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Prevalence of contralateral low back pain in volleyball players

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Abstract:
Background *- Although there aren't many contact injuries in volleyball, the lower back is still a frequently overlooked injury site. Unbalanced rotatory and extension movements of the spine, heavy single-leg landings, and repetitive overhead activities are all part of the game. The spinal stabilizing muscles, especially the multifidus, are subjected to excessive strain because of these biomechanical demands. Hand abduction and spiking motions in volleyball engage the contralateral trunk muscles, which can cause muscle fatigue and subsequent pain if they are repeatedly strained. Furthermore, landing on the dominant side with one leg puts excessive strain on the contralateral lumbar area. Despite these mechanical pressures in industries less is understood with contralateral low back pain (CLBP). Finding out how widespread CLBP is among volleyball players and looking at any potential links to hand dominance and playing mechanics are the goals of this study.*
Methodolgy *- Based on qualifying criteria, 120 participants were selected after institutional ethics committee approval. Consent was given by each participant. Each participant was given a Google Form questionnaire along with a printed copy. The collected data constituted the basis for the statistical analysis that followed.*
Result *- Numerous volleyball players reported experiencing contralateral low back pain, which usually affects the side opposite the main spiking arm. The pain, which varied in intensity, was found to affect the performance of different athletes. A statistical examination of the relationship between hand dominance and the prevalence of contralateral low back pain revealed a significant correlation ($p < 0.05$), indicating that repetitive sports movements could be a contributing reason to this pattern of discomfort.*
Conclusion *The results of the study show that contralateral low back pain is common among volleyball players and is particularly associated with repetitive motions such as spiking and single-leg landings. Significant correlations between hand dominance and the side of low back pain suggest that biomechanical stress on the opposing side of the dominant arm contributes to the development of pain. These results highlight the need for targeted preventive interventions and conditioning programs to reduce risk and enhance sports performance.*
Keywords: *Sports injury, Overuse injury, Single leg landing, Spiking Mechanics, Repetitive Strain Injury.*

INTRODUCTION

Volleyball game involves repetitive jumping, spiking, blocking, and landing mechanics, it is a dynamic and widely popular sport that puts special demands on the musculoskeletal system[1]. Volleyball players are at a considerable risk of overuse injuries, especially in the spine and lower extremities, even though the sport is regarded as non-contact. Repeated trunk rotation, hyperextension, and unilateral landings are frequently associated with low back pain (LBP), which is consistently recognized as one of the most prevalent musculoskeletal complaints among athletes[3]. A unique manifestation of this ailment in volleyball players, known as contralateral low back pain (CLBP), is attracting increasing clinical attention. Asymmetric loading patterns that occur during volleyball play are thought to be the cause of CLBP, which is defined as pain that appears on the lumbar side opposite the dominant playing arm[4].

Asymmetry is naturally encouraged by volleyball's biomechanics. The non-dominant lumbar spine is repeatedly loaded during a spike, for example, when a right-handed athlete uses their dominant arm to generate explosive force while their torso rotates contralaterally. Similarly, landing on one leg or unilaterally after a jump causes imbalances that put stress on the spinal structures on the other side. Players may be at

risk for localized pain syndromes as a result of these repetitive movements, which can harm the multifidus and other stabilizing muscles over time, impair the integrity of the intervertebral disc, and change neuromuscular coordination. In volleyball players with persistent back pain, imaging studies have shown structural alterations, such as disc degeneration and facet joint stress[8]. However, few studies differentiate between general LBP and contralateral presentations, leaving a gap in knowledge concerning the true prevalence and clinical implications of CLBP in volleyball athletes.

Research shows that between 30% and 60% of athletes experience LBP episodes during their careers, with volleyball players being comparatively more at risk because of their sport-specific behaviors[9][10]. Although the laterality and dominance-related distribution were not evaluated, a comprehensive epidemiological study found that more than 40% of professional volleyball players experienced recurrent episodes of LBP[11]. According to more recent biomechanical research, the risk of developing CLBP[12] is increased when asymmetric spinal loading is combined with insufficient hip mobility or core stability. Despite these realizations, there is still little data estimating the frequency of CLBP, how it relates to playing position, and how hand dominance affects its presentation.

It is essential for coaches, physiotherapists, and sports medicine professionals to comprehend contralateral pain patterns. In addition to offering useful epidemiological data, the identification of CLBP guides the development of training modifications, rehabilitation procedures, and preventive conditioning programs specifically suited for volleyball players[13]. Specific techniques like neuromuscular re-education, landing mechanics training, and core strengthening have demonstrated potential in lowering spinal strain and averting chronic pain syndromes[14]. Epidemiological studies on CLBP are required to protect athlete health, maximize performance, and prolong athletic careers[15] due to the increasing intensity of volleyball training at the professional and amateur levels.

The purpose of this study is to find out how common contralateral low back pain is in volleyball players and how it relates to landing mechanics, playing position, and limb dominance. The results of this investigation into this little-studied pattern of musculoskeletal pain could fill a significant vacuum in the literature on sports injuries today and serve as the basis for evidence-based preventive measures[16–20].

MATERIAL AND METHODOLOGY

This cross-sectional observational study was conducted at Krishna Vishwa Vidyapeeth, Krishna College of Physiotherapy, Karad, over a six-month period. A simple random sample method was employed to select 120 volleyball players overall. Participants in the study had to have played volleyball recreationally for more than two years, be between the ages of 15 and 35, and train for at least eight hours each week. Participants had to be free of hip surgery, recent lower limb surgeries, or recent lower back or lower limb fractures.

The data was gathered using a standardised questionnaire that asked about demographics and the history of low back pain, including its frequency, intensity, and connection to hand dominance. All participants gave their informed consent prior to data collection. After the data was gathered, it was statistically examined.

INCLUSION CRITERIA:

i) Age group 15-30 years
ii) Recreational volleyball for more than 2 years
iii) Volleyball training hrs/week: 8 hrs/week
iv) Subjects willing to participate

EXCLUSION CRITERIA:

1.Subjects with any history of hip surgery
2.Recent fractures related to lower back
3.Recent Surgery in lower limb

METHOD OF DATA COLLECTION

A self-structured questionnaire that was distributed in printed and Google Form formats was used to gather data after ethical approval and informed consent. Along with the presence and characteristics of low back pain, the tool also recorded demographic and sports-related information, such as age, sex, playing position, hand dominance, and injury history. Participants' self-reports of their dominant spiking arm were used to identify contralateral low back pain, which was then verified by an anatomical pain map. The Numerical Pain Rating Scale (0–10) was used to measure the intensity of the pain. With the researcher on hand to provide clarification, participants took 15 to 20 minutes to complete the questionnaire on their own. Submissions, both digital and physical, were examined for completeness. Microsoft Excel was used to code, anonymize, and compile the data for further statistical analysis.

RESULT

TABLE NO:1 Demographic data

VARIABLE	CATEGORIES	FREQUENCY	PERCENTAGE
AGE	10 - 15 YRS	16	13.22
	16-20 YRS	35	28.92
	21-25 YRS	54	44.62
	26 -30 YRS	11	9.09
	31 AND ABOVE	5	4.13
HEIGHT	149	1	0.82
	150-160	27	22.31
	161- 170	54	44.62
	171-180	30	24.79
	181-190	8	6.61
	191 ABOVE	1	0.82
GENDER	MALE	70	57.85
	FEMALE	51	42.14

TABLE1: INTERPRETATION

The majority of volleyball participants in the survey were between the ages of 21 and 25 (44.62%), indicating that this age group peaked in volleyball involvement. Those between the ages of 16 and 20 (28.92%) came in

second. Based on the physical criteria of volleyball, the majority of players (44.62%) were in the 161–170 cm height range. The gender distribution, which displayed 42.14% females and 57.85% males, allowed for a fair comparison. According to these demographics, young adults who play volleyball the most are typically of average to above-average height, which may put them at greater risk for injuries specific to the sport, such as contralateral low back pain.

TABLE NO 2. AREA OF LOW BACK PAIN

AREA OF LOW BACK PAIN IN CONTRALATERAL LOW BACK PAIN		
LOCATION	**FREQUENCY**	**PERCENTAGE**
L2	9	13.6
L1	32	48.4
R2	0	0
R1	1	1.5
L2, L1	23	34.8
R1, R2	1	1.5
TOTAL CLBP INDIVIDUALS 66		

L1=LEFT 1, L2=LEFT 2, R1= RIGHT1, R2= RIGHT2

TABLE NO 2: INTERPRETATION

The most common location of contralateral low back pain among the 66 volleyball players who had it was the left L1 (48.4%), followed by mixed discomfort in the left L1 and L2 (34.8%). 13.6% of respondents said they experienced isolated pain in the left L2 region.However, only 1.5% of respondents reported pain in their right L1 and none in their right L2, indicating that right-sided pain was uncommon. Additionally, only 1.5% of cases had combined right-sided involvement (R1, R2).

It is clear from this distribution that left-sided low back discomfort, particularly in the lumbar segments (L1 and L2), is more prevalent. The pattern offers strong proof that asymmetrical, repetitive volleyball movements, such as spiking and single-leg landing (especially for right-handed players), increase the contralateral lumbar spine's mechanical load, resulting in overuse and localised pain in those particular regions.

TABLE NO 3. DOMINANCE OF HAND

DOMINANCE OF HAND		
	FREQUENCY	**PERCENTAGE**
RIGHT	61	92.4
LEFT	5	7.5
TOTAL CLBP INDIVIDUALS 66		

TABLE NO 3: INTERPRETATION

The left (non-dominant) side of the lower back experiences the majority of stress, as evidenced by the fact that 92.4% of the 66 people with contralateral low back pain were right-hand dominant. This lends credence to the theory that right-handed players' repetitive overhead motions cause asymmetrical loading, which in turn exacerbates contralateral low back pain.

4.LEG LANDING AFTER ATTACKING

LANDING LEG AFTER ATTACKING		
	FREQUENCY	PERCENTAGE
RIGHT	16	24.2
LEFT	13	19.6
BOTH	37	56
TOTAL CLBP INDIVIDUALS 66		

TABLE NO:4 INTERPRETATION

Among the 66 volleyball players with contralateral low back pain, 56% reported landing on both legs, 24.2% landed on the right leg, and 19.6% on the left leg after attacking. This suggests that over 50% of the athletes employ a bilateral landing technique, which could lessen unilateral strain on the lumbar spine and more evenly distribute force. However, those
landing predominantly on a single leg especially the right leg—may experience increased mechanical load on the opposite (left) side of the lower back, contributing to contralateral low back pain. The asymmetrical nature of single-leg landings, particularly in right-hand dominant players, reinforces the role of landing mechanics in the development of CLBP.

5.ACCORDING TO THE PLAYERS POSITION

ACCORDING TO PLAYER POSITION		
	FRQUENCY	PERCENTAGE
LIBERO(X)	8	12.1
SETTER(Y)	17	25.7
SPIKER/MIDDLE BLOCKER(Z)	41	62.1
TOTAL CLBP INDIVIDUALS 66		

TABLE NO 5: INTERPRETATION

Of the 66 volleyball players who experienced contralateral low back pain, spikers/middle blockers had the highest prevalence (62.1%), followed by setters (25.7%) and liberos (12.1%). This suggests that players in the front row, particularly blockers and spikers, are more likely to develop CLBP. The contralateral lumbar spine is repeatedly stressed by these positions, which include powerful overhead hitting, landing on one leg, jumping frequently, and rotating the trunk. Setters are moderately represented because, despite being less likely to experience high-impact landings, they nevertheless make dynamic trunk and arm movements. The lowest incidence was observed in liberos, who usually do not perform overhead spikes or blocks, confirming the connection between contralateral spinal strain and overhead mechanics.

This pattern lends credence to the notion that volleyball players' probability of experiencing contralateral low back discomfort is greatly influenced by position-specific demands.

DISCUSSION

More than half of the sample reported having pain on the side opposite their dominant arm, indicating a high prevalence of contralateral low back pain (CLBP) among volleyball players. This result supports the idea that the contralateral lumbar spine experiences disproportionate biomechanical loading due to volleyball's asymmetric demands, which include unilateral landings, blocking, and spiking. The strong correlation

between pain laterality and hand dominance implies that the contralateral paraspinal and stabilizing structures[2] may be subjected to stress from repetitive overhead motions executed with the dominant arm.

Our results are consistent with earlier research showing that volleyball players have high rates of general LBP, ranging from 30% to 60%[3–5]. However, by differentiating contralateral pain patterns, which have not been sufficiently addressed in previous epidemiological studies, this study adds a new dimension. Without distinguishing contralateral presentations, Campbell et al. showed facet joint abnormalities and lumbar disc degeneration in volleyball players with persistent back pain. The claim that lateralized biomechanics are crucial in the development of pain is supported by the fact that right-handed dominant players in our sample were more likely to have left-sided CLBP.

The way that pain is distributed by player position emphasizes the mechanisms unique to each sport that contribute to CLBP. Due to their frequent use of explosive jumps, spikes, and repetitive trunk rotations, middle blockers and spikers showed the highest prevalence. Although at lesser rates, setters also reported contralateral pain, indicating that trunk asymmetry may extend beyond power-based roles to include repetitive dynamic movements. Liberos had the lowest prevalence, which is in line with their decreased use of single-leg landings and overhead hitting. The position-specific risk model put forth in earlier volleyball injury literature[10] is supported by this gradient.

Biomechanically, the eccentric activation of trunk stabilizers, especially the multifidus, during spiking and landing actions[11] can account for contralateral loading. Strain on contralateral structures can result from lumbar stability being compromised by fatigue or imbalance in these muscles[12]. Nadler et al. emphasized how hip muscle imbalance and weak core muscles contribute to lumbar pain syndromes in athletes[13]. Similarly, Zemková and Zapletalová stressed that in sports populations, back pain is associated with both the onset and persistence of deficits in core muscle endurance[14]. These results collectively imply that CLBP in volleyball players is a complex disorder impacted by neuromuscular control deficiencies, muscular imbalance, and repetitive asymmetrical loading.

These findings highlight the value of early screening and preventive measures from a clinical standpoint. The incidence of CLBP[15] may be decreased by implementing landing mechanics training, core stabilization programs, and muscle imbalance correction exercises. Furthermore, it has been demonstrated that combining proprioceptive and neuromuscular training can effectively prevent recurrent injuries in a variety of joints; applying this technique to volleyball spinal health may have comparable advantages[16]. Athletes who are regularly monitored for early indications of contralateral pain may benefit from prompt interventions that stop the development of chronic or incapacitating conditions[17].

The results of this study also prompt further investigation. To monitor the progression of CLBP over time and evaluate the efficacy of preventive measures, longitudinal research is required. Deeper understanding of the precise loading patterns causing contralateral pain[18] may be possible through biomechanical analyses employing motion capture and electromyography. Additionally, investigating how gender, playing surface, and training volume affect this condition[19] may reveal more risk factors. By reducing the burden of spinal pain and promoting longer athletic careers, broadening the scope of research will improve the clinical management of volleyball players[20].

In conclusion, the fact that volleyball players frequently experience contralateral low back pain emphasizes the necessity of focused preventive measures. Sports medicine practitioners can dramatically lower the risk of CLBP by treating asymmetric loading patterns, enhancing core stability, and optimizing training schedules. This will improve athlete wellbeing and performance.

CONCLUSION

The results of the study show that contralateral low back discomfort is surprisingly common among volleyball players, affecting over half (54.54%) of them. Low back pain on the side opposite the dominant playing hand appears to be largely caused by the repetitive and asymmetrical actions of the sport, such as landing, serving,

and spiking. These results highlight the importance of sports-specific biomechanical demands as well as the need for education and preventative care.

The prevalence of contralateral low back pain among volleyball players emphasises the importance of targeted physical therapy, well-rounded training, and early management. By strengthening the core, adjusting technique, and addressing muscular imbalances, the likelihood of developing or aggravating low back discomfort can be decreased. Future research with larger sample numbers and longitudinal follow-up may provide deeper insights into long-term effects and effective prevention strategies.

Conflict of Interest

The authors declare no conflict of interest related to this study. The research was conducted independently without any financial or commercial support from organizations that could have influenced the results. All participants were recruited voluntarily, and the data collection, analysis, and interpretation were carried out solely for academic and scientific purposes.

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