# Bony hip morphology and intrinsic risk factors for groin injury in male football players*

**Mosler A**
La Trobe Sport and Exercise Medicine Research Centre, School of Allied Health | La Trobe University, Australia

## Introduction by the editor Mario Bizzini

Es gibt eine relativ hohe Prävalenz von Leistenschmerzen bei männlichen Fussballspielern in der gesamten Literatur (ca. 21% aller time-loss-Verletzungen pro Saison), und es gilt als die dritthäufigste Verletzung im Fussball. Etwa $^2/_3$ aller Leistenverletzungen sind adduktorenbedingt.

Andrea Mosler (ehemals Aspetar, Doha, jetzt an der La Trobe University, Melbourne), die an der Konferenz #SportSuisse2018 präsentierte, schloss ihre Doktorarbeit mit einer Reihe von prospektiven Studien über Risikofaktoren für Leistenschmerzen bei Sportlern ab. Ziel war es, die intrinsischen Risikofaktoren für Hüft- und Leistenverletzungen zu identifizieren, festzustellen, ob das «gefährdete» Individuum durch Screening identifiziert werden kann, und den Zusammenhang zwischen knöcherner Hüftmorphologie und Leistenverletzungsrisiko zu untersuchen. Fast 600 männliche Fussballspieler der Qatari Stars League wurden untersucht (provokative Tests, Beweglichkeit, Kraft, Röntgen) und während zwei Saisons (2013–2015) Daten gesammelt. Von allen dokumentierten Hüft- und Leistenverletzungen (113) wurden 75% als Adduktoren-bedingte Leistenschmerzen klassifiziert. Eine frühere Hüft-/Leistenverletzung wurde als der wichtigste Risikofaktor für eine weitere Verletzung ermittelt, während die Adduktionskraft als (relativ) schwacher Risikofaktor eingestuft wurde. Die knöcherne Morphologie (Cam wurde in 60% aller Hüftgelenke dokumentiert) wurde nicht als Risikofaktor für Leistenverletzungen angesehen, und daher ist ihr Wert als Screening-Tool nicht indiziert und zumindest fragwürdig. Das muskuloskelettale Screening ist daher nützlich, um aktuelle Hüft-/Leistensymptome bei Sportlern zu erkennen (die dann eine spezifische Rehabilitation und ein spezifisches Training durchlaufen sollten), anstatt den Spieler für zukünftige Hüft-/Leistenverletzungen «zu prognostizieren».

Schlüsselwörter: Leistenverletzung, Risikofaktor, Adduktionskraft, screening

There's a relatively high prevalence of groin pain in male football players across the literature (ca. 21% of all time-loss injuries per season), and it is considered the third most common injury in football. About $^2/_3$ of all groin injuries are adductor related.

Andrea Mosler (former Aspetar, Doha, now at La Trobe University, Melbourne) who presented at the #SportSuisse 2018 conference, completed her PhD with a series of prospective studies on risk factors for groin pain in athletes. The aims were to identify the intrinsic risk factors for hip/groin injury, to determine if the "at-risk" individual can be identified through screening, and to examine the association between bony hip morphology and groin injury risk. Almost 600 male football players from the Qatari Stars League were screened (provocative tests, range of motion, strength, x-rays) and data were collected during two seasons (2013–2015). Of all documented hip/groin injuries (113), 75% were classified as adductor-related groin pain. A previous hip/groin injury was found to be the number 1 risk factor for another injury, while the adduction strength was found to be a (relative) weak risk factor. Bony morphology (cam was documented in 60% of all hip joints) was not found to be a risk factor for groin injuries, and therefore its value as a screening tool is not indicated and at least debatable. The musculoskeletal screening is therefore useful in detecting current hip/groin symptoms in athletes (which should then undergo a specific rehabilitation and training), rather than "predicting" the player "at risk" for future hip/groin injury.

Keywords: groin injury, risk factor, adductor strength, screening

Andrea Mosler

* A summary of the PhD project of Dr Andrea Mosler, La Trobe University, Australia

## Background

### *Epidemiology*

Hip and groin pain is common in athletes, particularly in sports like football, which involve high loads of running, direction change and kicking. [1–3] It is the third most common injury experienced by male professional football players, accounting for around 13% (range: 4-19%) of all time-loss injuries sustained each season. [4] Interestingly, groin injury is less frequent in elite female football players where it represents only 7% (range: 2–11%) of all reported injuries. [4]

Incidence rates for time-loss groin injury vary from 0.6 to 1.1/1000hrs, [4] and prevalence rates are high with up to 21% of male professional football players experiencing a time-loss hip/groin injury each season. [1,3,5] Most football injury surveillance studies use a time-loss injury definition. However, hip/groin injury often causes symptoms and reduced performance, without forcing time-loss from training and/or match play. Therefore, this definition probably underestimates the true burden of hip/groin injury. This was highlighted in a recent study where 59% of male football players reported at least one episode of hip and groin symptoms (with and without time-loss) over a six week period. [6]

### *Diagnostic terminology*

The groin area has been termed the "Bermuda triangle of sports medicine" due to the complex anatomy, and multifactorial aetiology, creating notorious difficulty in diagnosing and managing hip/groin injuries in athletes. [7] Many structural abnormalities are also found in asymptomatic athletes, which creates complexity to the diagnosis, management and prevention of these injuries. [8] Widespread variability in diagnostic terminology and classification systems for hip/groin injury are therefore found in published literature. Such heterogeneity makes it difficult to both synthesise the findings of clinical research, and provide recommendations for clinical practice. Standardised terminology and definitions for diagnosing hip/groin pain are clearly needed. In November 2014, an agreement meeting was held in Doha, Qatar where consensus was reached on standardised taxonomy and terminology to describe hip and groin pain, providing a guideline for clinicians and researchers. [8]

### *Risk factors and injury prevention*

Injuries have considerable negative impact on football team performance. [9] Therefore, effective injury prevention programmes are essential to reduce injury burden and optimise team performance. A key component of sports injury prevention success is the identification of risk factors and injury mechanisms. [10,11] Many studies have investigated the risk factors for hip/groin injury and three recent systematic reviews have synthesised the findings of these studies. [2,12,13] Previous groin injury and low adduction strength (both absolute and relative to abduction strength) were found to be significant intrinsic risk factors. [2,12] Results were conflicting on whether hip range of motion was a risk factor for hip/groin injury. [2,12,13] Considerable variation between studies in both methodology, and injury definition, precluded meta-analysis in these reviews. Improvement in hip/groin risk factor study methodology, and standardisation of injury definition, is therefore required to further understand the injury mechanisms.

Groin injury prevention programmes have usually failed to demonstrate significant success, despite including strategies aimed at minimising the effects of previously identified, modifiable intrinsic risk factors. [14] There are many possible reasons why these programmes have not been successful including:

- risk factors may exist that have not yet been examined or identified
- the interaction between intrinsic and extrinsic risk factors has not been taken into account with prevention programmes
- there is inadequate compliance and/or implementation of injury prevention programmes

### *Bony hip morphology- have we been missing a potential intrinsic risk factor?*

The term "bony hip morphology" refers to the surface shape of the bones that form the hip joint, specifically: the femoral head and neck, and the acetabulum. The bony morphological variants associated with hip pathology are cam and pincer morphology, and acetabular dysplasia. [15,16] Cam morphology is characterized by excessive bone formation at the antero-lateral aspect of the femoral head/neck junction, which creates asphericity of the femoral head. Pincer morphology describes acetabular overcoverage, while acetabular dysplasia is undercoverage of the femoral head *(Figure 1).*

Considerable interest in bony hip morphology has recently emerged due to an apparent association between hip joint morphology, pain, labral damage, and eventual osteoarthritis (OA). [17] However, the extent and nature of this association is hotly debated. While the risk of developing OA is up to 10 times higher in a hip with cam morphology or acetabular dysplasia, the vast majority of people with these morphological variants do not develop hip pain or OA. [15,18,19]

Bony hip morphology is a key feature of femoracetabular impingement syndrome which involves the pathologic, mechanical abutment of the proximal femur and acetabular rim. [20] This abnormal contact is theorised to cause higher compression and shear forces in the hip joint that may damage the articular cartilage and labrum, predisposing to hip OA. [17,21] The lack of clarity on the relationship between bony hip morphology and pathology related to FAIS has resulted in three consensus meetings being held since 2003. The most recent consensus meeting (June, 2016) strongly suggested the adoption of the term femoroacetabular impingement syndrome (FAIS) defined by Griffin et al 2016 [20] as: "a motion-related clinical disorder of the hip with a triad of symptoms, clinical signs and imaging findings. It represents symptomatic premature contact between the proximal femur and the acetabulum."

Since the early 2000's when Ganz and colleagues introduced the mechanical model of FAIS, there has been an exponential rise in surgical rates world-wide, with corrective surgery in the form of femoral and/or acetabular osteotomy suggested treatments. [21–23] Randomised controlled trials are currently being conducted which compare the efficacy of surgical and conservative management for FAIS.

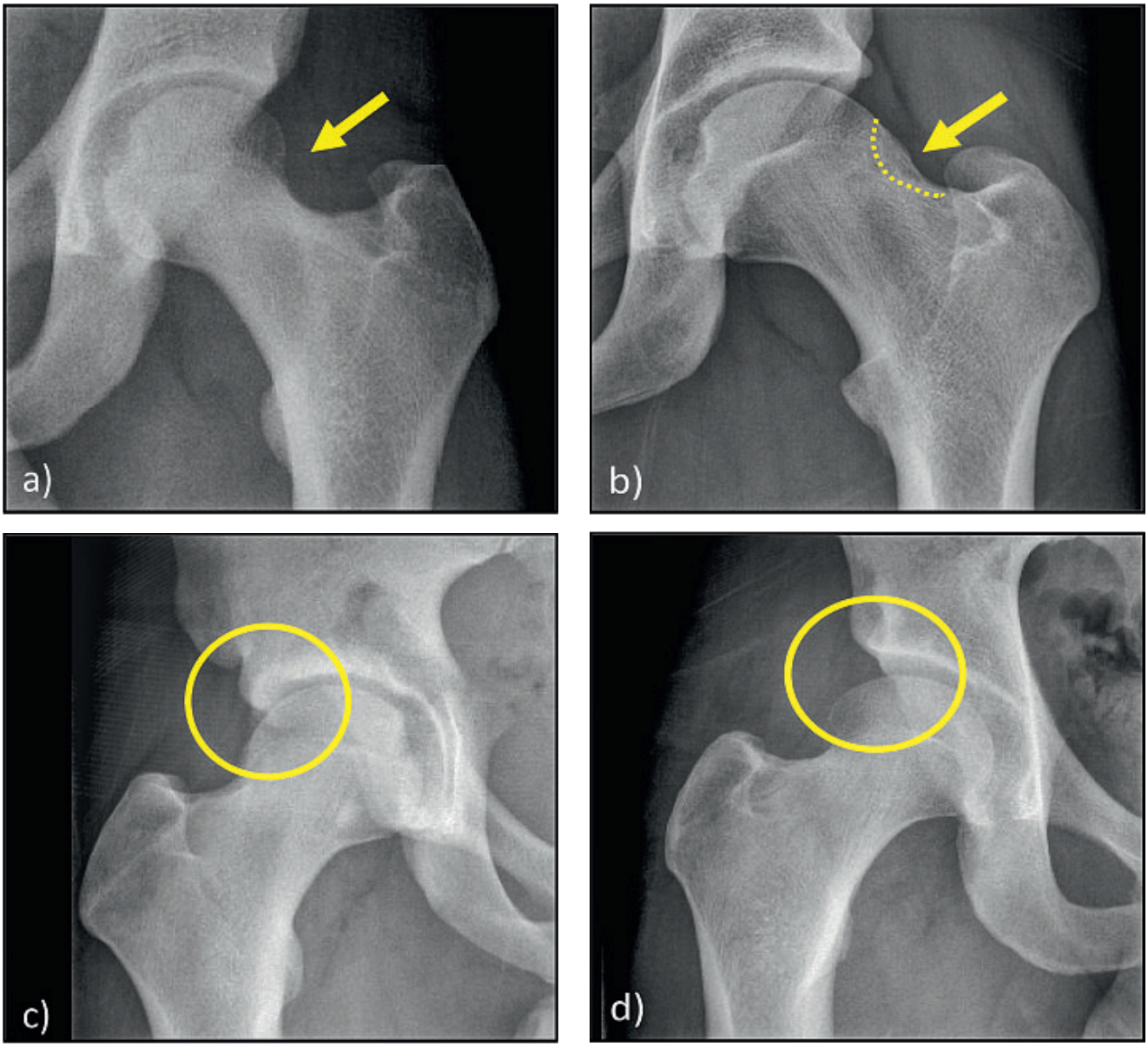


**Figure 1:** Bony morphological variants of the hip joint
a) Normal femoral-head neck offset and acetabular coverage
b) Cam morphology
c) Pincer morphology
d) Acetabular dysplasia

*Bony hip morphology and hip/groin pain in athletes*

With the aetiology of cam morphology linked to participation in vigorous sporting activities during maturation, [24] it is not surprising to find that the prevalence of cam morphology is higher in athletes than less athletic controls. [24,25] Young athletes with hip/groin symptoms have been found to have a high prevalence of cam and/or pincer morphology. [26,27] Therefore, a potential biomechanical link between cam and/or pincer morphology, reduced hip internal rotation range of motion, and increased pubic load has been proposed. [28] However, these bony morphological variants are also commonly found in asymptomatic hips. [29,30] Hence, their clinical significance is currently unclear in athletes.

A discrepancy exists between the high prevalence of cam morphology and the low incidence of hip related symptoms in professional male football players. [1,3,5,31] Given the rapid escalation in surgical procedures being performed to alleviate hip-related groin pain, there is a clear need to better understand the relationship between bony hip morphology and development of hip/groin pain in this population. The association between bony hip morphology and hip/groin injury had never been investigated prospectively until this PhD project. [32]

## Aim

The overall aim of my PhD research project was to prospectively investigate the association between intrinsic risk factors, including bony hip morphology, and time-loss hip/groin injury in male professional football players.

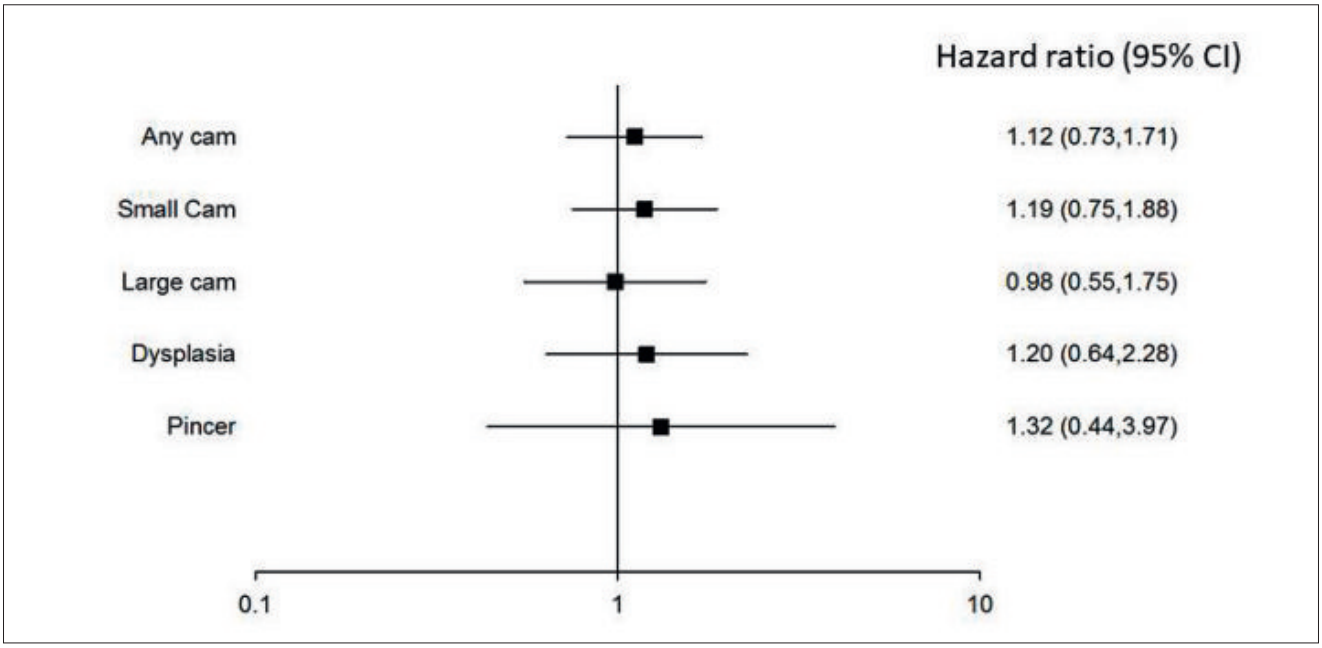


**Figure 2:** No association found between bony hip morphology and groin injury risk.

## Methods

A systematic review investigated the factors differentiating athletes with and without groin pain to inform the screening test battery. [33] A total of 575 football players underwent musculoskeletal, and X-ray screening specific for hip/groin pain during two consecutive seasons. Injury and exposure surveillance (training and match play) was conducted prospectively. Baseline data were analysed for two cross-sectional studies with the normal profiles for hip strength and range of motion, and the prevalence of bony morphological variants determined. Two prospective studies examined the epidemiology and intrinsic risk factors for hip/groin injury.

## Results

Dominance, previous groin injury and ethnicity had no clinically relevant effect on normal strength and range of motion profiles. [34] Cam morphology was very common (60% hips, 72% players), but acetabular overcoverage and undercoverage were uncommon (<13% players). Cam morphology prevalence was lower in East Asian football players. [31]

A high burden of groin injury was found in this cohort, at an incidence of 1.0/1000h (95% CI 0.9-1.1). Each club could expect 6.6 groin injuries (IQR 2.9-9.1) and 85 days lost per season (IQR 35-215 days). Adductor-related groin pain was the most common clinical entity (68%), and only two cases of hip-related groin pain (1%) were recorded in these two football seasons. [3]

Previous groin injury (HR= 1.8; 95% CI 1.2-2.7) and higher than normal eccentric adduction strength increased risk for hip/groin injury (HR=1.6; 95%CI 1.0-2.5). Lower than normal eccentric adduction strength increased risk for adductor-related injuries (HR =1.7; 95%CI 1.0-3.0). However, these associations were not strong enough to identify an 'at-risk' individual and therefore, not useful screening tests to predict injury. Bony hip morphology was not associated with groin injury risk. [32] *(Figure 2)*

## Conclusions

My PhD thesis found that musculoskeletal screening is most useful to detect current hip/groin symptoms, rather than detecting the individual "at-risk" of future groin injury. Hip adduction strengthening may prevent adductor-related groin injury, but is likely to be more effective if implemented to the whole team, rather than to the individual based on their screening test results. There is no indication for X-ray screening of bony hip morphology in asymptomatic male football players.

## Corresponding author

Dr Andrea Mosler, PhD, FACP
Specialist Sports Physiotherapist | Researcher
La Trobe Sport and Exercise Medicine Research Centre
School of Allied Health |
La Trobe University | VIC 3086 |
a.mosler@latrobe.edu.au

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