

Original article

A 4-year epidemiological injury analysis in a Japanese male professional basketball team in terms of racial differences in injury patterns

Tomoyuki Asada¹ and Hiroataka Mutsuzaki²

¹Department of Orthopaedic Surgery, Ichihara Hospital, Japan

²Department of Orthopaedic Surgery, Ibaraki Prefectural University of Health Sciences, Japan

Abstract

Objective: To analyze injury patterns in a male Japanese professional basketball team of this new league, with a particular focus on the difference between injuries of Asian and non-Asian players.

Patients and Methods: During four basketball seasons, we analyzed all injuries in a B2 league team. We investigated the injury rate (IR), game injury rate (GIR), practice injury rate (PIR), pathology, and body area of each injury. Player demographics and injuries were collected from a database, which was updated by the team's athletic trainer.

Results: In total, 47 injuries in 51 players during the 4-year seasons were included. The IRs overall, in Asian, and in non-Asian players were 4.42, 4.37, and 3.11/1000 player hours (PH), respectively. The GIR (47.16/1000 PH overall, 4.37 in Asian, and 3.11 in non-Asians) was significantly higher than the PIR (1.50/1000 PH overall, 1.66 in Asian, and 0.84 in non-Asian; $P < 0.001$ in all groups). Injuries of the upper body occurred only in Asian players ($n=17$; 51%, $P=0.022$). Most injuries occurred in the lower extremities than in other body parts ($n=30$; 64%, $P < 0.001$), for which Asian and non-Asian players showed similar tendencies. Ankle sprains were the most common acute injury ($n=7$; 15%, $P=0.007$), while joint problems were the most common chronic injury ($n=7$; 15%, $P=0.046$).

Conclusion: In this Japanese basketball team, the GIR of Asian, non-Asian, and overall players was higher than that of PIR. Injuries of the upper body were more frequent in Asian players than in non-Asian players in this league. Ankle sprains were the most common injury in both groups, while acute skin injuries occurred predominantly in Asian players. Prevention programs should be developed for injuries of the upper body in Asian players and those with lower extremity injuries.

Key words: injury analysis, basketball, ankle injury prevention, racial difference

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Introduction

A new professional basketball league in Japan, called the “B league” was launched in 2016 as a combination of two conventional male basketball leagues. The Japanese basketball league was formed in 1967 and included eight teams. The top Japanese league has changed its name several times; however, the B league is the first professional basketball

league in Japan. It consists of the B1, B2, and B3 subdivisions, including 18, 18, and 9 teams, respectively. Recently, the play style of basketball changed dramatically. Players tend to have more physical contact, which has become more important in recent games than before^{1,2}. The establishment of new professional basketball leagues allows foreign players to participate in the game. Physical differences between Japanese and foreign players may cause harder contact during sports leading to injuries.

A report from the National Collegiate Athletic Association (NCAA) indicated that the game injury rate (GIR) was significantly higher than the practice injury rate (PIR)³. Japanese professional basketball teams mostly consist of Japanese players, with few foreign players; the demographic and physical differences in players could create different injury patterns, especially during games. The injury characteristics in each ethnicity and background were needed to stratify the risk of injury in this league. However, to the best of our knowledge,

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Corresponding author: Hiroataka Mutsuzaki, 4669-2 Ami, Ami-machi, Inashiki-gun, Ibaraki 300-0394, Japan

E-mail: mutsuzaki@ipu.ac.jp

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no study has provided injury reports of teams in the new Japanese basketball league, especially from the viewpoint of racial differences. Therefore, this study had two purposes. First, to conduct an injury analysis of the new Japanese basketball league and describe injury characteristics in a B2 team focusing on the differences between Asian and non-Asian players.

Patients and Methods

Patients and ethical considerations

We retrospectively analyzed all injuries in a team of the B2 league during the 2014–2015, 2015–2016, 2016–2017, and 2017–2018 seasons and evaluated the injury rate (IR), GIR, PIR, and the pathology and body area of each injury. We included players who were part of the team for at least one season. Players contracted part-time (i.e., only played in one game) were excluded. This study was approved by the ethics board of our institution (approval no. e110). Informed consent was obtained using the opt-out method on our institution's website, and those who chose to 'opt-out' were confirmed and did not participate in the study. All players gave their consent.

Definitions

Injuries were defined based on diagnosis from a doctor in a hospital in the season. A team's trainer judged whether a player should go to the hospital when an injury occurred. Injuries included trauma injuries and overuse syndrome, which we defined as "acute injury" and "chronic injury", respectively, in this study. A team's trainer recorded all injuries during that season. Each season had a different trainer. The body area and pathology were classified for each injury based on a previous study⁴.

The IR was calculated using the formula below: The amount of playing time was measured in hours. Player hour (PH) was defined as the number of playing athletes multiplied by playing hours. In this study, the IR was calculated per 1,000/PH.

$$IR = \frac{\text{Number of injuries} \times 1,000}{\text{Amount of playing time}}$$

For IR, differences in units matter when comparing with previous reports. Various authors have reported IR using PH and athlete exposure (AE) as the two major units^{2–5}. AE can be defined as the number of players multiplied by the number of playing games. Therefore, AE is limited because of its inability to distinguish between athletes who played the whole game and those who played for just one minute⁴. In this study, we used PH because players were traded more frequently, especially during the first two seasons.

The race was expressed as Asian or non-Asian and was classified based on nationality. Asian players were classified as those from Japan, while non-Asian players were Cauca-

sian or African. None of the players were naturalized Japanese citizens.

Statistical analyses

For player demographics, Student's t-test was used to compare the characteristics of Asian and non-Asian players. The χ^2 test was used for other comparisons. The number of injuries was analyzed with the expected number from the number of players. The IR was analyzed with the expected IR according to the playing time. $P < 0.05$ was considered significant. All statistical analyses were performed using EZR on R commander ver. 1.40, Microsoft Excel 2016 (Microsoft; Redmond, WA, USA).

Results

In total, 47 injuries in 51 players occurred during the four seasons. The demographic data of patients are shown in Table 1. Asian players were all Japanese (39 players, 76.4%), including 39 injuries. One injury occurred in 12 players, two injuries in two players, three injuries in four players, five injuries in one player, and seven injuries in one player. In the non-Asian group, three players (6.4%) were white, and nine players (19.1%) were black, including eight injuries. Two injuries occurred in one player, and one injury occurred in six players. Non-Asian players were significantly taller and heavier than Asian players ($P < 0.001$).

Table 2 shows the game time, practice time, number of injuries, IR, GIR, and PIR in each group. The IRs for Asian and non-Asian players were 4.37/1000 PH and 3.11/1000 PH, respectively. The GIRs in each group were significantly higher than those in the PIRs ($P < 0.001$). The overall IR was 4.42/1000 PH. The GIR of both groups was significantly higher than the overall PIR ($P < 0.001$). Playing time, injury number adjusted by player number, IR, GIR, and PIR did not differ between Asian and non-Asian players.

Table 3 illustrates that injuries in the lower extremities were the most common ($n=31$; 64%, $P < 0.001$). Both the Asian and non-Asian groups also exhibited that injuries in the lower extremities were the most frequent. Half of all lower extremity injuries were noted as ankle and foot injuries ($n=15$; 32%, $P < 0.001$). Knee injuries were the second most common type of injury ($n=7$; 15%, $P=0.042$). When

Table 1 Demographics characteristics of the players

	Overall	Asian	Non-Asian	P-value
N	51	39	12	
Age (years)	29.3 ± 4.6	29.2 ± 4.9	29.7 ± 3.1	0.7
Height (cm)	188.6 ± 12.0	184.2 ± 9.3	203.6 ± 5.7	<0.001
Weight (kg)	87.7 ± 15.1	81.3 ± 9.6	109.0 ± 7.9	<0.001

The results are expressed as the mean ± standard deviation. N: Number of players; cm: centimeter; kg: kilogram.

Table 2 Injury rate

	Total	Asian	Non-Asian	P value
Total game time (hr)	657.38	480.04	194.09	0.161
Total practice time (hr)	10,634.87	8,438.51	2,380.36	0.513
Injury number in game	31	25	6	0.583
Injury number in practice	16	14	2	0.298
Overall IR	4.42	4.37	3.11	0.376
GIR	47.16	52.08	30.91	0.684
PIR	1.5	1.66	0.84	0.342

hr: hour; IR: injury rate; GIR: injury rate in-game; PIR: injury rate in practice. * $P < 0.05$: comparing GIR and PIR in each group.

Table 3 Details of injury according to the body parts

	Total	Asian	Non-Asian	P-value
Head	7	7	0	0.142
Head	1	1		
Face and scalp	6	6		
Upper limb	5	5	0	0.214
Shoulder	3	3		
Upper arm				
Elbow				
Forearm	1 *	1 *	*	
Wrist				
Hand and finger	1	1		
Spine and trunk	5	5	0	0.214
Cervical				
Thoracic and lumbar	3	3		
Trunk	2	2		
Lower limb	31	23	8	0.765
Hip and pelvis	2	1	1	
Thigh	6	5	1	
Knee	7**	5	2	
Lower leg	1	1		
Ankle and foot	15**	11	4	
Total	47	39	8	0.293

* $P < 0.05$ as compared between each group of body parts; ** $P < 0.05$ as compared with respect to the number of injuries among lower limb injuries.

comparing injury patterns among players of different ethnicities, there were no significant differences in overall IR between Asians and non-Asians (4.37 vs. 3.11/1000 PH; $P = 0.376$). However, injuries to the upper body, including the head ($n = 7$; 15%), upper extremities ($n = 5$; 11%), and spine and trunk ($n = 5$; 11%), occurred only in Asian players ($n = 17$; 51%, $P = 0.022$). Head injuries occurred with an acute onset and included two lip lacerations, two eyelid lacerations, one nasal fracture, and one concussion.

Table 4 shows the pathologies of acute injuries. Sprains were the most frequent acute injury ($n = 11$; 23%, $P = 0.007$). During games, skin injuries were the second most frequent injuries in Asian players, while no skin injuries occurred in non-Asian players ($n = 5$ vs. 0; $P = 0.155$). Non-game-related

skin injuries also occurred in Asian players during practice.

Table 5 shows the pathologies of chronic injuries. Joint injuries were the most prevalent ($n = 7$; 15%, $P = 0.046$), including those in the knee ($n = 3$; 42% in chronic joint pain, $P = 0.666$), followed by the lumbar spine ($n = 2$; 29%), shoulder ($n = 1$; 14%), and hip ($n = 1$; 14%). During games, joint problems were the most prevalent ($n = 4$; 80%, $P = 0.035$). Both groups showed similar tendencies in joint problems during the games.

Discussion

This is the first report describing injury patterns in the reorganized Japanese professional basketball league. We

Table 4 Frequency of acute injury

Acute injury	N (%)	Game-related			
		Total	Asian	Non-Asian	<i>P</i> -value
Sprain	12 (31.4%)*	8	6	2	0.922
Rupture	7 (22.9%)	5	3	2	0.385
Contusion	6 (17.1%)	5	4	1	0.852
Skin injury	6 (17.1%)	5	5	0	0.215
Fracture	2 (5.7%)	1	1	0	0.579
Concussion	1 (2.9%)	1	1	0	0.579
Dislocation	1 (2.9%)	1	1	0	0.579
Total	35 (100%)	26	21	5	0.605

N: number of injuries. * $P < 0.05$; frequent among all injuries.

Table 5 Frequency of chronic injury

Chronic injury	N (%)	Game-related			
		Total	Asian	Non-Asian	<i>P</i> -value
Joint	7 (58.3%)*	4*	3	1	0.944
Ligament	3 (25.0%)	0	0	0	NA
Muscle strain	1 (8.3%)	1	1	0	0.579
Existing injury	1 (8.3%)	0	0	0	NA
Total	12	5	4	1	0.852

N: number of injuries; NA: not available. * $P < 0.05$; frequent among all injuries.

found that the GIR was higher than the PIR in both Asian and non-Asian groups in this study. No significant difference in IR of all injuries across different ethnicities was indicated, while injuries of the upper body were most frequent in the Asian population ($n=17$; 51%, $P=0.022$).

A study from the NCAA¹⁾ indicated that the GIR (13.79/1000 PH) was significantly higher than the PIR (3.98/1000 PH), which is consistent with the findings of our study. Rodas *et al.*⁶⁾ reported that the total IR in the Spanish league was 10.8/1000 PH (GIR, 76.4/1000 PH; PIR 7.1/1000 PH), injuries that caused players to be absent from game or practice were 4.8/1000 PH, and injuries that only needed medical attention were 4.0/1000 PH. This result was considerably higher than ours (GIR 47.16/1000 PH; PIR 1.50/1000 PH). We defined injury based on hospital diagnosis, while other reports classified players as being injured when they were rejected from the game²⁻⁴⁾. In this team, doctors did not occasionally attend practice, but a venue doctor was always needed during the official game time. A team trainer attends the practice and judges whether the injury requires hospital-based diagnosis, such as radiographic imaging, or treatment by doctors, especially during practice. Injuries judged as not requiring medical attention were not reported. This may have caused a reduction in the number of injuries compared with reports from other countries.

There was no significant difference in IR across ethnici-

ties. However, injuries of the upper body occurred most frequently in the Asian population ($n=17$; 51%, $P=0.022$). Head injuries, such as concussions and nasal fractures, are disastrous events that require additional precautions for prevention. In an analysis by the NBA²⁾, head injuries occurred in 8.5% of all injuries and 11.5% of game-related injuries. Each team in this Japanese professional basketball league accepted three players of different nationalities. Player demographic data (Table 1) revealed that players of other nationalities were taller and heavier than Japanese players ($P < 0.001$). Furthermore, foreign players on these teams played as power forward or center owing to their physical superiority. These physical differences were similar to those of other teams and could account for the incidence of head injuries in Asian players due to physical contact and playing styles, such as screening and picking-and-rolling. Based on previous reports, basketball-related facial injuries are inescapable, and precautions for preventing such injuries are ineffective^{7, 8)}. On the other hand, another study indicated mouthguards' effectiveness in reducing morbidity and expense in dental injuries⁸⁾. Hence, a mouthguard should be recommended for all players as a preventive measure.

No previous study has indicated that an Asian player's contact with a non-Asian player causes facial injuries. In this study, there was no medical record of the situation at the time of injury, mentioning parties involved in a clash. A

more detailed injury record should be established in further studies to consider the differences in risks and precautions across players of different leagues, nationalities, and positions¹⁾ to clarify the importance of a preventive plan.

Ankle injuries were the most common, occurring more frequently than injuries of other body parts. Asian and non-Asian players showed similar tendencies in the overall injury pattern, with no significant difference between the groups. Injury patterns, in terms of the body parts affected, differ for each sport. Although ankle injuries are known to be common among basketball players and thus involve the use of high-top shoes, side cutting and jumping movements within a crowded playing field contributed to their occurrence in our study. Grassi *et al.* described the importance of screening unstable ankle joints to prevent ankle sprains⁹⁾. More focus needs to be placed on providing programs to prevent ankle injury.

Joint injuries were the most common ($n=7$; 15%, $P=0.046$). In particular, knee joint pain without onset was the most frequent ($n=3$; 42% in chronic joint injury, $P=0.666$). However, details regarding knee joint pain, such as anatomical location (i.e., anterior or posterior) or diagnosis (i.e., patellofemoral syndrome, tendinitis, enthesitis), have not been described. Starkey *et al.* described the patellofemoral syndrome in professional basketball as “silent and endemic”²⁾. More detailed assessments of knee joint injuries and pain should be conducted. Furthermore, the patellofemoral syndrome should be correctly diagnosed and treated because knee pain/injury has a significant impact on playing time.

Although this report reveals the injury patterns in a new Japanese basketball league, we recognize that our study had some limitations. First, injuries were defined differently in other studies. We admit that there was a selection bias based on trainers in the season included in this study. Second, several different players were included in the 4-year follow-up.

The lack of continuous follow-up makes it difficult to assess which injuries significantly impact playing time. Third, this study was designed as a retrospective cohort study, and the population size and sex of the players were limited in this study because we examined only a team in the B2 Japanese league retrospectively. A small sample size may have resulted in no statistical difference between Asian and non-Asian players. Moreover, it is possible that female players demonstrate a different injury pattern^{3, 10)}. Further investigations involving other Japanese teams and females are needed to confirm this study’s findings and determine the injury patterns of other populations.

Conclusion

This is the first report describing injury patterns in a Japanese professional basketball team belonging to the new Japanese “B league”. We found that the overall GIR and Asian and non-Asian groups were significantly higher than the upper body’s PIR injuries only in Asian players in this team. Acute injuries were common, especially in the lower extremities, such as the ankle/foot and knee in both groups. Acute face injuries were common only in Asian players. Our study highlights the importance of establishing prevention programs and treating injuries in the lower extremities and the face, especially during game time.

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