 2 case studies and 1 literature review (see Table 1). Furthermore, this study found a concentration of research on Piriformis Syndrome in the Southeast (7), Northeast (3), Midwest (2), South (2) and (1) international regions published in São Teotóneo in Portugal. It was also observed that most of the studies of publications related to the topic occurred in the years 2007 (1), 2008 (1), 2013 (2), 2014 (1), 2015 (1), 2016 (1), 2017 (1), 2019 (2), 2021 (1), 2022 (3) and 2023 (1), as shown in Table 1 below:

Table 1. Presentation of scientific publications on Piriformis Syndrome with authors' names, years of publication, journal names, methodological approaches and main findings.

| AUTHOR | YEAR | SOURCE | TYPE OF PUBLICATION | STUDY SITE | RELATIONSHIP WITH THE RESEARCH OBJECTIVES | METHODOLOGICAL APPROACH | MAIN FINDINGS |
|---|---|---|---|---|---|---|---|
| Cunha *et al* | (2008) | Jundiai Medical School | Article | São Paulo | Yes | Quantitative cross-sectional study | The main results obtained in this study showed that the sciatic nerve was located inferiorly to the piriformis muscle, bifurcating in the middle third of the thigh into the common tibial and fibular branches. |
| Poselho *et al* | (2013) | Brazilian Journal of Orthopaedics | Article | São Paulo | Yes | Quantitative cross-sectional study | This study presented a case of a 42-year-old patient with a 17-year history of left-sided lumbosciatica. This study identified the presence of an anatomical variation between the piriformis muscle and the sciatic nerve. |
| Schmit & Hahn | (2013) | UNINGÁ Magazine | Article | Rio Grande do Sul | Yes | Literature Review | This article affirms the importance of anatomical knowledge in diagnosis, since knowing and differentiating a herniated lumbar disc from a case of piriformis syndrome is fundamental for diagnosis, as is differentiating the anatomical alterations between the piriformis muscle and the sciatic nerve. |
| Ameida; Dumas & Mello | (2014) | Health Sciences Journal | Article | Brasília | Yes | Non-Randomized Controlled Study | This article has highlighted the importance of a sports physiotherapist in athletics teams. |

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|---|---|---|---|---|---|---|---|
| Abreu *et al* | (2015) | Scientific Station Magazine | Article | Minas Gerais | Yes | Quantitative cross-sectional study | In this study, the author stated that Piriformis Syndrome is one of the etiological factors of lumbocitalgia. |
| Baretta *et al* | (2016) | State University of Western Paran á | Article | Paraná | Yes | Quantitative cross-sectional study | This article stated that neural mobilization with nerve compression has beneficial effects on muscle function and trophism. |
| Greco *et al* | (2017) | São Camilo University Center | Book Chapter | São Paulo | Yes | Non-Randomized Controlled Study | The article stated the importance of knowing the anatomical variations of the sciatic nerve and the piriformis muscle, with the aim of describing these structures in human cadavers, in order to understand the nature of patients' sciatic pain by observing alterations in these structures. |
| Santos; 0liveira & Pereira | (2019) | Brazilian Journal of Neurosurgery | Article | Sergipe | Yes | Quantitative cross-sectional study | This study stated that low back pain is related to lumbar disc herniation, but that it can also be caused by piriformis syndrome. |
| Oliveira & Carmezim | (2019) | Tondela-Viseu Hospital Center | Article | São Teotónio - Portugal | Yes | Case Study | A case study was carried out in this article on a 68-year-old patient who had a history of hypertension and gonarthrosis. A physical examination revealed evidence of piriformis syndrome. And this article affirms the importance of early diagnosis of the syndrome for treatment. |
| Filho; Ferreira & Ventura | (2021) | Versailles Communication | Article | Goiânia | Yes | Non-Randomized Controlled Study | This study points out the important measures for the treatment of Piriformis Syndrome, among which the main ones were: Acupuncture, Neural Mobilization, Psychotherapy, Kinesiotherapy, Massage Therapy, Muscle |

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|---|---|---|---|---|---|---|---|
| | | | | | | | Relaxants, among other measures that help immensely in the treatment of the syndrome.. |
| Aragão *et al* | (2022) | Scientific Digital Publishing | Book Chapter | Sergipe | Yes | Non-Randomized Controlled Study | This study affirms the importance of knowing the anatomical variations for the diagnosis of piriformis syndrome. |
| Damasceno & Malta | (2022) | Ibero Magazine | Article | São Paulo | Yes | Quantitative cross-sectional study | The authors of this article pointed out various types of treatment for piriformis syndrome, including: The correction of biomechanical factors, kinesiotherapy, drawing up a program of home stretching exercises to collaborate with therapeutic treatment, in some cases the use of steroid and anesthetic injections, and surgical procedures. |
| Loures *et al* | (2022) | Oriental Article Magazine | Article | Minas Gerais | Yes | Quantitative cross-sectional study | This article has shown the types of pathologies and injuries that can contribute to piriformis syndrome, including continuous or intermittent sciatica and herniated lumbar discs. |
| Medeiros *et al* | (2023) | Federal University of Sergipe | Book Chapter | Sergipe | Yes | on-Randomized Controlled Study | This research stated that piriformis syndrome causes deep gluteal pain, which consists of secondary sciatica, evolving into an abnormal condition of the piriformis muscle. |

**Source:** Prepared by the authors (2024).

According to Table 1, knowledge of the anatomical variations of the piriformis muscle and the sciatic nerve is extremely important to describe these structures in human cadavers, to understand what causes the nature of sciatica, observing changes in these anatomical structures (GRECO et al., 2017). In addition, anatomical knowledge is important for diagnosis, to differentiate a herniated lumbar disc, and anatomical changes between the piriformis muscle and the sciatic nerve, according to the authors (SCHMIT & HAHN 2013). And among the studies researched, one article presented a case study of a 42-year-old patient with a history of left-sided lumbocitalgia for 17 years, so in this study, the presence of anatomical variation between the sciatic nerve and the piriformis muscle was identified, says Poselho et al. (2013), so these studies confirm the importance of anatomical knowledge for the diagnosis and treatment of piriformis syndrome.



## DISCUSSION

An analysis of the topic of piriformis syndrome was carried out for the discussion of this article, addressing the diagnosis of the syndrome, and also highlighting the importance of treatment and rehabilitation methods.

### Differential Diagnosis of Piriformis Syndrome

A thorough physical assessment of the patient is essential for an accurate diagnosis. The first step in the assessment is to see if there is any trauma to the buttocks or the presence of intestinal or bladder alterations. The second step is to carry out a physical examination of the musculoskeletal system, looking at the lumbar spine, pelvis, sacrum and the length of the legs, as well as a neurological examination and diagnostic tests. Other pathologies included in the differential diagnosis include facet syndrome, lumbar canal stenosis, trochanteric arthritis and bursitis, sacroiliac junction dysfunction, myofascial pain syndrome, endometriosis, degenerative disc disease, compressive fracture and sacroiliitis. Therefore, the physiotherapeutic assessment assists in a final diagnosis, excluding the possibility of diseases that have similar symptoms (SANTOS, OLIVEIRA & PEREIRA., 2019).

### Main Treatment Methods for Piriformis Syndrome

The main method of treatment is physiotherapy, which involves manipulation techniques, postural re-education, classic kinesiotherapy, as well as stretching exercises for the piriformis muscle, which should be performed daily by the patient, with the aim of

promoting nerve decompression. However, kinesiotherapy cannot be applied in the acute phase of the syndrome, thus respecting the patient's pain threshold (BARETA et al. 2016).

Active kinesiotherapy, passive stretching, proprioceptive neuromuscular facilitation and soft tissue mobilization help to control the symptoms of the syndrome and improve range of motion. In addition to these methods, resting the muscles is useful for rehabilitation, as is the use of therapeutic resources such as electrotherapy and thermotherapy. Both methods help to reduce pain, increase muscle flexibility and increase the mobility of the sacroiliac and lumbar joints Bareta et al. (2016). The rehabilitation of piriformis syndrome involves correcting the biomechanical factors that caused the syndrome. And in some cases, treatment involves neural mobilization acting on muscle trophism which promotes beneficial effects on muscle function Bareta et al. (2016). Local injections of anesthetics and steroids are also alternative treatments, and in more serious situations, surgical exploration of the sciatic nerve is performed (BARETA et al., 2016).

It is worth mentioning that there are several other therapies that can add to the treatment of piriformis syndrome, such as Acupuncture which is an ancient Chinese technique, when used to treat piriformis syndrome can help relax tense muscles, improve blood circulation and reduce sciatic nerve pain, say the authors (FILHO; FERREIRA & VENTURA., 2021). Massage therapy can also be an effective approach to help treat piriformis syndrome. This method involves different massage techniques to improve blood circulation, and release tension in the piriformis muscle and surrounding tissues, thus relieving pressure on the sciatic nerve, reducing pain, and generating relaxation and well-being (FILHO; FERREIRA & VENTURA., 2021). Muscle relaxants may also be prescribed to aid treatment, as these medications help relax muscles, reducing stiffness and pain. By relaxing muscles, muscle relaxants relieve pressure on the sciatic nerve, which provides temporary relief of symptoms. Psychotherapy also plays an important role in managing chronic pain. Chronic pain can affect a patient's emotional and mental well-being, causing symptoms of anxiety, stress and depression. However, it varies from case to case, and based on the patient's assessment, the techniques that will be adopted for treatment will be defined (FILHO; FERREIRA & VENTURA., 2021).

## CONCLUSION

Piriformis syndrome significantly affects people's quality of life. However, an accurate diagnosis, which excludes possible diseases with similar symptoms, is essential for the treatment of this syndrome. The therapeutic plan includes various therapeutic approaches available to help alleviate and treat symptoms, promoting patients' well-being. From physical

interventions, such as physiotherapy and massage therapy, to electrotherapy and muscle relaxants, these therapeutic approaches can play an important role in the patient's rehabilitation. In addition, other complementary approaches that can be useful for physical and emotional rehabilitation have been pointed out, such as acupuncture and psychotherapy. With a comprehensive and effective approach, it is possible to successfully treat the symptoms of piriformis syndrome, providing a better quality of life for patients.

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