

KNEE JOINT INJURIES IN YOUNG BASKETBALL PLAYERS


LESÕES NA ARTICULAÇÃO DO JOELHO EM JOVENS JOGADORES DE BASQUETEBOL

LESIONES DE LA ARTICULACIÓN DE LA RODILLA EN JÓVENES JUGADORES DE BALONCESTO



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Mingju Huang¹ 
(Physical Education Professional)

Yangmei Zheng¹ 
(Physician)

1. Guilin University of Electronic
Technology, Guilin, Guangxi, China.

Correspondence:

Yangmei Zheng
Guilin, Guangxi, China. 541004.
liu42112zhou821@163.com

ABSTRACT

Introduction: Basketball is a popular sport globally, and as the development of college basketball develops, basketball injuries also tend to increase. The knee has the highest injuries and problems incidence, reducing the athlete's ability and shortening their professional career. **Objective:** Explore the causes and characteristics of knee joint injuries in basketball players, comparing their different levels, performances, and positions. **Methods:** 600 college basketball players were studied. Current and past injuries were collected. A questionnaire on lifestyle, behavior, and habits was also applied, and their levels of physical ability and knowledge were also evaluated. Statistical methods were employed to investigate the characteristics and causes of knee joint injuries in young athletes. **Results:** Among knee joint injuries of adolescent basketball players, there were more medial collateral ligament injuries and meniscal injuries. The probabilities are 34.1% and 24.3%, respectively. Patellar strain and cruciate ligament injury accounted for 12.1% and 19.5%, respectively, and the probability of fracture injury was 2.4%. **Conclusion:** The knee joint is one of the most vulnerable joints in basketball. The consequences of its injury can bring an athletic career down and have a considerable impact on athletes' physical and mental health. **Evidence Level II; Therapeutic Studies – Investigating the results.**

Keywords: Basketball; Sports; Knee injuries; Adolescent.

RESUMO

Introdução: O basquete é um esporte popular em todo o mundo e com o desenvolvimento do basquetebol universitário, as lesões causadas pelo basquetebol também tendem a aumentar. O joelho possui o maior índice de lesões e problemas nessa articulação também reduzem a capacidade do atleta, encurtando a sua carreira profissional. **Objetivo:** Explorar as causas e características das lesões na articulação do joelho em jogadores de basquetebol comparando seus diferentes níveis, desempenhos e posições. **Métodos:** 600 universitários jogadores de basquete foram estudados. Foram arquivadas as lesões atuais e pregressas. Um questionário sobre estilo de vida, comportamento e hábitos também foi aplicado; seus níveis de habilidade física e conhecimento foram avaliados. Métodos estatísticos investigaram as características e causas das lesões na articulação do joelho nos jovens atletas. **Resultados:** Entre as lesões articulares de joelho nos jogadores adolescentes de basquete, houve mais lesões ligamentares colaterais mediais e lesões meniscais. As probabilidades são de 34,1% e 24,3%, respectivamente. A tensão patelar e a lesão do ligamento cruzado representaram 12,1% e 19,5%, respectivamente, e a probabilidade de lesão por fratura foi de 2,4%. **Conclusão:** A articulação do joelho é uma das partes mais vulneráveis do basquetebol. As consequências de sua lesão podem acarretar o fim da carreira esportiva, tendo um impacto considerável sobre a saúde física e mental dos atletas. **Nível de evidência II; Estudos Terapêuticos - Investigação de Resultados.**

Descritores: Basquetebol; Esportes; Traumatismos do Joelho; Adolescente.

RESUMEN

Introducción: El baloncesto es un deporte popular en todo el mundo y con el desarrollo del baloncesto universitario, las lesiones causadas por el baloncesto también tienden a aumentar. La rodilla tiene el mayor índice de lesiones y los problemas en esta articulación también reducen la capacidad del deportista, acortando su carrera profesional. **Objetivo:** Explorar las causas y características de las lesiones de la articulación de la rodilla en jugadores de baloncesto comparando sus diferentes niveles, rendimientos y posiciones. **Métodos:** Se estudiaron 600 jugadores de baloncesto universitario. Se presentaron las lesiones actuales y pasadas. También se aplicó un cuestionario sobre el estilo de vida, el comportamiento y los hábitos; y también se evaluaron sus niveles de capacidad física y conocimientos. Se emplearon métodos estadísticos para investigar las características y las causas de las lesiones de la articulación de la rodilla en atletas jóvenes. **Resultados:** Entre las lesiones de la articulación de la rodilla de los jugadores de baloncesto adolescentes, hubo más lesiones del ligamento colateral medial y de menisco. Las probabilidades son del 34,1% y del 24,3%, respectivamente. La distensión rotuliana y la lesión del ligamento cruzado representaron el 12,1% y el 19,5%, respectivamente, y la probabilidad de lesión por fractura fue del 2,4%. **Conclusión:** La articulación de la rodilla es una de las partes más vulnerables del baloncesto. Las consecuencias de su lesión pueden llevar al fin de una carrera deportiva, teniendo un impacto considerable en la salud física y mental de los atletas. **Nivel de evidencia II; Estudios terapéuticos - Investigación de resultados.**

Descriptores: Baloncesto; Deportes; Traumatismos de la Rodilla; Adolescente.



INTRODUCTION

Basketball is a popular sport popular all over the world. Injuries caused by basketball are on the rise. Due to inattention to methods and methods in basketball, many participants have sports injuries, especially knee injuries, which are the most common.¹ This has seriously affected the performance of high-level basketball players and the improvement of their athletic ability, thus shortening the athlete's lifespan.

METHOD

Research object

The article focuses on 600 high-level basketball players from regular full-time colleges and universities as the research object.

Research methods

Questionnaire survey method

Design the questionnaire based on the research content. We selected dozens of Gaoping basketball students from each school as the survey subjects, and each handed out one questionnaire.² A total of 600 questionnaires were distributed, and 563 were returned, with a recovery rate of 93.8%. There are 554 valid questionnaires, with an effective rate of 92.3%.

Mathematical Statistics

We input all data into the computer and use Microsoft Excel 2003 software for statistics, analysis, and processing.

Anatomy experiment method

We selected adult male knee joint specimens and made them into joint specimens that completely exposed the ligaments of various parts.³ We saw horizontally at 20cm at the proximal and distal ends of the articular surface. The broken end is fixed and embedded with dental cement in the upright position. On the calf rotation shaft axis, screw 6 screws at the end of the femur with an interval of 2 cm. The angle of the nail and the axis of rotation are respectively 30°, 45°, 60°, 90°, 120°, and 150°. We fixed the specimens on the MTS material testing machine. The end of the femur is connected with a corresponding stabilization device. Apply flexion, extension, rotation moments, and flexion-extension simultaneous rotation moments on it, and measure the changes in knee joint flexion-extension and rotation angles.⁴ Finally, the article conducts a destructive tear test of the tibial collateral ligament, fibular collateral ligament, and anterior and posterior cruciate ligament. At the same time, the meniscus injury test and the biomechanical test were carried out.

Modeling and Simulation of Knee Joint Injury

Suppose $X = (X_1, X_2, \dots, X_p)$ represents a P dimensional random vector. I represents a constant vector that affects the athlete's elbow (knee) joint injury factor. Under the $I_i' I_i = 1, i = 1, 2, \dots, p$ constraint, we use the following formula to establish a linear transformation matrix that produces the athlete's elbow (knee) joint injury factor

$$\begin{cases} Y_1 = I_1' X = i_{11} X_1 + I_{p1} X_p \\ Y_2 = I_2' X = i_{12} X_1 + I_{p2} X_p \\ Y_p = I_p' X = i_{1p} X_1 + I_{pp} X_p \end{cases} \quad (1)$$

We use Y_1 to replace P original variables X_1, X_2, \dots, X_p that produce the athlete's elbow (knee) joint injury factors, and require Y_1 to be able to express the information of the original variables.⁵ The characteristics of the relationship between basketball players' overtraining and elbow (knee) joint injury factors can be expressed by the following formula

$$Var((Y_i)) = I_i' \Sigma I_i \quad (2)$$

$$COV((Y_i, Y_j)) = I_i' \Sigma I_j \quad (3)$$

The larger the value of $Var(Y_1)$, the more information Y_1 contains the factors that affect the athlete's elbow (knee) joint injury. We use I_1 to make $Var(Y_1)$ extremely large. The i principal component of X needs to satisfy the condition of $Y_i = I_i' X$. I_i represents the characteristics of the relationship between basketball players' overtraining and the factors that affect athletes' elbow (knee) joint injury. Σ represents X covariance matrix. We use the following formula to obtain a sample matrix of the elbow (knee) joint injuries caused by overtraining of basketball players

$$X = (X_1, X_2, \dots, X_p)' \quad (4)$$

The correlation matrix of a sample of the elbow (knee) joint injury caused by overtraining of basketball players is expressed as follows

$$P = \frac{1}{n-1} X' X \quad (5)$$

Establish a basketball player's overtraining elbow (knee), joint injury model, based on the following formula:

$$Y_i = a_{i1} \frac{X_1 - \bar{X}_1}{S_1} + a_{i2} \frac{X_2 - \bar{X}_2}{S_2} + \dots + a_{ip} \frac{X_p - \bar{X}_p}{S_p} \quad (6)$$

RESULTS

Analysis of the structure and injury of the knee joint

We know that the knee joint is the most complicated part of the human body through physiological anatomy. It is formed by connecting the medial and lateral condyles of the femur, the patella, the medial and lateral condyles of the tibia, and the patella. Each joint surface is covered with a layer of joint soft muscle. At both ends of the knee joint, some femurs and tibias constitute levers. It receives greater stress than other joints during activities. Because the knee joint has the largest articular surface, superficial parts, and the strongest leverage, it has a heavy load, is unstable, and is easily injured. In basketball, the human body has more left and right sliding steps, making the knee joint's medial collateral ligament easy to damage.⁶

Analysis of the mechanism of basketball players' knee joint injury

In the valid 554 questionnaires, 479 people answered that they had suffered sports injuries in basketball.⁷ Among them, 123 people suffered knee injuries, and the injury rate was 25.7%. (Table 1)

The technical action characteristics of basketball lead to different degrees of injury in various knee joint parts. Basketball players must have a low center of gravity when attacking or defending with the ball and are mostly in a squatting position, so the knee joints are highly strained and prone to injury. In high-level basketball players of colleges and universities, the medial collateral ligament injury and meniscus injury occurred more frequently in the knee joint injuries. The probability was 34.1% and 24.3%, respectively.⁸ Patella strain and cruciate ligament injury accounted for 12.1% and 19.5%, respectively. Fracture injuries are relatively rare, accounting for only 2.4%.

The characteristics of basketball are the momentary alternation of offense and defense, sudden start, acceleration or stop, turning, jumping or squatting, and posture changes. Knee joint injury is one of the common injuries when playing basketball for a long time. The knee joint injury is most common when the offender's body is in a non-contact state. Such as the change of direction in basketball, emergency stop, sidecut, etc. The survey showed multiple risk factors for a knee injury in basketball (Table 2). One of the most basic physical characteristics in basketball is a low center of gravity. The knee joint is always in 130°~150° flexion when sliding or standing because this position is the best posture for the quadriceps to obtain the maximum torque. According to the anatomical experiment method, the electromyogram showed that the quadriceps muscle only participates in the knee extension when the knee joint is in this position, which increases the strength and effect of the extension. In addition, the collateral ligament and cruciate ligament of the knee joint are in a relaxed state at this position.⁹ This facilitates the direction change of the knee joint so that the knee joint is more flexible when changing direction. The contraction of the quadriceps muscle accomplishes the powerful take-off and landing. The strong contraction of the quadriceps makes the patella and femur collide. Repeated impacts can easily damage the cartilage of the patella and femur and cause patella-femoral arthropathy. This is often manifested as knee pain when athletes take off or land. In addition, long-term training can cause knee joint strain. As shown in Table 2, the main causes of basketball injury are as follows:

Table 1. Classification statistics of knee injury types in basketball.

Location	Type of damage	Number of people	Percentage(%)
Knee joint	Meniscus injury	30	24.3
	Injury of the medial and lateral collateral ligaments	42	34.1
	Cruciate Ligament Injury	24	19.5
	Patella injury	15	12.1
	Patella osteochondrosis	5	4
	Fat pad injury	4	3.2
	fracture	3	2.4
	total	123	100

Table 2. Risk factors that cause basketball players' knee joint injuries.

Risk factors	N	Percentage (%)
Poor technical ability	28	22.8
Too fast	5	4.1
Insufficient warm-up	21	17.1
fatigue	19	15.4
collision	9	7.3
Decreased exercise capacity	3	2.4
Lack of care	2	1.6
fall	9	7.3
Psychological factors	12	9.8
Hard ground	10	8.1
Unsuitable sneakers	5	4.1
total	123	100

DISCUSSION

Analysis of the causes of sports injuries

The level of sports training is not high

Basketball sports have relatively high requirements for participants' physical fitness, including strength, speed, endurance, coordination, and agility. These qualities are necessary to complete the difficult technique in basketball technique. However, the physical fitness of some athletes

is not very good. At the same time, they lack systematic training but want to try beautiful but difficult basketball skills. This greatly increases the chance of injury.

Insufficient preparation activities

Lack of warm-up or incorrect warm-up is the main cause of sports injuries. Most athletes don't pay enough attention to warm-up activities. They think that warm-up activities consume physical strength, and they just do some simple leg presses, waist extensions, and sometimes no warm-up activities at all. This is the root cause of the damage. Therefore, the preparation activities must conform to the principle of science.

Improper arrangement of exercise volume

This is manifested in the amount of exercise that violates the principle of "gradual and orderly progress." This makes local overburden, practice density, practice time, practice intensity, and other aspects unscientific and causes damage.

Psychological factors

The investigation found that athletes have the mentality to avoid training or teaching, worry about failure, and intend to punish others. Psychological factors such as emergency factors in life, major changes or inadaptability to the climate, low or high emotional state, and the level of social support can all cause damage to psychological fluctuations.

Site factors

The content includes dim lighting affecting eyesight, rough and uneven training venues, or damage caused by long-term training in cement venues.

Insufficient safety education

Coaches do not pay enough attention to the prevention of basketball injury and the safety education of students. Some students are aggressive and combative. To win the game, they often do not pay attention to sports ethics and do not abide by the game's rules. This also caused some damage that shouldn't have occurred.

Preventive measures for knee joint injuries in basketball

Strengthen moral and spiritual education for athletes. We require athletes to strictly abide by the game rules to prevent uncivilized and even brutal fouls on the court. Coaches strengthen safety education for athletes and enhance self-protection awareness. Be fully prepared before the start of the exercise. In this way, the flexibility and coordination of the joints can be improved. It is necessary to understand the structural characteristics of the knee joint and the confrontation law of basketball. Strictly require technical movements and sports precautions to save energy and effort during the exercise, without movement, and avoid injury. Efforts should be made to improve the conditions of the training and competition venues. Improve the teaching level of coaches and conduct scientific training. Teach students following their aptitude and arrange the amount of exercise training reasonably. Strengthen lower limb muscle strength training and improve joint sensitivity and stability. If the strength around the knee is strengthened, the injury can be avoided. Therefore, it is particularly important to increase the strength and stretching exercises of the lower extremity muscles in the teaching training. Master the methods of self-protection during exercise. Keep warm after exercise to prevent wind, cold, and dampness. Use hot bath, massage, and other means to accelerate the elimination of local fatigue. After the initial recovery from an injury, you must follow the principle of gradual and orderly progress when participating in physical exercise to avoid injury. Don't play under overload and fatigue. Once a knee injury occurs, you must wait until you have fully recovered before exercising. In this way, as much as possible to avoid the recurrence of knee joint injuries.

CONCLUSION

The knee joint is one of the most vulnerable parts of basketball. The consequences of its injury can lead to the end of a sports career. This has a certain impact on the physical and mental health of athletes. Pay attention to the protection of knee joints in teaching and training.

Pay attention to the inspection and treatment of knee joint injuries to improve the scientific nature of sports.

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