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Original research

Generalized ligamentous laxity may be a predisposing factor for musculoskeletal injuries

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ABSTRACT

Objectives: The aim of this study is to determine if generalized ligamentous laxity may be a predisposing factor for musculoskeletal injuries in young males. We hypothesized that generalized ligamentous laxity would be more common in individuals with musculoskeletal injuries compared with controls.
Design: Prospective Age- and Gender-matched Case-Control Study examined generalized ligamentous laxity in 100 consecutive individuals aged 18–25 who reported with musculoskeletal injuries to a primary healthcare center in the military. The Beighton score was used to measure joint laxity, which was determined to be present by overall scores equal to or exceeding 4. The control group comprised 100 age- and gender-matched individuals without any musculoskeletal injuries or complaints. The prevalence of generalized ligamentous laxity was then compared between cases and controls. Subgroup analyses were also performed to evaluate the epidemiology of injury within the cases.
Methods: This prospective case-control study examined generalized ligamentous laxity in 100 consecutive individuals aged 18–25 who reported with musculoskeletal injuries to a primary healthcare center in the military. The Beighton score was used to measure joint laxity, which was determined to be present by overall scores equal to or exceeding 4. The control group comprised 100 age- and gender-matched individuals without any musculoskeletal injuries or complaints. The prevalence of generalized ligamentous laxity was then compared between cases and controls.
Results: Generalized ligamentous laxity was present in 12% of the cases compared with 4% of controls Clearer to be presented as (P-value: 0.043). Individuals who presented with musculoskeletal injuries were 3.35 times more likely to have generalized ligamentous laxity as compared to controls. Lower limb injuries were more common than upper limb injuries amongst the cases.
Conclusions: Generalized ligamentous laxity was more common in individuals who presented with a musculoskeletal injury. Hence, it may be a predisposing factor for musculoskeletal injuries.

1. Introduction

Ligamentous laxity is a known entity that results in joint hypermobility, and may occur in patients with a primary genetic disorder affecting the connective tissue or as part of a syndromic disorder such as Trisomy 21.[1] In the majority of individuals though, joint hypermobility exists in isolation and may be associated with musculoskeletal symptoms such as pain and crepitus. In these individuals, there is no genetic aberrancy. This has been labeled as "generalized ligamentous laxity" or "non-pathologic hypermobility". For the purpose of this study, the term "generalized ligamentous laxity" will be used.

Generalized ligamentous laxity indicates that the range of motion across various joints in an individual is increased compared with the mean range of motion in the general population.[2] The prevalence of generalized ligamentous laxity in the general population has been shown to be between 5% and 15%.[2,3] It becomes less common as individuals age, due to stiffening, and is slightly more prevalent in females than in males, as well as in the non-dominant upper or lower limb. Interestingly, there is also some variation in the races, with the African ethnic group having an estimated prevalence as high as 57%.[3]

Generalized ligamentous laxity has been implicated with musculoskeletal injuries such as ankle sprains, cruciate ligament injuries and shoulder instability.[4–6] Ramesh et al. suggest that generalized ligamentous laxity was a significant risk factor for anterior cruciate ligament (ACL) injury.[4] In this study, they assessed joint laxity in 169 consecutive patients who underwent an anterior cruciate ligament reconstruction and compared this with 65 age- and gender-matched controls. They found that generalized ligamentous laxity was present in 42.6% of the patients with an ACL injury as compared to 21.5% in controls. Hence, they concluded that there is an intrinsic relationship between proprioception, increased ligamentous laxity and ACL injury.

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It is assumed that the risk of injuries associated with generalized ligamentous laxity is higher during activities that are more physically challenging, particularly where the lower extremity is involved. However, there is conflicting evidence in the current literature as to whether the risk of injury during sports or physical activity is greater in individuals with generalized ligamentous laxity compared to controls. While the review by Pacey et al. was conclusive of a significantly increased risk of knee joint injury for hypermobile participants playing contact sports,[7] other systematic reviews have been unable to definitely determine any difference in the risk of injury sustained by individuals with generalized ligamentous laxity.[8,9] This has led to a variety of recommendations from clinicians and researchers advising individuals with generalized ligamentous laxity on the risks incurred during sports and training. While some recommend that those with generalized ligamentous laxity should participate in non-contact activities such as swimming, Pilates and Tai Chi,[10] others suggest that these individuals can fully involve themselves in sporting activities as long as they are asymptomatic.[11]

Little evidence has emerged from the Asia-Pacific regarding the epidemiology of generalized ligamentous laxity. We asked if generalized ligamentous laxity was more common in individuals presenting with musculoskeletal injuries as compared to controls. This can then be extrapolated to understand the association between generalized ligamentous laxity and musculoskeletal injury. This will allow primary prevention methods to be employed in schools and training institutes with those who are pre-identified to have generalized ligamentous laxity.

2. Methods

This was a prospective case-control study conducted from January to July 2012. All participants in this study were male Singapore residents who were serving their National Service commitment in the same military training institute. Singaporean male citizens are mandated to serve National Service after completion of post-secondary education and/or upon reaching the age of eighteen, with the majority being drafted into the Singapore Armed Forces (SAF) as conscript soldiers. An artificial stratification of Singapore's young male population allowed for a focused study with control of age, gender and to a certain extent activity level.

The cases comprised of 100 consecutive individuals who presented to the primary healthcare center in the military training institute with musculoskeletal injuries involving the upper or lower extremities that occurred as a result of physical activity. Musculoskeletal injury was defined as an injury or disorder of the muscles, tendons, ligaments, joints, nerves, blood vessels or related soft tissue including a sprain, strain and inflammation.

Our control group comprised of 100 age- and gender-matched individuals but did not have any musculoskeletal symptoms or injury for a period of 3 months or more from the time of recruitment. The control group was recruited by visiting the training facility and seeking volunteers. In an attempt to reduce sampling bias, recruitment took place on a large scale and did not target any individuals.

Both cases and controls were national servicemen training in the same military institute. All cases and controls were male individuals aged 18–25. All participants who had a previous injury or surgery involving the upper and lower extremities were excluded from this study.

Demographic data was gathered using a questionnaire that participants answered individually. The surveyed factors include personal history, smoking history and involvement in sporting activity as well as the baseline demographic and anthropometric data.

Table 1
The Beighton score is a simple system to quantify generalized joint laxity. It uses a simple 9 point system, where the higher the score the higher the laxity. A score of more than 4 indicates generalized joint laxity.

Joint	Finding	Points
Left little (fifth) finger	Passive dorsiflexion > 90°	1
Right little (fifth) finger	Passive dorsiflexion > 90°	1
Left thumb	Passive dorsiflexion to the flexor aspect of the forearm	1
Right thumb	Passive dorsiflexion to the flexor aspect of the forearm	1
Left elbow	Hyperextension > 10°	1
Right elbow	Hyperextension > 10°	1
Left knee	Hyperextension > 10°	1
Right knee	Hyperextension > 10°	1
Forward flexion of trunk with knees fully extended	Able to rest palm and hands flat on the floor	1

Presence or absence of generalized ligamentous laxity was assessed using the Beighton score (Table 1).[12] A cut-off score of 4 or greater was used to determine the presence of generalized ligamentous laxity.

Two blinded reviewers who were clinicians calculated the Beighton scores of all participants. The scores were recorded and tabulated on the questionnaire.

All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) Version 20 (IBM® SPSS Statistics, Armonk, New York, USA). A sample of 100 participants in each arm was estimated based on a prevalence ratio of 10:1 (cases:controls). The sample size was based on achieving an 80% power with $\alpha = 0.05$, SD = 1.0 and dropout = 10%. Prevalence of generalized ligamentous laxity in the cases and controls was calculated and a Fisher exact test was used to assess whether the difference in the prevalence of generalized ligamentous laxity between the cases and controls was significant. A significance level of $\alpha = 0.05$ was selected for analysis. An odds ratio (OR) was calculated to determine the risk of having generalized ligamentous laxity in the cases compared with controls.

Informed written consent was obtained from all participants, and ethics approval was obtained from the medical research ethics board within the Singapore Armed Forces.

3. Results

Both cases and controls were matched for age and gender. All other demographic details were comparable with no significant differences (Table 2).

12 patients (12%) demonstrated generalized ligamentous laxity in the 'case' group compared with 4 patients (4%) in the 'control' group (OR, 3.35; $P < 0.05$; Table 3). Compared with controls, individuals who presented with a musculoskeletal injury were 3.35 times more likely to demonstrate generalized ligamentous laxity. However, when comparing 'cases' and 'controls' with a Beighton score of more than or equal to 5, there was no statistical significance.

Amongst the cases, lower extremity injuries were found to be more common than upper extremity injuries. 67 out of the 100 cases had lower limb injuries. There were a total of 28 cases with ankle injuries, 37 with knee injuries and 2 with hip injuries. Of the upper limb injuries, there were 16 shoulders, 12 elbows and 5 wrists.

Further analysis showed that for each type of injury, there were no significant differences between those with generalized ligamentous laxity (Beighton score ≥ 4) and those without generalized ligamentous laxity (Beighton score < 4).