Diagnostic accuracy of referrals to a physical therapy department stating plantar fasciitis

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ABSTRACT

Background: Heel pain is one of the most common lower limb disorders seen by physical therapists. Heel pain is not always due to plantar fasciitis. It can be caused by a variety of soft tissue, osseous or systemic disorders. Inappropriate and untimely treatment secondary to misdiagnosis will lead to failure of conservative treatment and serious consequences. **Objective:** To determine the accuracy of referrals into a physical therapy department for management of "plantar fasciitis". Design: Cross sectional survey using an existing validated questionnaire and clinical assessment. Setting: Four community hospital clinics overseen by one physical therapy department. Participants: Forty-one subjects referred for management of "plantar fasciitis". Main outcome measures: Diagnosis at referral versus actual diagnosis. **Method:** A specialist clinician used a foot pain and symptom questionnaire and criterion based examination to assign a diagnosis of "plantar fasciitis", tibialis posterior tendon dysfunction "TPTD" or "other" to patients referred into the physical therapy department between November 2010 and March 2011 for management of "plantar fasciitis". Additional information including the referral source was obtained to allow targeted referrer education if a high incidence of misdiagnosis was identified. **Results:** Forty-one referrals were received from podiatrists, general practitioners (GPs), and orthopedic surgeons. Assessment revealed 26.8% (n=11) actually had plantar fasciitis, 26.8% (n=11) had TPTD and 46.3% (n=19) were categorized as "other". No statistically significant difference in diagnostic accuracy was found between referral sources at a p-value of 0.403. **Conclusion:** Whilst plantar fasciitis is a common cause of rear foot pain, careful consideration should be given to the differential diagnosis to ensure that appropriate treatment for alternative conditions is provided expediently.

Key Words:*Plantar fasciitis,plantar heel pain, Diagnostic accuracy.*

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INTRODUCTION

Almost 2 million working days were lost in the USA in 2008/09 due to lower limb musculoskeletal disorders [1]. Heel pain is one of the most common lower limb disorders seen by physical therapists [2]. It is estimated to affect around 10% of runners and a similar amount of the general population [3,4]. Plantar fasciitis (PF) can cause significant discomfort and disability [5] in the plantar surface of the heel and, though it is usually self-limiting, can last for months and even years in the worst cases [6]. Symptoms include pain and tenderness on the plantar surface of the heel on weight bearing [6].

Despite being a common problem, heel pain is not always due to plantar fasciitis. It can be caused by a variety of soft tissue, osseous or systemic disorders [5]. These includemusculoskeletal injury through exercise or activity such as tendinopathy of one of the tendons passing around the malleoli [7] or peripheral nerve pathology such as tarsal tunnel syndrome [8]. An important competing diagnosis to plantar fasciitis is tibialis posterior tendon dysfunction (TPTD).

There is anecdotal evidence to suggest that this condition is often mistaken for plantar fasciitis [9, 10]. Tibialis posterior tendon pathology has been cited as an important differential diagnosis to plantar fasciitis when a patient complains of medial heel pain [5, 10]. This may be because the tibialis posterior tendon passes through the medial flexor retinaculum [5] to the primary insertion on the navicular tuberosity [11], a location directly adjacent to the typical site of plantar fascial symptoms.

The tibialis posterior tendon is vulnerable to degenerative pathology [12], with suggested etiologies including systemic or local steroid use, hypertension [13], obesity [13] and previous trauma to the region [13, 14]. It has been reported that TPTD is known to be more common in women [14, 15] with an average age of onset of 40 [14] though it should not be

ruled out in other age groups [14].

Whilst a number of studies assert that misdiagnosis of TPTD is common [5,10,15,16] to our knowledge none directly investigated the frequency with which TPTD is mistaken for PF. Khols-Gatzulis et al. [15] suggested that patients who present with medial longitudinal arch structure damage as a cause of "acquired flat foot" (i.e. TPTD) are unlikely to get an early diagnosis and are often told they have an ankle sprain or osteoarthritis (OA) [15,17], although no data is provided to support this conclusion. Other differential diagnoses of PF have been suggested such as rear foot coalition, tibial spurring, tarsal tunnel syndrome, Baxter's neuritis, tenosynovitis of the tibialis posterior tendon, spring ligament injury, hind foot fracture and accessory navicular [17].

Many of these diagnoses, in common with TPTD, carry serious consequences and timely diagnosis is important.The consequences of defaulting to a diagnosis of plantar fasciitis can be illustratedby considering TPTD prognosis. Johnson and Strom [18] describe TPTD as progressive and classify it into stages from one to three, with a fourth stage later added by Meyerson et al. [19], ranging from pain-free mild weakness on single leg heel rises to tendon degeneration with fixed pesPlano valgus deformity with medial and lateral pain. Conservative intervention becomes more restricted and difficult with each stage [19]. Stage four occurs when degenerative changes are also present [15], which may require surgical arthrodesis [20].

Surgery incurs a variety of risks [21] including perioperative fracture, infection and neurological damage [22], and post-surgical rehabilitation is long and protracted [23], taking at least 5 weeks in plaster of Paris and a further 6 weeks in a CAM walker (walking boot) prior to functional rehabilitation. If awareness of TPTD was greater and diagnosis achieved earlier, extensive reconstructive surgical procedures, particularly those required for late stage cases, may be unnecessary or the number of procedures required may be reduced [18].The inherent disability [19] described, and lengthy rehabilitation [23]associated with the surgery that may ultimately be required, could be avoided reducing treatment costs. The code for this type of procedure ("Complex procedure to mid foot or hind foot without autogenous bone graft (osteotomy/fusion with or without tendon transfers") is WO460 [24]. W0460 costs approximately $1500 per procedure [24, 25]. This is likely to be considerably higher when the costs of the complete episode of care including postoperative walker, physical therapy and follow up are considered. It has also been shown that early intervention may decrease the potential for progressive deformity in TPTD while allowing ambulation [26] and improved pain levels with orthoses and eccentric exercise [27]. Conservative treatments like these have been shown to be cost effective [28]. There is potential for the initiation of inappropriate treatment if plantar fasciitis is mistakenly diagnosed in cases of TPTD, e.g., steroid injection that has been suggested to be a risk factor for tendon ruptures [13].

Inappropriate and untimely treatment could lead to the therapeutic window in which successful conservative treatment can be provided for TPTD being missed. With this in mind, the objective of this study was to establish the prevalence of misdiagnosis of plantar fasciitis in referrals to Health Check Center Physical Therapy Department, Brooklyn, NY, USA with particular focus on TPTD.

METHODS

Prior to data collection, the study was registered with Health Check Center and deemed observational audit. It was also approved by Nova Southeastern University Health Care and Psychology Ethics Panel. Study design was informed by reference to the STARD statement (Standards for the Reporting of Diagnostic accuracy studies). Historically, the objective of the STARD initiative was to improve the accuracy and completeness of reporting of studies of diagnostic accuracy, to allow readers to assess the potential for bias in the study (internal validity) and to evaluate its generalizability (external validity).

Subjects were invited to participate in the study if their referral to the physical therapy department stated "Plantar fasciitis". Terms synonymous with plantar fasciitis such as "Policeman's heel" and "jogger's heel" were considered eligible for inclusion but none was received during the study period. A time constrained data collection period of 16 weeks was set, and by counting the number of patients referred with "plantar fasciitis" over a 4-week pilot period, it was predicted that a sample size of over 36 patients could be recruited in the main data collection period between November 2010 and March 2011.

Patients without pain were excluded as a number of the diagnostic tests are based on the presence of pain/tenderness. Participants satisfying the inclusion/exclusion criteria (shown in Table 1) were sent an information sheet and consent form in advance of their first assessment appointment. These were collected at the assessment appointment, at one of four community hospital or primary care center clinic locations.

Table 1. Inclusion/exclusion criteria

Inclusion Criteria	Exclusion Criteria
Medial heel pain in one or both feet	Definitive diagnosis already made – i.e. Plantar fasciitis diagnosed prior to referral by MRI or ultrasound scan
Over 18 years of age	Previous posterior tibial tendon or plantar fascial tear or rupture
	Previous surgery to either the plantar fascia or posterior tibial tendon
	Pain in both the plantar heel area and posterior tibial tendon area concurrently
	No pain
	Consent not given or withdrawn

Participants were asked to complete a screening questionnaire for TPTD, used by Kohls-Gatzoulis et al. in their previous work on that condition [15]. Criterion based diagnosis was used to discriminate between PF and TPTD to optimize external validity [29], and these are shown in Table 2 [30, 31]. A data sheet was then completed for each participant that included demographic data and the Foot Posture Index (FPI-6) [32,33], included as an objective and reliable technique [34] for investigating foot posture asymmetry which is recognized as an important diagnostic sign in TPTD [15,16]. The Visual Analogue Scale (VAS), a recognized and validated method [35-37], was used to record pain. The clinical diagnostic criteria shown in Table 2 were also completed, which were based on recommendations from the literature. Diagnosis of TPTD is primarily clinical [15, 17,38].

Table 2. Criterion based diagnosis to discriminate between plantar fasciitis PF and TPTD

PTTD Diagnostic Criteria	Plantar fasciitis Diagnostic Criteria
Too many toes sign [16,20,42]	First step pain [5,6,31,47,48]
Medial ankle swelling [16,20,42]	Medial plantar calcaneal tenderness [6,31,47]
Medial ankle/tibialis posterior tendon tenderness [16,43,44]	Pain on stretch of plantar fascia [6]
Single leg heel rise weakness/impossible [16,20,21,22,36,44,45,46]	Single leg heel rise possible
Arch lowering reported on affected side [16,20,42]	Corresponding increase in activity level [47]
Positive PTTD questionnaire result [44]	Negative PTTD questionnaire result [44]

Many authors advise observing the "too-many-toes" sign on the affected side (Fig. 1), unilateral arch height lowering [14,15,38], and medial ankle swelling [15,39,40] which have been shown to identify 100% of TPTD cases and have 98% specificity [40].

Fig. 1. The "Too many toes" sign

The single heel rise is the most commonly applied functional test (Fig. 2) [15, 18] and has been widely used in the literature [14, 15, 19, 32, 40, 42].

Diagnosis of plantar fasciitis can also be made with relative

Fig. 2. The Single Heel Raise test

certainty using clinical assessment [43] and history [27]. Clinical signs include pain that is worse on first steps after rest [5,6,27,43,44] which then eases and worsens again with continued activity [27,44], tenderness over the medial calcaneal tuberosity [6,27,43] and pain when the plantar fascia is palpated or stressed/stretched such as when dorsiflexing the hallux [5] (Fig. 3).

Fig. 3. Hallux dorsiflexion – plantar fascia stretch test.

Negative findings aided discrimination between conditions. For example, absence of plantar fascial tenderness but presence of tibialis posterior tendon tenderness indicated the structure involved. A diagnosis was determined for each participant depending on the outcomes of the clinical tests.

Participants were considered positive for TPTD if they had medial ankle pain and swelling plus two other positive questions on the screening questionnaire [40],and given that,they met the stated clinical criteria. Participants were considered positive for plantar fasciitis if there was a negative TPTD screening questionnaire outcome and the criteria shown in Table 2 were met. Diagnosis was made using multiple criteria from Table 2 and not on the strength of one positive finding alone, and the absence of the signs of other conditions also contributed to the diagnosis made. All participants were assessed by the same clinician to eliminate inter-rater error and improve reliability. The assessing clinician was an experienced physical therapist specialized in musculoskeletal disorders.

RESULTS

Diagnostic accuracy

There were 41 participants in total with 41.5% males (n17) and 58.5% female (n24). All met the inclusion criteria. Patient flow within the study is shown in Fig. 4. There were no losses to follow up due to the single data collection session employed. The clinical diagnosis is illustrated in Fig.5. Overall, 26.8% (n=11) patients were diagnosed with plantar fasciitis (PF), 26.8% (n=11) with tibialis posterior tendon dysfunction (TPTD) and 46.3% (n=19) with other conditions as listed in Table 3, or a diagnosis could not be established at the initial assessment (n=3).

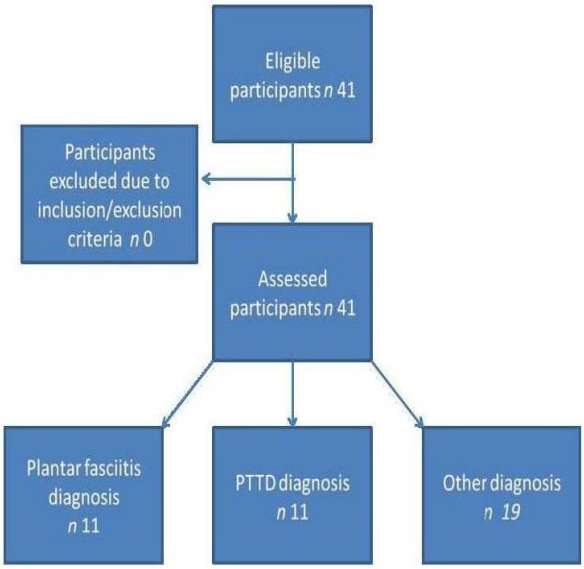

Fig. *4.* Subject flow in the study

The results suggest that males are more likely to have a diagnosis other than plantar fasciitis (82.4% of males did not have plantar fasciitis versus 66.7% of females). The average age of the male participants was 57.3 years (SD ± 11.75) and 55.8 years (SD ± 13.35) for the females.

Table 3: List of conditions other than PF and TPTD

Possible Calcaneal fat pad injuries (*n*4)	Referred pain from lumbar spine (*n*1)
Dorsal lateral foot pain (*n*3)	Achilles pain (*n*1)
Osteoarthritic pain in ankle (*n*3)	Probable Tarsal Tunnel Syndrome (*n*2)
Flexor Hallucis Injury (*n*1)	Hallux Abductovalgus (Bunion) pain (*n*1)

Referrals were received from the sources shown in Fig. 5. The results from the three most frequent referral sources were analyzed .The remaining referral source was omitted from this analysis as only 3 referrals were received from that source. Sensitivity calculation is an important technique for providing insight to diagnostic accuracy [45, 46]. All incoming referrals had the same diagnosis at the beginning, meaning the specificity calculations would invariably give a 0% result, as this considers "true negatives" of which there would be none since only referrals stating "plantar fasciitis" were considered.

The sensitivity of referrals received into the physical therapy department was 26.8%. In order to establish if a targeted education program may be necessary, sensitivity was compared for the referral sources.General practitioners sensitivity for diagnostic accuracy was 37.5%, Orthopedic department 33.3% and Podiatrists 15.3%, with inaccuracy rates of 62.5%, 66.6% and 84.7% respectively.

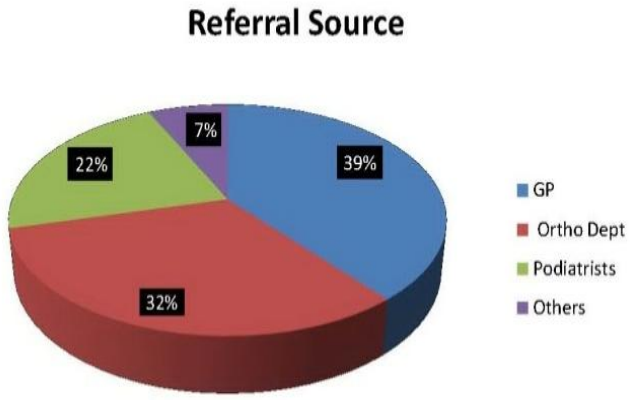

Fig. 5: Referral source

Using, IBM SPSS Version 22.0 (SPSS, Inc., IBM Corporation, Somers, New York) and Graph Pad Prism (Version 6.01 for Windows; Graph Pad Software, San Diego, CA, USA), a Chi-squared test [46,47] was performed to establish if this was a statistically significant difference. A *p*-value of 0.403 suggests that there was no statistically significant difference in the rates of accuracy between referral sources.

Other results

The average Body Mass Index (BMI) and Visual Analogue Scale (VAS) values by sex and diagnosis are given in Table 4.

These results show the average BMI scores were overweight for all groups and average VAS scores between 6.5 and 7.1 across all groups. This suggests a level of homogeneity in the participants.

Table 4: The average Body Mass Index (BMI) and Visual Analogue Scale (VAS) values by sex and diagnosis

Diagnosis	BMI Average		VAS Average	
	Male	Female	Male	Female
Plantar fasciitis	30.5 (SD±1.7)	26.9 (SD±3.9)	7.0 (SD±3.6)	6.6 (SD±1.3)
PTTD	30.5 (SD±3.9)	28.6 (SD±5.8)	6.8 (SD±2.1)	6.5 (SD±1.9)
Other	28.0 (SD±4.8)	27.6 (SD±6.0)	7.1 (SD±1.6)	6.8 (SD±1.5)

The results in Fig. 6 summarize the FPI data obtained. They show 90.9% of individuals in the TPTD group had a more pronated foot posture on the affected side (i.e. a higher FPI score) and 45.4% had a foot posture within a more pronated FPI category (i.e. a higher category of the FPI) on the affected side. This is in comparison to 36.4% and 27.3% respectively in the plantar fasciitis group, indicating asymmetry of foot posture within both groups, but with the higher percentage in the TPTD group.

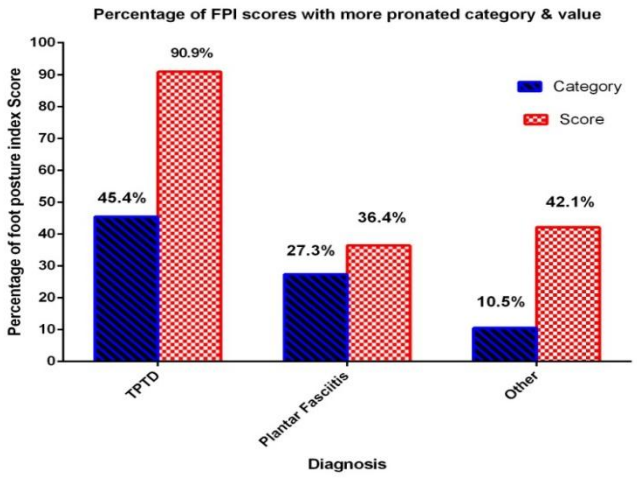

Fig. 6. Symmetry of Foot Posture Index by Diagnosis

DISCUSSION

The results suggest that there is inaccuracy in the diagnosis of rear foot pain provided by referrers into the physical therapy department. An overall rate of diagnostic inaccuracy of 73.1% indicated prevalent misdiagnosis in this study.

There was no statistical significance in diagnostic accuracy between the two largest referral groups suggesting education programs should be given across referral sources, and need not be targeted to any particular professional group.

The results need to be considered with regard to some limitations of the study.Firstly, there is a possibility that patients with accurate TPTD diagnoses were not referred to the physical therapy department, but to other disciplines such as podiatrists or orthopedics.Therefore, the sample may be biased. However, other disciplines were also included in this study as referral sources and it is probable that patients are eventually assessed by a physical therapist due to the role of orthoses in the management of TPTD [15, 48]. The relatively short period of the study may prevent such patients from having entered the study.

Secondly, it could be argued that the diagnosis stated on the referral form and the use of "plantar fasciitis" as an umbrella term is irrelevant because they are being referred to a specialist who then makes an informed diagnosis on examination. However, the National Health Service (NHS) Clinical Knowledge Summaries guidelines [49] list a number of ways to manage plantar fasciitis. A referral to a physical therapist is suggested if symptoms persist after 3 months.Other regimes such as medication, stretches and, in particular, corticosteroid injection are also advised and can be instigated before the 3-month delay recommended prior to physical therapy referral to apply shockwave therapy. If the diagnosis has been made incorrectly, these measures would be untimely and inappropriate, particularly local corticosteroid injection which has been shown to increase the risk of pathology to the tibialis posterior tendon [13]. Patients are also then misinformed and may begin inappropriate self-treatment.Early intervention has been suggested as important in preventing deformity with TPTD [26] and this is compromised by misdiagnosis.

Thirdly, the diagnostic criteria used in this study are purely clinical. They do not represent the gold standard in diagnosis. For example, ultrasound scanning would have been a more definitive diagnostic tool for identifying the presence of plantar fasciitis [50, 51] or magnetic resonance imaging (MRI) scan for identifying TPTD [48] but given time and financial constraints, there was a need to be pragmatic. The diagnoses can be confidently made clinically [15,17,27,38,43], which is more in keeping with the decision making process that occurs before treatment is initiated by referrers prior to onward referral. For example, it is not suggested in the NHS clinical knowledge summaries guidelines [49] that GPs seek ultrasound confirmation prior to administering non-steroidal anti-inflammatory medications or local corticosteroid injections. It is felt that these points

justify the methodology chosen, but it is accepted that in order to definitively diagnose conditions, and therefore more confidently extrapolate the results, further research would benefit from using gold standard diagnostic techniques.

The average BMI results found in this study are consistent with the evidence that both plantar fasciitis and TPTD patients are often overweight [2, 3, 5, 14-16]. The VAS scores also indicate that the patients in all diagnosis groups are experiencing moderate pain levels [52].

This could suggest that diagnostic accuracy, and therefore appropriate treatment, should be a priority for referrers. The FPI values show that it is more common to see asymmetry of foot posture in those with TPTD (90.9% of individuals) as compared to plantar fasciitis (36.4%). This is consistent with the unilateral arch height lowering described in the literature as a sign/symptom of TPTD [14, 15, 38] rather than plantar fasciitis. This is an important point for referrers when making clinical diagnoses. It is acknowledged that a degree of asymmetry was found in both groups in this study and, clearly, diagnosis should be made using multiple diagnostic criteria and not a single piece of evidence. The ramifications of misdiagnosis of plantar fasciitis as TPTD appear to be less severe than the other way around, given the possible self-limiting nature of plantar fasciitis [6].

It is noted that more males (41.2%) were diagnosed with TPTD than females (16.7%) in this study, which is contrary to the findings in the literature to date [14, 15]. The authors acknowledge this but find it likely that the small sample size is a significant factor in this finding. This is also likely to relate to the gender differences found in the "other" category.

Recommendations for further research with a larger sample size and in conjunction with other disciplines, using gold standard diagnostic techniques, can be made.

A comprehensive understanding of misdiagnosis would require a long-term study using large numbers and considering a range of referral diagnoses. It is also appropriate to suggest that further research is carried out into diagnostic skills of the clinicians referring such conditions. This may indicate the need for education programs including the clinical diagnostic criteria used in this study. These are widely and consistently described in the literature and do not require expensive equipment or large amounts of time. They can be carried out by most health professionals involved in lower limb musculoskeletal care and can be easily utilized. The use of these tests could help the referrer differentiate between those individuals requiring swift onward referral for specialist intervention, and those who can be managed with various conservative interventions prior to considering onward referral. For example, the single leg heel rise test (Fig. 2) is a quick and clinically useful test to perform at assessment.

CONCLUSION

This study suggests that a significant number of cases perceived to be plantar fasciitis, by primary referrers into the physical therapy service, do not suffer from this condition. TPTD should be considered as a differential diagnosis to plantar fasciitis along with a number of other conditions. Referrers should give particular regard to the importance of early intervention in the former to reduce deformity and disability in individuals with this condition.

List of Abbreviations

GP General Practitioner

NHS National Health Service

OA Osteoarthritis

PF Plantar Fasciitis

TPTD Tibialis Posterior Tendon Dysfunction

FPI Foot Posture Index

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الملخص العربى

الدقة التشخيصية لحالات التهاب اللفافة الأخمصية المحالة إلى قسم العلاج الطبيعي

هدف البحث: -تحديد دقة تشخيص الحالات المحالة لقسم العلاج الطبيعي بالتهاب اللفافة الأخمصية. . **تصميم البحث: -** مسح عابر سريع باستخدام استبيان معتمد متحقق من صحته،بالإضافة إلى تقييم سريريبمعاييرقياسيه. .**مكان البحث: -** 4 عيادات خارجية بأربع مستشفيات محلية يعالج مرضاهم بقسم علاج طبيعي واحد. شارك في البحث 41 مريضا محال إلى قسم العلاج الطبيعي بتشخيص التهاب اللفافة الأخمصية.**مقاييس النتائج الرئيسية: -** التشخيص المحال به المرضى مقابل التشخيص الفعلي بعد فحصهم. .**طريقة البحث: -** قامأخصائي علاج طبيعي مؤهل بإجراء فحص للمرضى عن طريق استكمال استبيان تفصيلي لألم القدم أو وجود أي اعراض مرضية أخرى وأجرى ايضاً فحص ممنهجسريري لتقرير ما إذا كانت حالة المريض تطابق فعلياً التشخيص بالتهاب اللفافة الأخمصية أو أن هناك خلل مرضى بوتر العضلة الظنبوبية الخلفية أو غير ذلك من الأمراض التى قد تختلط على الطبيب المعالج لتشابه اعراضها مع التهاب اللفافة الأخمصية وذلك للمرضى المحالين لقسم العلاج الطبيعىفى الفترة من نوفمبر 2010 إلى مارس 2011 للعلاج من التهاب اللفافة الأخمصية . وتم جمع معلومات اضافية عن جهة إحالة المرضى لتقرير ما إذا كان هناك ضرورة لتعليم الأطباء بالأقسام الطبية المختلفة المحولة لقسم العلاج الطبيعىفى حال ملاحظة ارتفاع نسبة الخطأ فى التشخيص لجهة ما.**النتائج: -** تم احالة المرضىالمشاركينفى هذا البحث من اطباء القدم والممارسين العاميين وجراحى العظام. وثبت بالفحص أن 26.8 % (11 حالة) تعاني فعلياً من التهاب اللفافة الأخمصية وعدد مماثل 26.8 % (11 حالة) يعانى من خلل مرضى بوتر العضلة الظنبوبية الخلفية و 46.3 % (19 حالة) يعانى من امراض اخرى غير التشخيص المدون بالتحويل للعلاج الطبيعى، اى ان نسبة الخطأ فى التشخيص الطبى لالتهاب اللفافة الأخمصية للحالات المحولة إلى قسم العلاج الطبيعى بلغت 73.1 %، ولم يوجد فرق ذو دلالة احصائية فى دقة التشخيص بين مصادر الإحالة المختلفة.

الخلاصة:-فى حين ان التهاب اللفافة الأخمصية سبب شائع للألم فى القدم الخلفية ينبغى النظر بعناية فى التشخيص التفريقى للوقوف على حقيقة المرض والتفريق بينه وبين امراض اخرى قد يغفل عنها الطبيب المعالج وتتسبب فى إحالة المريض إلى العلاج الطبيعى بتشخيص خاطىء ربما يؤدى إلى عدم اعطاء العلاج المناسب للمرضى .

مفتاح كلمات البحث:- التهاب اللفافة الأخمصية،آلام أخمص الكعب، دقة التشخيص.