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Lumbar Bone Stress Injuries in Cricket Fast Bowlers: A Review

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Abstract

Lumbar Bone Stress Injuries (LBSI) encompass a spectrum ranging from bone stress reactions to lumbar stress fractures (LSF). These injuries are among the most prevalent in cricket players, particularly fast bowlers. This review highlights the epidemiology of LBSIs and explores both modifiable and non-modifiable risk factors associated with their development. Early diagnosis, along with appropriate workload management, plays a crucial role in the effective management of these injuries. Furthermore, structured prevention programs implemented by cricket organizations can significantly reduce the incidence and long-term impact of LBSIs in the sport.

Keywords: Cricket, Lumbar, LBSI, Fast bowlers, Stress reaction

Introduction

Lumbar bone stress injuries (LBSI) are among the most prevalent injuries in cricket players, with a time loss from active sport from 6 to 8 months [1]. In recent times, elite international cricketers for India, such as Jasprit Bumrah and Hardik Pandya, have been sidelined due to these injuries. They broadly include injuries involving the posterior vertebral arch, predominantly the pars interarticularis and the lumbar pedicle. They can range from bone stress reaction to complete lumbar stress fractures (LSF), which can be incomplete or complete [2]. Due to the asymmetrical and repetitive loading of the lower end of the vertebral column during pace bowling, along with high workloads, pace bowlers are the most prone to LBSI amongst all cricket players [3]. Prevention, timely diagnosis, and appropriate management and follow-up of these injuries are paramount for the well-being and longevity of pace bowlers.

In this short review, we will aim to provide a concise summary of the epidemiology, risk factors, presentation, injury prevention, and management strategies for LBSI and provide a clear understanding to all orthopaedic surgeons to adequately address these injuries.

Epidemiology

Various studies have estimated that 30–67% of fast bowlers have a lumbar stress reaction on magnetic resonance imaging (MRI) compared to 6% of the general population [4,5]. This highlights the impact of the repetitive loading of the lower back during rotation and hyperextension, which is seen in the bowling action of fast bowlers, with the highest impact being observed at the time of back foot landing [6]. Based on research conducted on the updated guidelines for injury definition given by Orchard et al. in 2016 [7], the annual incidence of LSF was found to range from 2.46 to 3.2/100 cricketers based on Australian and English elite level male fast bowlers [8,9]. In Australian cricketers, these injuries had the highest prevalence in elite players, with a total of 15% of all missed playing time being contributed to LBSI [8]. Despite having an incidence lower than other injuries, such as hamstring strains, the number of match days lost was the highest for LBSI due to the nature of the injury and the prolonged healing period. In a study on New Zealand cricket players between 2009 and 2015, the highest number of match days lost was attributed to lumbar spine injuries when both domestic and international players were taken into account [10]. Epidemiological studies for the incidence and prevalence of LBSI in Indian elite cricket players (Ranji level

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and above) are not available as per a search of the available literature.

Risk factors

A number of modifiable and non-modifiable risk factors have been investigated across various studies to determine their role in the incidence of lumbar stress reactions and injuries. Because of the large amount of heterogeneity of the available literature, strong evidence is not available for any of these [11].

Age

Younger fast bowlers have been found to be more susceptible to these injuries. This has been postulated to be a result of the delayed maturation of the lumbar spine compared to the rest of the skeleton, where complete ossification of the neural arch occurs by the age of 20 years [12]. In multiple studies, it has been observed that bowlers under 25 years are more prone to these injuries [9,13]. In a prospective evaluation of LSFs undertaken by Always et al., it was observed that the annual rate of LSFs was 4.90 per 100 fast bowlers in players <22 years of age compared to 2.46 for the entire study cohort [9]. In a study specifically conducted on adolescent fast bowlers, it was observed that increasing age was associated with a higher risk of LBSI; this was attributed to the potentially higher workload as bowlers mature and start turning out for senior teams [2].

Gender

There is a lacuna of research regarding the role of gender in the incidence of LBSI. It has been suggested that LBSI are more common in male cricketers, with a rate of 16.3 LBSI in male pace bowlers when compared to 3.0 in female pace bowlers observed in one study cohort [1]. The reasons for this difference have not been investigated properly, but various theories include lower workloads, earlier skeletal maturity, and differences in biomechanics of bowling actions [14-16]. In a comparison of elite Australian male and female cricketers, the injury incidence rate of LSFs was significantly higher in male cricketers compared to female cricketers [17].

Bone Characteristics

LBSIs have been seen to occur more commonly at the contralateral side of the bowling arm, with the pedicle of the neural arch the most commonly affected bony structure [18]. The most common levels for LBSI are L4 and L5, but injuries at upper lumbar levels have also been studied [3,19,20]. Conflicting evidence is available regarding the BMD at the site of injury in fast bowlers with LBSI, with a cross-sectional survey by Always et al. demonstrating lower BMD at L1–L4, but a prospective trial in adolescent fast bowlers demonstrating higher BMD on the injured site [2, 18].

Biomechanics

Biomechanical factors, including muscle mass and asymmetry of the quadratus lumborum and bowling technique, have been implicated in the pathogenesis of LBSI [6,21]. Contrasting evidence has been presented with respect to greater quadratus lumborum mass on the bowling side arm by Engstrom et al. and Kountouris et al., but currently there is no consensus [22-24]. Various types of bowling actions have been described (front-on, side-on, semi-open, mixed), out of which the mixed type of bowling action has been most commonly seen to be associated with the rate of LBSI in various studies [25, 26]. In an extensive study of bowling technique and its correlation with LBSI, the authors determined that higher rear hip flexion at the time of back foot contact; along with greater lumbopelvic extension at the time of front foot contact, had a higher chances of suffering from LBSI. These have been attributed to poor control of the lumbopelvifemoral complex during the bowling action, resulting in greater localized stresses on the lumbar spine [6]. In addition, increased shoulder counter-rotation and increased range of lateral flexion of the thorax during the bowling stride have been linked with LBSI [11, 21].

Workload

Overuse and increased workload have been investigated as a cause of LBSI in fast bowlers. Increased workload faced by older adolescent fast bowlers was theorized as the cause of increased LBSI by Keylock et al., as previously described [2]. 7-day workloads between 234 and 293 deliveries and >294 deliveries were associated with increased risk of LBSI [9]. Multiple other studies have highlighted the role of inadequate rest days (<3.5 days), and a sudden increase in workload as risk factors [27, 28].

Previous LBSI

Injuries that have not fully healed are a risk factor for recurrence of injury, recurrent LBSI on the opposite side, and chronic complications such as lithesis, degenerative disorders, and chronic back ache [29,30]. Recurrent LBSI (same or different locations) were observed in 33% of the affected individuals in the evaluation by Saw et al. [1].

Management

Pain does not have the strongest correlation with the extent of injury, and stress reactions or LSFs may be detected on a screening MRI [12]. When symptomatic, the bowler may present with low-grade chronic pain, which progressively hinders bowling and the ability to bowl longer spells. Acute fractures may present as an acute spasm [3].

The various diagnostic modalities for LBSI include Computed Tomography (CT) scan, single-photon emission CT (SPECT), MRI, and bone scan [1]. The injury can be picked up on a CT scan in the form of elongated pars, sclerosis, or a cortical breach. The most commonly used diagnostic and screening tool is MRI, which can pick up stress reactions in the initial stages of marrow edema. The lesion may not always be symptomatic, which emphasizes the importance of screening in susceptible players [1, 9, 30].

Majority of the cases are managed conservatively with an initial rest period, followed by gradual rehabilitation and reintroduction to training [30, 33]. Healing of LBSI takes place in the form of woven bone, which is followed by bone formation and remodelling. It is a gradual process that can take up to 6 months. In a study on Australian cricketers, it was observed that 87% of all LBSI healed over time, with a 100% healing rate observed in stress reactions [1]. They found that median days to return to bowling were 143 days, but the median days to return to competitive cricket were 182 days. In the study by Singh et al. [4], the median time to fracture union on MRI was 203 days for 25/31 fractures which showed radiological union. Gradual reintroduction to bowling and avoidance of long periods in which training is abandoned have been emphasized in the importance of the rehabilitation of these injuries [3, 18]. This is important to achieve optimal performance by these players and to prevent recurrent LBSIs. In cases which do not show healing by conservative measures, placement of a screw perpendicular to the fracture line (Buck's technique) is a surgery which can be done with or without bone grafting to promote bone healing with preservation of motion in the lumbar spine [31- 33].

Prevention

Screening programs and workload management for fast bowlers constitute the two facets in preventing LBSI, especially in young players. MRI has been used as a screening tool in Australian cricket and has helped in the early detection of these injuries at the level of stress reaction [1]. MRI has also been used in follow-up of these injuries to dictate return to play, although individual-specific factors also play an important role [4]. A significant proportion of injuries are recurrences with longer return to playing times seen in those cases, so proper rehabilitation becomes even more imperative in these cases [1, 11]. Coaches and trainers have to be educated about these injuries, along with the importance of workload management of young fast bowlers, especially once they graduate to higher playing levels with more rigorous schedules.

Future Research

Despite extensive research available on various aspects of LBSI, there are 2 clear gaps in research. First, considering the impact these injuries have had on the Indian national side in the recent past, more extensive research is needed in the Indian context especially owing to the possible differences in biomechanics in our population. Based on these, adequate screening and load management programs need to be instituted in collaboration with the National Cricket Academy (NCA) to minimize the impact of such injuries on our players. Second, with the advent of women's cricket; more research is warranted to specifically study the bearing of these injuries in that cohort.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the Journal. The patient understands that his name and initials will not be published, and due efforts will be made to conceal his identity, but anonymity cannot be guaranteed.

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