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Update Article

Epidemiological Analysis of 245 Patients with Athletic Pubalgia*

Análise epidemiológica de 245 pacientes com pubalgia atlética

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Abstract

Objective To analyze the clinicoepidemiological characteristics of pubalgia in athletes and to define the epidemiological profile of patients complaining of lower abdomen and groin pain at a specialized center.

Methodology We conducted a retrospective study based on a case series to evaluate the epidemiological profile of 245 athletes with pubalgia reported in their medical records from October 2015 to February 2018. The selected sample underwent a clinical evaluation, and the results were recorded through the application of a questionnaire.

Results The sample consisted of 245 patients aged between 14 and 75 years. Soccer and running were the most prevalent sports. Most subjects (58%) trained or played sports 3 or more days a week. After evaluating specific sports movements, symptoms worsened in 24% of the patients when changing direction; in 23%, when kicking; in 22%, during sprints and speed training; in 17%, during long runs; and in 14%, when jumping. Pain during intercourse was reported by 13% of the patients. For most subjects (80%), the inguinal region, the adductor muscles, and the pubis (midline) were the main pain sites. The tests involving adductor contraction against resistance with an extended knee was positive in 77.6% of the patients, and the one involving simultaneous hip and abdomen flexion against resistance was positive in 76.7% of the sample.

Keywords
- sports
- epidemiology
- inguinal
- hernia
- pubalgia
- athletic injuries

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Conclusion The present study has demonstrated the predominance of pubalgia in male patients who play soccer and practice running. In most cases (80%), pain occurred in the inguinal region, the adductor muscles, and the pubis. Confirmation of the clinical diagnosis took more than six months for most patients.

Resumo

Objetivo Analisar as características clínico-epidemiológicas da pubalgia do atleta, e definir o perfil epidemiológico dos pacientes com queixa de dor na região baixa do abdômen e virilha avaliados em um centro especializado.

Metodologia Realizou-se um estudo retrospectivo de uma série de casos, no qual se avaliou o perfil epidemiológico de 245 pacientes esportistas com pubalgia, registrados em prontuário, entre outubro de 2015 e fevereiro de 2018. A amostra selecionada foi submetida a uma avaliação clínica, e os resultados foram documentados a partir da aplicação de um questionário.

Resultados A amostra estudada foi de 245 pacientes com idades que variavam entre 14 e 75 anos. O futebol e a corrida foram os esportes mais prevalentes, e 58% treinavam ou praticavam esporte 3 ou mais dias por semana. Após a avaliação dos movimentos esportivos específicos, foi observada piora dos sintomas em 24% com a troca de direção; em 23%, nos chutes; em 22%, nos *sprints* e treinos de velocidade; em 17%, nas corridas longas; e em 14%, nos saltos. Dor durante o ato sexual foi relatado em 13% dos pacientes. A maior parte dos pacientes (80%) relatou que a região inguinal, os adutores e o púbis (linha média) eram os principais sítios da dor. O teste de contração dos adutores contra resistência com joelho em extensão foi positivo em 77,6% dos pacientes avaliados, e o teste de Flexão simultânea do Quadril + Abdômen contra resistência foi positivo em 76.7% dos pacientes.

Conclusão O presente estudo demonstrou o predomínio dessa lesão nos pacientes do sexo masculino praticantes de futebol e de corrida. A dor, na maioria dos casos (80%), estava presente na região inguinal, nos adutores e no púbis. A maioria dos pacientes demorou mais de seis meses para ter o diagnóstico clínico confirmado.

Palavras-chave
- esportes
- epidemiologia
- hérnia
- inguinal
- pubalgia
- lesões em atletas

Introduction

Pubalgia refers to lower abdominal and inguinal pain involving the pubic bones, the pubic symphysis, and adjacent structures. The condition may be associated with systemic inflammatory diseases or genital and urinary infections.[1]

This type of pain is frequent in athletes, especially those of sports that demand intense and multidirectional muscle contractions.[2] Pubalgia is reported in approximately 6% of all chronic injuries related to sports.[3,4] According to Brunt and Barile[5] (2013), its diagnosis and management are always challenging, as symptoms are insidious and diffuse in a complex anatomical region, and multiple causes can coexist.

The pubis functions as a fulcrum for several movements, and adjacent muscles provide dynamic stability. Falvey et al.[6] (2009) have described the groin triangle in layers, from the superficial to the deepest, and the structures that can cause pain in the region. Regarding anatomical aspects, Meyers et al.[7] (2005) have described the concept of macro-joints (lumbosacral, sacrococcygeal, sacroiliac, and pubic symphysis) and micro-joints (muscle attachments, including the psoas and adductor muscles).

There are four main groups of causes of chronic groin and pubic pain: pubalgia, adductor muscle dysfunction, hip joint conditions, and osteitis pubis. In athletes, pubalgia is the weakening of the posterior wall of the inguinal canal with dilation of the transverse fascia and widening of the inguinal triangle.[8]

The main mechanism of injury is trunk hyperextension, thigh hyperabduction, and an imbalance between the strong thigh adductors and weak lower abdominal muscles. This creates a shear force in the pubic symphysis. The incidence of pubalgia is higher among football, rugby, and hockey players.[8]

Today, three major theories describe the pathophysiological aspects of athletic pubalgia. The first theory suggests that the main cause of the condition is ilioinguinal or iliohypogastric nerve entrapment by the external oblique muscle, causing a slightly more proximal pain.[9,10] The second theory states that pubalgia is due to a weakness in the posterior abdominal wall, with compression of the genitofemoral nerve by the pseudoherniated bulb.[8] Finally, the third theory suggests a muscle imbalance due to a precursor lesion in the adductor musculature increasing the pressure in the adductor compartment. This results in macro or microscopic lesions in the pubic attachments close to the pubic cartilage plate.[11]

Athletic pubalgia is diagnosed based on the clinical complaint, physical examination findings, and imaging tests,

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such as radiography, magnetic resonance imaging, and ultrasound.[12,13]

The initial treatment is conservative, with rest, analgesic and anti-inflammatory drugs, and physical therapy. Surgical treatment is indicated for refractory cases.[8]

The present paper describes the epidemiological profile of athletic pubalgia at a reference center for the care and treatment of athletes. In addition, it aims to establish links with age group, gender, the type and level of sport, training frequency, characteristics, time until diagnosis, location of symptoms, and the semiological tests and maneuvers more frequently used.

Materials and methods

The present is a retrospective study based on case series that was conducted after obtaining approval from the institutional Research Ethics Committee (under opinion number 2.925.919). We reviewed medical records of patients with lower abdominal and inguinal pain regardless of gender, age, the type of sport, the frequency of the training, the time elapsed since the onset of symptoms, and previous follow-ups with a specialist from October 2015 to February 2018.

Patients diagnosed with prostatitis, urinary tract infection, varicocele, ovarian cyst, endometriosis, appendicitis, diverticulitis, adhesions, overactive bladder syndrome, and those surgically treated for athletic pubalgia were excluded from the study.

All 245 participants underwent a clinical evaluation with the application of a direct, specific questionnaire (►**Figure 1**), as well as a physical evaluation (►**Figure 2A-J**).

The routine physical examination consisted of the provocative tests shown in ►**Figure 2**. We categorized age into groups and expressed the characteristics as frequencies and proportions (%). Data comparison used the Fisher exact test. The statistical analysis was performed using the R (R Foundation for Statistical Computing, Vienna, Austria) software, version 3.6.1. Values of $p < 0.05$ were considered statistically significant.

Results

Epidemiological profile of the patient with athletic pubalgia

This case series comprised 245 participants, 29 women and 216 men, with ages between 14 and 75 years. Most of the participating athletes were Brazilian citizens from 21 different states (Acre, Amazonas, Bahia, Ceará, Distrito Federal, Espírito Santo, Goiás, Maranhão, Minas Gerais, Mato Grosso, Pará, Pernambuco, Paraná, Rio de Janeiro, Rio Grande do Norte, Rondônia, Roraima, Rio Grande do Sul, Santa Catarina, Sergipe, and São Paulo). And four athletes were foreigners (from Angola, Guinea, France, and Portugal).

A total of 44 participants were professional athletes, 19 practiced sports at the university/school level, and 182 played recreationally. Acute pain was reported by 36 participants. After the medical evaluations, 23 participants had indications for surgical procedures to mitigate their symptoms.

Distribution of sports practiced by athletes with pubalgia

The participants practiced 25 different types of sports (►**Figure 3**), and 3 stood out as the most common among participants, either as the main or as secondary activities. The most prevalent primary sport was soccer (N = 148), followed by running (N = 81) and gym workout (N = 70).

Soccer was the main sport for 129 participants, followed by running and gym workout, with 43 and 16 subjects respectively. Altogether, these 3 sports accounted for 76.7% of the sample (188 of 245). The 3 modalities most selected as secondary or auxiliary sports were gym workout (N = 54), running (N = 38), and soccer (N = 19), regardless of the primary modality. Most (66.1%; 111 out of 168) athletes with pubalgia selected these 3 modalities as secondary sports.

Most participants who primarily played soccer also practiced gym workouts (N = 32) and running (N = 22) as secondary modalities (►**Figure 4A**). Gym workout and running were the secondary sports for 66.7% of the participants (54 out of 81). Among the participants who primarily practiced running, the two sports most practiced as an auxiliary activity were gym workout (N = 9) and soccer (N = 8) (►**Figure 4B**), accounting for up to 58.6% of secondary sports (17 out of 29). Among those who primarily practiced gym workouts, running (N = 5) and soccer (N = 3) were the secondary activities, representing 57.1% of the secondary sports practiced by these athletes (8 out of 14).

Evaluation of physical examinations

►**Table 1** shows the results of the physical examination and provocative tests. The test of adductor contraction against resistance with an extended knee (EF4) was positive in 77.6% of the evaluated patients, followed by the test of simultaneous hip and abdominal flexion against resistance (EF2), which was positive in 76.7% of the patients. The hamstring flexibility test (EF9) showed the lowest sensitivity, since it was only positive in 29% of the patients.

Association with sport level, age, and time until diagnosis

Regarding the time elapsed until the diagnosis of pubalgia, 118 patients had their diagnoses established in less than 90 days since the onset of pain, including 20 professional athletes, 88 recreational athletes, and 10 university athletes (►**Table 2**). Diagnostic confirmation occurred after 90 days for 127 patients (24 professional, 94 recreational, and 9 university athletes). The age range between 25 and 40 years predominated in both groups.

Considering the 3 main sports (soccer, running, and gym workout) alone, the most affected age group was that between 25 and 40 years, corresponding to 57% of the total number of athletes evaluated. Regarding gender, there was a male predominance, representing 89% of the sample. As for physical conditioning, 75% of the subjects diagnosed with pubalgia practiced sports at a recreational level, while 18%

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Pubalgia

Name: _____ **Age:** _____ **Sex:** _____

Contact (email and mobile): _____

Main sport you practice: _____ Other sports: _____

Weekly frequency of training: _____ Location (gym/staff): _____

Level: Professional ( ) - University/school ( ) - Recreational ( )

Characteristic and history of pain: _____

_____

Time since onset of symptoms: _____ Acute onset or progressive worsening: _____

Time taken until diagnosis: _____

Number of doctors who sought to reach the Specialist: _____

Does it interfere with your sports performance? Yes ( ) ; No ( )

Feel the pain: Coughh ( ) ; Sneeze ( ) ; Sexual intercourse ( ) ; Sports ( ) ; Running ( ) ; Walking ( )

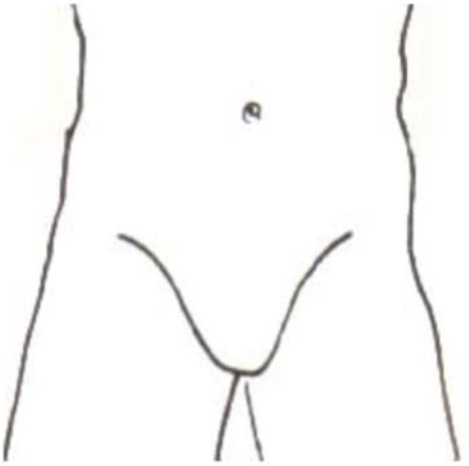
At rest: Pain improves ( ) ; The pain remains ( ) ; The pain gets worse ( )

In which sports movements do you perceive worsening: Change of direction ( ) ; Long runs ( )

"Shots" and speed drills ( ) ; Jumps ( ) ; Kicks ( )

Main sites of pain (mark in the figure):

(a) Pubis – midline;
(b) Periumbilical - superior;
(c) Inguinal region;
(d) Adductor region;
(e) Scrotal pouch;
(f) Lumbar spine - posterior;



( ) I authorize the use of the above data in the research "Epidemiological analysis of patients with Pubalgia in Brazil".

Signature: _____

Fig. 1 Model of the evaluation form/directed questionnaire.

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Fig. 2 Routine physical examination and provocative tests. (**A**) Orthostatic compression of the anterior compartment (EF1); (**B**) simultaneous hip and abdomen flexion against resistance (EF2); (**C**) adductor contraction against resistance with a flexed knee (EF3); (**D**) adductor contraction against resistance with an extended knee (EF4); (**E**) palpation of the inguinal ring (EF5); (**F**) palpation of the adductor attachment in the pubis (EF6); (**G**) palpation of the pubic body (EF7); (**H**) oblique muscle test against resistance (Grava maneuver) (EF8); (**I**) flexibility tests, especially for the hamstrings (EF9); (**J**) hip range of motion (EF10).

were professional athletes, and 7.4% were university athletes. ►**Table 3** shows these data.

Discussion

The present case series evaluated athletes with pubalgia who practiced 25 different sports, both as main or secondary activities. It is not surprising that soccer is the sport most played by patients treated for pubalgia globally. In the present study, however, the athletes who preferred soccer were not only more predominant, but also those who practiced other activities more often. The discrepancy in the choice of secondary activities is remarkable: 81 soccer players reported practicing secondary activities, while these numbers among athletes who practice running and gym workouts were considerably smaller (29 and 14, respectively).

Most of our patients (88.1%) were male, which is consistent with other studies.[14] It is believed that the gynecoid pelvis protects against lesions, probably because it provides a greater attachment area for the abdominal musculature, increasing the surface for force distribution.

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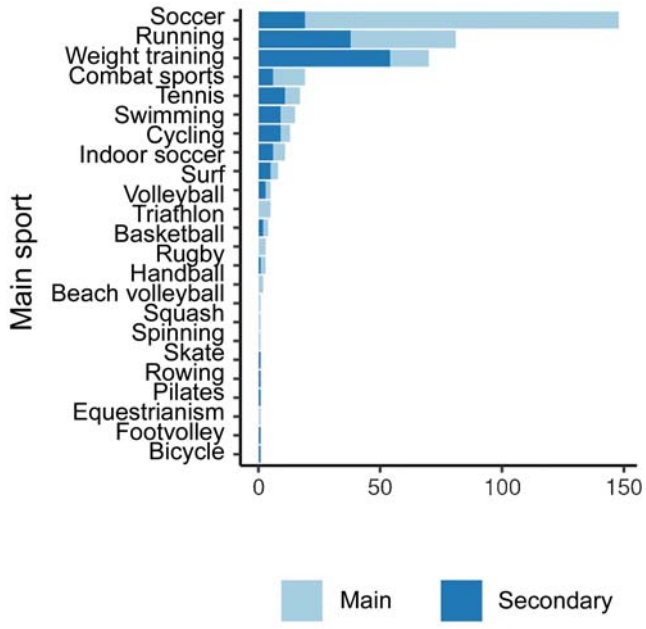


Fig. 3 Prevalence of sports among athletes with pubalgia.

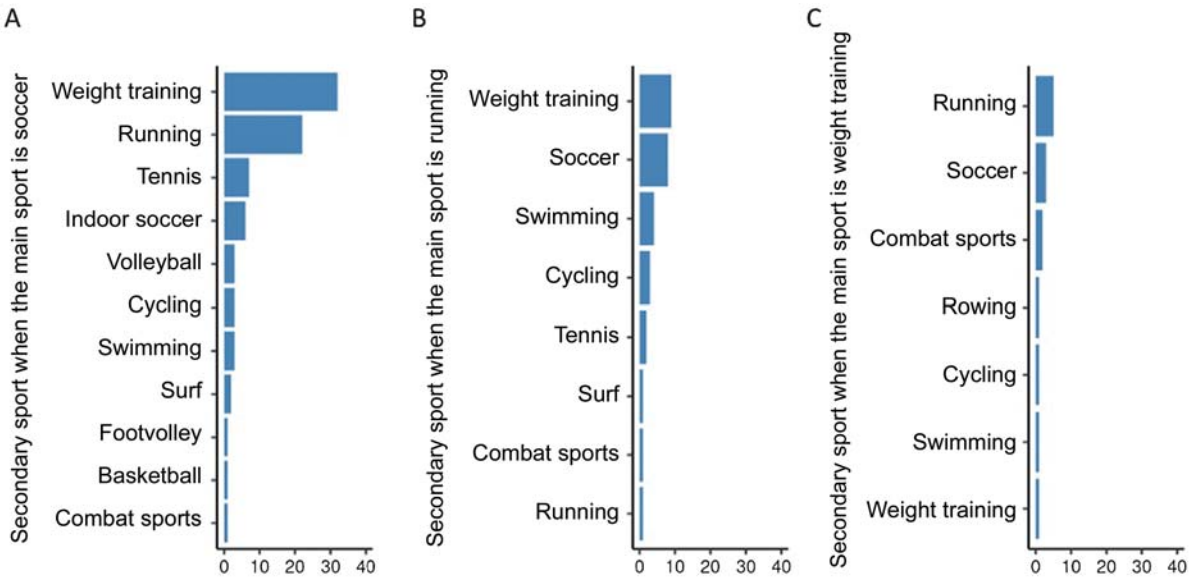


Fig. 4 Secondary sports practiced by the evaluated patients. (**A**) When the main sport evaluated is soccer; (**B**) When the main sport evaluated is running; (**C**) When the main sport evaluated is gym workouts.

In the first studies about pubalgia, virtually all patients were professional athletes. But this has gradually changed over the years, and now a significant number of recreational athletes comprise similar case series.[14] In the present study, 58% of the patients played sports 3 or more times a week.

According to Brunt and Barile[5] (2013), among professional athletes, football, soccer, and hockey account for more than 70% of the cases of pubalgia. In the present study, soccer (60%) and running (15%) were the most prevalent sports.

Soccer is usually the sport with the highest incidence of pubalgia, followed by rugby,[8] football, and ice hockey.[12,13] Regarding track and field, running is a sport with a low incidence of pubalgia if we compare data from Brazilian studies with that if other series; in the present study, its prevalence was of 15%.

Regarding the time since symptom onset until diagnosis, 55% of the subjects reported it was longer than 6 months, and 15%, longer than 12 months. The literature[3] reports that the mean time between symptom onset and the definitive

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Table 1 Evaluation of the frequency of response in the physical examinations (N = 245)

Physical examination	n (%)
EF1	77 (31.4)
EF2	188 (76.7)
EF3	166 (67.8)
EF4	190 (77.6)
EF5	153 (62.4)
EF6	102 (41.6)
EF7	168 (68.6)
EF8	71 (29.0)
EF9	37 (15.1)
EF10	120 (49.0)

Abbreviations: EF1, orthostatic compression of the anterior compartment; EF2, simultaneous hip and abdomen flexion against resistance; EF3, adductor contraction against resistance with a flexed knee; EF4, adductor contraction against resistance with an extended knee; EF5, palpation of the inguinal ring; EF6, palpation of the adductor attachment in the pubis; EF7, palpation of the pubic body; EF8, oblique muscle test against resistance (Grava maneuver); EF9, flexibility tests, especially for the hamstrings; EF10, hip range of motion.

diagnosis ranges from 1 to 53 months, with a median time of 6 months.

Regarding the characteristics of the pain, most patients reported symptom improvement at rest and worsening during the practice of sports, running, and walking. Another 13% had pain during sexual intercourse, 11%, when sneezing, and 8%, when coughing. As for specific sports movements, symptoms worsened when changing direction, during long runs, sprints and speed training, jumps, and kicks. Most patients referred pain in the inguinal region, adductor muscles, and pubis. Other affected sites were the lumbar spine, the proximal thigh, the

Table 2 Association of the physical examinations, sport level, and age, with the time until diagnosis

Physical examination	≤ 90 days; N = 118–n (%)	> 90 days; N = 127–n (%)	*p*-value[b]
EF1	33 (28%)	44 (35%)	0.27
EF2	94 (80%)	94 (74%)	0.36
EF3	83 (70%)	83 (65%)	0.42
EF4	93 (79%)	97 (76%)	0.76
EF5	72 (61%)	81 (64%)	0.69
EF6	44 (37%)	58 (46%)	0.20
EF7	76 (64%)	92 (72%)	0.22
EF8	36 (31%)	35 (28%)	0.67
EF9	13 (11%)	24 (19%)	0.11
EF10	59 (50%)	61 (48%)	0.80
Age			0.88
< 25 years old	20 (17%)	25 (20%)	
25-40 years old	70 (59%)	72 (57%)	
> 40 years old	28 (24%)	30 (24%)	
Sport level			0.88
Professional	20 (17%)	24 (19%)	
Recreational	88 (75%)	94 (74%)	
University/ School	10 (8.5%)	9 (7.1%)	

Abbreviations: EF1, orthostatic compression of the anterior compartment; EF2, simultaneous hip and abdomen flexion against resistance; EF3, adductor contraction against resistance with a flexed knee; EF4, adductor contraction against resistance with an extended knee; EF5, palpation of the inguinal ring; EF6, palpation of the adductor attachment in the pubis; EF7, palpation of the pubic body; EF8, oblique muscle test against resistance (Grava maneuver); EF9, flexibility tests, especially for the hamstrings; EF10, hip range of motion.
Note: [b]Fisher exact test.

Table 3 Association of the most prevalent sports with age group, gender, and sport level

Characteristics	Total; N = 188–n (%)	Soccer; N = 129–n (%)	Running; N = 43–n (%)	Gym workout; N = 16–n (%)	*p*-value[b]
Age					< 0.001
< 25 years old	38 (20%)	35 (27%)	2 (4.7%)	1 (6.2%)	
25-40 years old	108 (57%)	72 (56%)	24 (56%)	12 (75%)	
> 40 years old	42 (22%)	22 (17%)	17 (40%)	3 (19%)	
Gender					< 0.001
Female	21 (11%)	0 (0%)	15 (35%)	6 (38%)	
Male	167 (89%)	129 (100%)	28 (65%)	10 (62%)	
Sport level					0.034
Professional	33 (18%)	29 (22%)	2 (4.7%)	2 (12%)	
Recreational	141 (75%)	90 (70%)	39 (91%)	12 (75%)	
University/ School	14 (7.4%)	10 (7.8%)	2 (4.7%)	2 (12%)	

Note: [b]Fisher exact test.

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perineum, and the testes.[15] Patients from other countries also reported inguinal, adductor, and pubic pain.[14,16]

In the present study, the most prevalent positive clinical test was the adductor contraction against resistance with an extended knee, in 190 patients, followed by simultaneous unilateral hip and abdomen flexion against resistance, in 188 patients. This finding is consistent with those of the literature,[15] as muscle contraction in adduction against resistance, trunk flexion, and inguinal palpation were the most sensitive tests for the diagnosis of pubalgia. Although valuable for patient assessment, inguinal palpation relies on the experience of the examiner, especially their ability to differentiate pubalgia from inguinal and femoral hernias. Other findings described include tenderness in the conjoint tendon, pubic tubercle, and medial inguinal region.[12]

Conclusion

Most patients with suspected pubalgia are male young adults between the ages of 26 and 45 years, who practice soccer or running at a recreational level. They present symptoms that interfere with sports performance. Their pain improves with rest and worsens with exercises, sexual intercourse, sneezing, coughing, and specific sports movements, such as changing direction, sprints and speed training, jumping, and kicking. The pain was most prevalent in the inguinal region and the pubis. The most commonly positive pain-related clinical tests were adductor contraction against resistance with an extended knee and simultaneous unilateral hip and abdomen flexion against resistance. For some patients, the time from symptom onset until final diagnosis took more than 12 months.

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Conflict of Interests
The authors have no conflict of interests to declare.

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