Review Article

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Pathophysiology and classification of iliotibial friction injuries

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ABSTRACT

As a result of the frequent endurance sports that are being practiced nowadays, many techniques have been introduced to this field with favorable outcomes regarding to the management approaches of the different injuries. However, no previous investigations have adequately discussed the pathophysiology of iliotibial band friction syndrome (ITBS) based on recent evidence from the current studies in the literature. In the present investigation, we have discussed the pathophysiology and related classification of iliotibial band friction injuries based on the current studies in the literature. The current evidence about the pathophysiology of the condition is still controversial, although epidemiological investigations indicate that ITBS is becoming a more prevalent condition among runners and other endurance athletes. Furthermore, many factors can attribute to the development of the condition and have been reported to take essential roles in the pathophysiology of the disease. Some of these factors include gender, iliotibial band tightness, rearfoot eversion and weak hip abductors. Further investigations are still needed to completely understand the pathophysiology of the disease to help clinicians aim to achieve better interventions to enhance the outcome of practicing endurance and excessive exercises.

Keywords: Iliotibial band, Friction, Injury, Pathophysiology, Management, Diagnosis

INTRODUCTION

Overuse or traumatic injuries to the iliotibial band can cause significant morbidities and might limit the movements of the affected patients. In a previous investigation in the United States, it has been demonstrated that the prevalence of presentations to the emergency department secondary to acute knee injuries was found to be 2.29 per 1000 population.¹ Another investigation also suggested that around 50% of the patients with acute knee injuries will eventually have a magnetic resonance imaging

(MRI)-diagnosed injury to the iliotibial band.² Among the different injuries to the iliotibial band, iliotibial band friction syndrome (ITBS) is the most common condition.

ITBS is well known as an overuse injury. It usually affects long-distance runners and practitioners of endurance sports in general. Estimates show that the prevalence of the condition among cycling individuals has been estimated to be 15-24% as an overuse injury. Many etiological and risk factors have been involved in the pathogenesis of the condition. The main characteristic of the pathology is the

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repetitive friction of the iliotibial band and the underlying bursa that lies alongside the lateral femoral epicondyle. Estimates show that the condition is the most common etiology of pain in the lateral knee among runners. Furthermore, it has been demonstrated that among the different overuse injuries, around 5-14% of them are correlated with running.^{4,5} In 1975, the study by Renne was the first to describe the condition among marine individuals following the participation of excessive endurance exercises.⁶ As a result of the frequent endurance sports being practiced nowadays, many techniques have been introduced to this field with favorable outcomes. However, no previous investigations have adequately discussed the pathophysiology of the condition based on recent evidence from the current studies in the literature. Therefore, this study aims to discuss the classification and pathophysiology of iliotibial friction injuries.

METHODS

This literature review is based on an extensive literature search in Medline, Cochrane, and EMBASE databases which was performed on 4th September 2021 using the medical subject headings (MeSH) or a combination of all possible related terms. This was followed by the manual search for papers in Google Scholar while the reference lists of the initially included papers. Papers discussing the iliotibial friction injuries were screened for relevant information, with no limitation on date, language, age of participants, or publication type.

DISCUSSION

Repetitive friction of the iliotibial band can significantly lead to the development of iliotibial band syndrome. Pain is the main characteristic of the affected patients, and the condition usually affects long-distance runners and practitioners of endurance sports in general. Since the condition was first described, many theories emerged regarding the pathophysiology and mechanism to explain how iliotibial friction injuries develop. As a result of the repetitive movements of the knee for instance, during running repeated backward and forward shifting of the iliotibial band occurs over the underlying lateral femoral condyles.⁷ Accordingly, injury to the iliotibial band can easily develop as a consequence of the significant inflammation and friction to the band following the repetitive movements. However, more recent evidence has questioned the validity of this theory over time based on the recent advances in the field. According to some anatomical considerations of the iliotibial band that has been reported in a previous investigation by Fairclough et al, it has been reported that the anterior-posterior glide of the iliotibial band is impossible to occur, and the development of the friction syndrome cannot truly take place in this anatomical landmark. On the other hand, the authors reported that a repeated cycle of iliotibial band tightening could happen due to a potential anteriorposterior movement pattern. This has significantly been associated with repeated compression effects of the connective tissue that lies beneath the iliotibial band as a consequence of the repeated cycles of tightening over the lateral fascia. The explained anatomical considerations by the authors include an intramuscular septum that connects the iliotibial band with the linea aspera and the fact that the band is just a thickened zone of the underlying lateral fascia and not a distinct or true anatomical structure. Therefore, the previous theories about repetitive friction were controversial based on this updated evidence.

In a previous case report by Costa et al, the authors reported a case of a 28-year old runner that suffered from lateral knee pain. ⁹ The authors reported an underlying cyst huge cyst within the joint capsule of the affected knee. Another anatomical review of the same pathology was also provided by Nemeth and Sanders where the authors reported that the knee synovial capsule had a lateral extension similar to the pathology that was previously reported in the case by Costa and colleagues. 9,10 In another investigation by Hariri et al, the authors also questioned the previous theory about whether friction and subsequent inflammation is the main characteristic that leads to the development of ITBS.¹¹ The authors indicated that, following the surgical excision of an iliotibial band-related bursa, the symptoms of the ITBS were reportedly improved among their patients in their case series investigation.

In another context, in an MRI-based investigation, Isusi et al reported that no evidence for thickening or inflammation was noticed in the iliotibial band of their included patients. 12 Besides, the authors also reported that they did not recognize the presence of a bursa-like structure. On the other hand, they indicated the presence of subchondral osseous erosion and edema of the lateral condyle, in addition to significantly observed signal changes to the soft tissues underlying the iliotibial band based on MRI findings. Similar findings were also reported in the investigation by Nemeth and Sanders. 10 In the same context, the same findings were also reported in the study by Muhle et al as the authors indicated no apparent presence of a cyst, bursa, or a lateral recess concerning the iliotibial band among both cadavers and patients suffering from ITBS.¹³ On the other hand, the authors indicated that the MRI findings of these patients included a compartment-like structure concerning the iliotibial band that contained abnormalities that were diagnosed to be poorly defined signal intensities.

The differences in the pathophysiology of the ITBS might be attributable to the potential presence of different types of the condition. For instance, one type might be attributable to the potential compression of the connective tissues that lie under the iliotibial band and compromise the space between the knee line and lateral epicondyle, which develops secondary to the repetitive movements of the iliotibial band over this anatomical region. Another type might be attributable to the irritation and manipulation of an underlying bursa, cyst, or a lateral synovial recess. It should be noted that there is little evidence about any

potential changes that might affect the iliotibial band itself during any of the aforementioned theories. 14,15 Furthermore, it is also still controversial about the previous suggestion of whether anterior-posterior gliding of the iliotibial band occurs and takes place in the pathology of developing ITBS or not. Evidence also suggests that the different results might be attributable to the various symptom acuity among the different studies in the literature, which can be a limitation of some potential findings among some studies in the literature.16 For instance, it has been demonstrated that not having symptoms at the time when the study was conducted, the symptoms acuity might be different among the study groups, which might be attributed to the heterogeneous administration of compensatory mechanisms to avoid the development of certain symptoms (as pain) at the time when the injury was initially experienced.

Accordingly, analyzing the cause and effect relationship in these situations cannot be adequately established, especially when interpreting retrospective data. Within the stance phase of endurance activities, it has been observed that the hip adduction angles decrease among patients with a history of ITBS and others that did not develop any apparent symptoms. ^{17,18} Moreover, patients might develop a pattern of compensatory action to cope with the underlying pathology. ¹⁹

Many factors were reported to attribute to predispose to the development of ITBS among the different studies in the literature. Previous investigations have demonstrated the impact of gender on the pathophysiology for the development of ITBS. For instance, some studies reported that angles of internal knee rotations and hip adduction were significantly larger in the included females with ITBS as compared to the healthy controls. ^{18,19} This has been explained by other investigations that suggested the overuse during endurance activities eccentrically on the hip abductor musculature as a result of the increased demand secondary to the increased angles at the knees and hips. ¹⁸⁻²⁰ Accordingly, it has been demonstrated that the development of these events can significantly lead to

compressing the iliotibial band against the lateral femoral condyle and the greater trochanter.²¹ Therefore, females are more likely to develop iliotibial friction injury-related symptoms than males. 22 On the other hand, another investigation by Grau et al. 23 demonstrated that hip abduction weakness was not significantly different in their population of 10 patients that suffered from ITBS as compared to the healthy controls. It is worth mentioning that the authors used a mechanically-stabilized dynamometer, instead of a hand-held one. Accordingly, further evidence is still needed to affirm the association between hip abductor weakness and the development of ITBS and iliotibial friction injuries as a result of the controversies in the current literature. 14 Another factor that might contribute to the development of ITBS would be having tight iliotibial bands since such structures can introduce more compression to the underlying structures, leading to a more significant impact and pathology. Evidence shows that using the Ober test is the most common approach to assess the tightness of the iliotibial band. This test has been adequately discussed elsewhere in a study by Gajdoski et al.²⁴ However, it should be noted that among the different studies in the literature about ITBS, not many of them have assessed the association between iliotibial tightness and the development of ITBS, whether by using the Ober test or any other assessment modality. Only an investigation by Devan et al reported that they found an association between the development of ITBS and having a positive Ober test in their included population of female athlete students.²⁵ Similarly, it has been reported that most athletes with ITBS usually suffer from tight iliotibial bands. However, clinical examination and Ober test might not be too sensitive to detect them in clinical settings, despite being widely used in such situations.¹⁴ On the other hand, another investigation demonstrated that increased strain was significantly associated with runners with ITBS, which was remarkably observed during running.²⁶ The increased strain of the iliotibial band might be attributable to the external load that overlies it during excess activities. Accordingly, further investigations might be needed for further verification of these findings.

Intrinsic	Extrinsic
Varus knee	High impact running styles
Internal tibial rotation	Training errors
Cavus-varus foot	Hill running
Femoral antetorsion	Insufficient muscle stretching
Knee lateral laxity	Bad or inadequate running shoes
Excessive foot pronation	Incorrect cleat pedal and saddle alignment
Hip abductors weakness	Cycling to running transition in triathlon
Lower leg discrepancies	

Figure 1: A summary of the different extrinsic and intrinsic factors that can attribute to the development of an iliotibial band friction injury. 30-32

Rearfoot eversion was also reported among studies in the literature to be a predictor for having different types of injuries to the lower extremities, including iliotibial friction injuries, as demonstrated by Busseuil et al that showed that overpronated athletes significantly developed these events.²⁷ On the other hand, other investigations indicated that these findings were contraindicated to theirs as they observed that athletes that were diagnosed with ITBS significantly had more decreased rearfoot pronation than the control groups of this study. 18,28 Increased internal rotation of the knee, increased landing forces, genu recurvatum, and reduced hamstring strength more than that of the quadriceps on the same side are also common factors that might attribute to the development of iliotibial band friction injuries, according to the different studies in the literature. 18,25,27,28 Figure 1 also shows a summary of the different extrinsic and intrinsic factors that can attribute to the development of an iliotibial band friction injury. It is worth mentioning that many other non-friction injuries can affect the iliotibial band and have been extensively discussed in another literature review.²⁹

CONCLUSION

The current evidence about the pathophysiology of the condition is still controversial, although epidemiological investigations indicate that ITBS is becoming a more prevalent condition among runners and other endurance athletes. Furthermore, many factors can attribute to the development of the condition and have been reported to take essential roles in the pathophysiology of the disease. Some of these factors include gender, iliotibial band tightness, rearfoot eversion, and weak hip abductors. Further investigations are still needed to completely understand the pathophysiology of the disease to help clinicians aim to achieve better interventions to enhance the outcome of practicing endurance and excessive exercises.

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