Jumper's knee in beach volleyball: an ultrasonographic survey in 54 elite italian players

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DOI: 10.12920/jopola.2014.05

Riassunto

Obiettivi. Il ginocchio del saltatore è la più frequente patologia da ipersollecitazione nel volleyball e nel beach volley. Il presente studio ha lo scopo di identificare ecograficamente le alterazioni dell'apparato estensore del ginocchio di giocatori professionisti di beach volleyball che hanno sofferto o soffrono di ginocchio del saltatore, quindi di confrontare i rilievi con quelli riscontrati in soggetti asintomatici.

Metodo. Cinquantaquattro giocatori di beach volley (31 donne, 23 uomini) sono stati reclutati durante la seconda tappa del campionato italiano tenutosi nel luglio 2012 a Roma, Italia. A tutti i soggetti è stato raccolta l'anamnesi patologica remota ed è stato effettuato l'esame obbiettivo del ginocchio. Ogni atleta ha completato un questionario riguardo l'attività sportiva quindi è stato eseguito un esame ecografico dell'apparato estensore del ginocchio.

Risultati. 10 giocatori (19%) presentavano o riferivano di aver sofferto del ginocchio del saltatore. Tra questi, i maschi erano in numero significativamente maggiore rispetto alle femmine (p= 0,043). Tra i soggetti che non presentavano storia di ginocchio del saltatore l'11,4% mostravano segni ecografici di degenerazione tendinea mentre tra i soggetti che presentavano ginocchio del saltatore, in atto o pregresso, il 60% risultavano avere segni ecografici di degenerazioni (p=0,003).

Conclusioni. La prevalenza complessiva di atleti che soffrivano o avevano sofferto di ginocchio del saltatore era simile a quella riscontrata nella pallavolo. Segni ecografici di degenerazione tendinea sono presenti nella maggior parte dei soggetti che soffrono o hanno sofferto di ginocchio del saltatore. Il monitoraggio clinico, ecografico e sportivo dei soggetti asintomatici con alterazioni ecografiche potrebbe fornire ulteriori elementi sulla storia naturale del ginocchio del saltatore, ai fini della prevenzione di questa frequente patologia sportiva da ipersollecitazione.

Abstract

Objectives. The jumper's knee (JK) is the most frequent overused pathology in volleyball and beach volleyball. This research aimed to identify ultrasonographic abnormalities of the patellar extensor apparatus of professional beach volleyball players who have suffered or are suffering from JK, and to compare their ultrasongraphic alteration detected with those found in asymptomatic subjects.

Method. Fifty-four beach volleyball players (31 women, 23 men) were recruited during the second stage of the Italian beach volleyball championship held in July 2012 in Rome, Italy. Clinical history was obtained from all subjects, followed by physical exam. Each athlete completed a questionnaire regarding sports activities. Bilateral ultrasonographic evaluation of the patellar extensor apparatus was then performed.

Results. 10 players (19%) had suffered or were suffering the JK. Among these subjects, the males were significantly more than females (p = 0.043). Among subjects who had no history of JK4 players (11.4%) showed ultrasonographic tendon degeneration changes, while among the subjects with current or previous JK, 6 players (60%) were considered to have degeneration (p = 0.003).

Conclusions. Overall prevalence of beach volley players with current or previous JK was similar to that found in volleyball. Best part of subject with current or previous JK had ultrasonographic degenerative changes. Clinical ultrasonographic and training checking of the asymptomatic subjects with ultrasonographic extensor apparatus alterations may provide extra data on the natural history of the JK, which can be useful in preventing this common sport overuse injury.

Introduction

The JK (patellar tendinopathy), is a patellar extensor apparatus overuse sport injury, can occur at three levels: patella (base or apex), quadriceps tendon and tibial tuberosity[1,2,3]. In an extensive survey, Ferretti et al.[4] found out a prevalence of 22.8% of volleyball players who suffering or had suffered by JK. Among beach volleyball an incidence of 9% of JK was estimated in a 7.5-week study period[5].

In literature, there is only a single ultrasonographic

investigation regarding the prevalence of the patellar extensor apparatus alterations, in beach volleyball players; it correlates ultrasonographic finding with symptoms estimated with the Lysholm knee scoring scale[6].

The aim of this study was to estimate current or previous JK prevalence in a group of 54 elite beach volleyball players of the Italian championship, and to examine their ultrasonographic changes of the patellar extensor apparatus.

Materials and Methods

Study population The study included 54 athletes (32 women, 22 men) participating in the second stage of the 2012 Italian Beach Volleyball Championship held July 20-22 in Rome, Italy. A self-administered questionnaire was then completed by each subject to obtain demographic information and data regarding sports activities and weekly training time and former knee injuries and complaints. All players provided written informed consent.

Clinical Evaluation The medical history regarding knee pathology was acquired. The subjects' weights and heights were recorded. Then physical examination of the knees was performed by an orthopedic surgeon (GM) evaluating range of motion and visible evidence of muscle atrophy, swelling at the anatomical sites prone to extensor tendinopathy. Pain at the digital pressure and extension against resistance. Jumper's knee diagnosis was based on a typical history and clinical findings.

Ultrasonographic assessment

All ultrasonographic examinations were performed and interpreted by experienced medical doctor operator (A.T.) (more than 10 years of experience in musculoskeletal sonography) blinded to the findings of the clinical examination. All of the athletes underwent ultrasonographic static and dynamic examination (Hitachi Aloka SSD Alpha 7 Premier unit ecograph) of both shoulders.

Calcific tendinopathy: hyperechoic oval focus with or without sharp margins, posterior acoustic shadowing or posterior enhancement.

Tendon degeneration: coarse echogenicity of the tendon (hypoechoic with possible anechoic foci), hypomobility and diminished mobility and elasticity on dynamic imaging.

Inflammation: anechoic area in the tendon (fig 1b) which represents acute inflammation when positive on Power Doppler and chronic inflammation when Power Doppler is negative.

The diagnosis of the tendon inflammation was established as follows: inflammation describes an area that was compressible under the probe. During dynamic testing, the area generally diminished in volume. By small movements of the probe in the sagittal plane, it was possible to see the whole tendon beneath the anechoic area[7].

Statistical Analysis

All data were initially entered into an ACCESS database (Microsoft, Redmond, Washington – United States) and the analysis was performed using the Statistical Package for the Social Sciences Windows, version 15.0 (SPSS, Chicago, Illinois, USA). Descriptive statistics consisted of the mean ± standard deviation for parameter with gaussian distributions (after confirmation with histograms and the Kolgomorov-Smirnov test), median and range (min; Max.) for frequencies and categorical variables with non-gaussian distributions. Comparison among groups was performed with the ANOVA one-way for continuous parametric variables or the Chi-Square test or Fisher's exact test (if cells<5) for frequencies variables. A p value of < 0.05 was considered statistically significant.

Results

The mean age of the athletes in the study was 27.7 years (range: 17-44 years). All the subjects had played beach volleyball for more than 8 years. The average height was 190, 5±9, 6 cm for male and 174,5±6,0 for females; the average body weight was 85,7±9,2 kg for male and 63,41±6,5 for females (Table 1).

10 players (7 men, 3 women) (19%) reported suffering or had suffered by JK. Among these, the males were significantly more than females (Fisher's exact test; p= 0,043<0,05).

Two players had undergone surgery to the patellar tendon, both at the age of 24: one had surgery for the left patellar tendon rupture after the inferior patellar pole (no corticosteroid treatment) and one had scarification treatment of the right patellar tendon. A player (man) had bilateral infiltrative growth factors treatment at the age of twenty-nine. Four athletes had a history of bilateral patellar tendinopathy, and 4 athletes showed symptoms of JK (3 men and one woman, 2 cases bilaterally). Only one athlete reported a previous quadriceps tendinopathy.

Ultrasound scan identified degeneration changes in the patellar tendon of 10 athletes (one bilaterally): among these, 3 had current JK, 3 had previous JK and 4 had no

DOI: 10.12920/jopola.2014.05

history of JK. Two athletes with history of JK showed no ultrasonographic patellar tendon changes. No calcification was observed. One player with current symptoms had an ultrasonographic shape abnormality of the apex patella in the left knee (Fig. 1).

Table 1. Description of the general characteristics of the studied cases. (Anthropometric parameters, mean age etc.)

	Sex	N.	Mean ± SD	Min	Max
Age	**–**	22	28,59±5,31	20	40
	–	32	27,19±6,8	17	44
	Total	54	27,76±6,2	17	44
Weight	**–**	22	85,77±9,2	70	102
	–	32	63,41±6,5	52	77
	Total	54	72,52±13,4	52	102
Stature	**–**	22	190,36±9,6	158	203
	–	32	174,53±6,0	162	185
	Total	54	180,98±10,9	158	203
BMI	**–**	22	23,768±3,1	19,7	35,3
	–	32	20,794±1,6	17,6	25,8
	Total	54	22,006±2,8	17,6	35,3

Among subjects with no history of JK (44) only 5 (11.4%) had ultrasonographic tendon degeneration changes while among subjects with history of JK (10) 6 (60%) had degeneration changes (Fisher exact test; p=0,003<0,01).

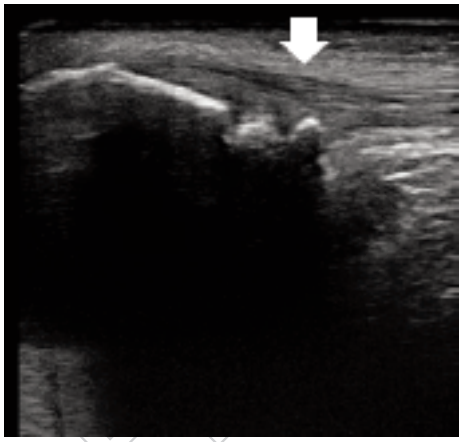

Figure 1. Athlete suffering of current jumper's knee, ultrasongraphic scan: irregularity of the apex patella profile; the distal tendon inferior to the apex patella is hypoechoic.

Discussion

The aim of this research were to identify the prevalence of current or previous JK, therefore to detect the patellar extensor apparatus ultrasonographic changes, in a group of professional beach volleyball players of the Italian championship.

Nineteen per cent of the examined players had suffered or were suffering by jumper's knee. This prevalence is slightly lower than that recorded by Ferretti [4] (22.8%) in a large epidemiological study on volleyball, more than 25 years ago. In a 7.5-week retrospective study on 178 beach volleyball players, Bahr et al.[5] found 16 subjects (9%) who had suffered by JK. In a group of 56 elite volleyball male players, Lian et al.[8] found out a prevalence of 44.6% of current JK: this prevalence is higher than that found in our survey out in beach volleyball players (3/22=13.6%).

In professional beach volleyball players Pfirrmann et al.[6] noticed high prevalence of ultrasonographic changes of quadriceps tendinosis (21%, dominant leg, 34%, non-dominant leg). According to these authors, quadriceps tendinosis in professional beach volleyball players is as common as patellar tendinosis. They observed a close correlation between ultrasonographic changes of the quadriceps tendon and painful symptoms during the competition; this correspondence lacked about the patellar tendon ultrasonographic changes. In our survey, three cases of patellar tendon ultrasonographic abnormalities (degeneration) were unmatched to any current or previous symptoms. Only one player had previous quadriceps painful symptoms, while all other JK cases involved the patellar tendon. According to Lian et al.[8,9] the this last was the most common site of JK in athletes.

Players with JK used to compete for several years with knee pain, even they had limitation of the level of play[8]. Subcutaneous tendon rupture, a rare event[10,11], is the most dangerous and harmful pathological JK course for the athlete. Tendon rupture forces the athlete to suspend sport activities for many months and may fix suboptimal functional recovery and performance. Among studied subjects, tendon rupture occurred in one case.

Patellar tendon rupture follows histopathological changes of tissue, isolated or in combination, such as hypoxic degenerative change, mucoid degeneration, tendolipomatosis, and calcifying tendinopathy[12].

Ultrasound and MRI scans are excellent tools in studying tendons but these instrumental examinations cannot predict a tendon rupture. Moreover, association

DOI: 10.12920/jopola.2014.05

between tendon alterations detected by these assessments and clinical symptoms is poor[13].

Among studied subjects, there was a statistically significant correspondence between subjects with tendon changes detected by ultrasound scan and those with current or previous JK (chi square p=0,001; $p<0.005$); however, five athletes (9,2%) with tendon degenerative changes had no current or previous history of JK. Latter subjects may be affected by an asymptomatic stage of the disorder, which can progress to a painful stage.

In asymptomatic athletes, ultrasonographic hypoechoic areas of the tendon have been considered a risk factor for the development of JK[14,15]. Power Doppler flow in the tendon, expression of neovascularization, is associated with current pain symptoms[15,16,17].

In a pain-free tendon, some authors[18,19] assumed that an MRI area of increased signal intensity on T2 - weighted gradient-echo image anticipate a definite tendon damage. According to Kulig et al.[20] clinical MRI cannot differentiate between inflammatory and degenerative alterations.

Risk factors for JK include: male gender, high training volume[21,22], greater weight[23] and deeper knee flexion angle during landing from the spike jump[24]. In players with greater quadriceps strength, high loads of the patellar tendon contribute to cause JK: in these athletes, a refinement of landing technique may prevent tendinopathy[25]. Our studied subjects showed a statistically significant association of JK with male sex. Overall prevalence of athletes who were suffering or had suffered of JK was 19%, similar to that found in volleyball. Ultrasonographic examination revealed degenerative changes of the patellar tendon in 60% of patients with current or previous disease, and in 11.4% of pain-free subjects. Clinical ultrasonographic and training monitoring of the asymptomatic subjects may provide additional data on the natural history of the JK useful in prevention of this common sport overuse musculoskeletal injury.

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DOI: 10.12920/jopola.2014.05

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DOI: 10.12920/jopola.2014.05