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Etiology and Nursing Care of Children's Knee Joint Sports Injury Diseases

Long Liu, Chongqing Preschool Education College, China*
Zhankui Zhai, Chongqing Preschool Education College, China
Weihua Zhu, Chongqing Preschool Education College, China

ABSTRACT

The objective is to explore the etiology, diagnosis, treatment, and prevention of children's knee joint sports injury. The medical records of hospitalized children with sports injuries from 2019 to 2021 were retrospectively analyzed. The total number of hospitalized children with knee joint sports injury increased from 27 in 2019 to 46 in 2021. The main diseases are meniscus injury, dislocation of patella, avulsion fracture of tibial intercondylar crest, ligament injury, articular cartilage injury, and other diseases. Children's sports injuries occur in different ages groups, with the highest incidence in the age group of 7-14, and the incidence rate of boys is about 1.5 times that of girls. Moreover, the number of knee joint sports injury diseases in children is increasing, especially for school-age children. Low energy injury is the most common cause of injury, but high energy injury may lead to serious knee joint function damage, which should be paid great attention.

KEYWORDS

Children's knee joint nursing, Children's sports injury, Knee joint of children, Nursing and prevention, Sports injury

INTRODUCTION

With the rapid development of China's economy and the continuous improvement of people's living standards, parents pay more attention to the health of their children, and the development of children's athletic ability is increasingly common. However, due to its unique characteristics, children's sports knee joint injuries and diseases are an easy to miss diagnosis and often misdiagnosed. For China, the field of children's sports medicine is still in the primary stage of development. Limited facilities in school physical education, the allocation of physical education curriculum is unreasonable, extracurricular physical education training pursues achievements, and the implementation of physical and mental health education curriculum gradually appears problems (Richardson et al., 2005). In this study, the children with knee joint sports injuries admitted in 2019-2021 were analyzed retrospectively, aiming at studying the causes of knee joint sports injuries and diseases in children. At the same

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time, the causes were analyzed and the corresponding preventive measures were discussed to avoid or reduce the occurrence of knee joint sports injuries and diseases in children as much as possible.

RELATED MATERIALS AND METHODS

Related Content of Knee Joint Injuries

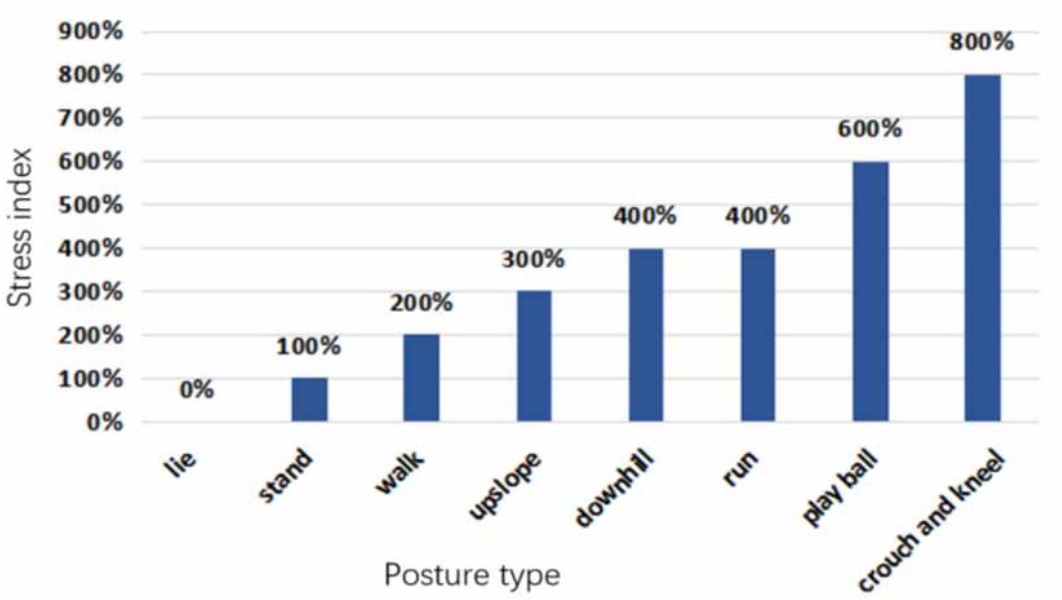
Knee joint injuries are divided into acute and chronic injuries. Acute injuries include muscle strain, meniscus injury, cartilage injury, and ligament injury (anterior and posterior cruciate ligaments, as well as internal and external collateral ligament injuries). Chronic injuries include: chronic injury transformed from acute injury, patellar tendon end disease, patellar cartilage, and traumatic arthritis. The knee joint, as a highly mobile joint, is easy to injure during exercise. Acute injury may damage muscles, cartilage, and ligaments. For children, acute injury may turn into chronic injury if it is not treated promptly and effectively. Knee ligament injury is also known as knee ligament injury. It is commonly seen in sports injuries, mainly manifested as knee joint pain, swelling, and limited knee joint movement. The ligament in a knee joint ligament injury refers to the ligaments surrounding the knee joint, such as the anterior cruciate ligament, medial collateral ligament, lateral collateral ligament, posterior cruciate ligament, medial patellar ligament, and lateral patellar ligament. Knee joint injuries exhibit early histological fibrosis. After a knee ligament injury, conservative or surgical treatment is required based on the severity of the injury. Tendons are similar to ligaments, connecting muscle fibers and musculoskeletal structures. This type of replacement structure is also known as a graft, which is a ligament that medical staff can refer to when removing a part of the patient's pathological knee joint. After the surgery, the patient will smoothly undergo another course of rehabilitation training. Severe injury in sports and excessive movement of knee joint are the main reasons for knee joint injuries. The common causes of knee joint sports injuries in children include: sprains, falls, bruises, abrasions, impact injuries, and other violent injuries that are more prone to occur in highly adversarial activities, such as basketball and football, long term participation in repetitive jumping exercises, or frequent mountain climbing, building climbing, and squatting, and incorrect exercise methods and lack of reasonable exercise protection. Children should be extra careful in the process of antagonistic sports, and exercise that is harmful to the knee joint should be moderate. However, if the knee joint has been injured and feels unwell, it is likely that the knee joint injury has occurred and medical attention should be sought in a timely manner. The pressure on the knee joint in different postures is shown in Figure 1.

The main symptoms of knee joint sports injuries in children are obvious pain, swelling, and limited mobility immediately after injury. When taking X-rays at the hospital, it may be difficult to accurately diagnose meniscus or cruciate ligament injuries due to joint swelling. For months or years, there may still be discomfort such as joint weakness, pain, and interlocking, and even no obvious discomfort. Therefore, it is necessary to seek further consultation with a sports injury specialist to make a clear diagnosis. Chronic strain may cause pain when walking, squatting, or jumping on a flat road and may also be manifested as limited joint movement, swelling, interlocking, softness, and fatigue.

Patient Information

From January 2019 to December 2021, 108 children (112 knees) with knee joint injuries were selected from the hospital of study. There were 66 males and 42 females. The age ranged from 4 to 14 years with an average of (7.5 2.6) years. Body mass index ranged from 18.5 to 26.3 kg/m2, with an average of (20.5 2.4) kg/m2. In 2019, a total of 27 children were treated, accounting for 3.5% (27/753) of the total number of patients with knee joint sports injuries. In 2014, 35 children were admitted, accounting for 4.0% (35/861) of the total number of patients with knee joint sports injuries. In 2021, there were 46 cases, accounting for 4.6% (46/997) of the total number of patients with knee joint sports injuries.

Figure 1. Pressure on the knee joint in different postures



In the same year, the number of hospitalized patients and the proportion of patients with knee joint sports injuries showed an upward trend.

Inclusion criteria:

(1) The patient's vital signs are normal; (2) No other complications.

Exclusion criteria:

(1) The patient is over 10 years old; (2) Patients and their families don't cooperate with researchers. The certification result of the Ethics Committee is approved.

According to the age of the children, this study was divided into two groups: preschool group (3-6 years old), 15 children, including 9 males and 6 females. There are 93 school-age children (7 ~ 14 years old), including 57 males and 36 females. Retrospective analysis of children's gender, disease composition, pathogenic factors and their changing trend.

Precautions

(1) Heavy exercise and overload activities will cause reactive synovitis, swelling and pain of the knee joint, which can be relieved after rest. (2) The organic diseases of the knee joint itself, such as cartilage injury and meniscus injury, will cause local pain and limited movement in the knee joint, which will stop after rest. The diagnosis of this condition can only be made through specialist physical examination and necessary imaging examination. (3) Excessive flexion and extension of the knee joint may lead to local uplift, hyperplasia, and tenderness of tibial tubercle at the stop of patellar ligament. This involves chronic traumatic inflammation of epiphysis, so the patient will need to rest. After adolescence, callus will heal and the symptoms can be alleviated.

Nursing Care of Suppurative Arthritis

Firstly, close attention must be paid to the patient's condition changes. Close observation of ECG monitoring is necessary to ensure a smooth respiratory tract. Recording urine volume can find problems early and take preventive measures ahead of time (Chaiyachati et al., 2020) to avoid urinary retention symptoms. For children with fever, physical cooling methods can be used, such as rubbing alcohol, applying medical ice packs, or using drugs to reduce fever as prescribed by the doctor. Children with acute symptoms should rest in bed, raise the affected limb, promote blood circulation and reduce swelling, and fix the affected limb with plaster to maintain basic functions and avoid joint deformation (Dong et al., 2021). In addition, joint function exercise should be actively carried out during the postoperative rehabilitation period, and parents should be encouraged to divert their children's attention by telling stories, listening to songs, touching, and so on, so as to achieve the purpose of alleviating pain. It is necessary to develop good habits of work and rest and ensure sufficient sleep time. In terms of diet, it is advisable to eat small amounts and multiple meals, and avoid consuming stimulating foods such as raw, cold, and spicy foods. Pay attention to hygiene conditions, promptly and effectively clean the mouth, maintain facial cleanliness, and keep the dormitory bed clean. In accordance with the doctor's advice, bacterial culture and drug sensitivity tests should be carried out in time, and antibiotics should be selected reasonably. Drug concentration and dropping speed should be paid attention to, and drug toxicity and side effects should be observed (Vasquez et al., 2014).

Nursing Care of Children With Synovitis

The knee joint is the largest synovial joint among the major joints of the human body. Synovial membrane is prone to various acute and chronic synovitis due to the stimulation of primary and prone articular cartilage and bone and extra-articular diseases.

Closely Observe the Condition

Before the child wakes up, take off the pillow, tilt his head to one side, and keep the airway open. Continuous monitoring of life signs such as oxygen inhalation, body temperature, sensation, blood flow, observation, and other indicators when limbs are injured, and thus judging whether there is any injury to nerves and blood vessels. The patient's limb pad should be raised 15° ~ 30° to facilitate venous and lymphatic reflux and relieve pain and edema. After arthroscopic surgery, the knee joint should be compressed and bandaged with a large cotton pad or elastic bandage to prevent intra-articular bleeding and wound bleeding (Lv et al., 2023). After that, attention should be paid to observe whether the bandage on the wound is bleeding and in need of replacement. If there is a large amount of water in the knee, patients should reduce bed activities, increase non-weight exercise in bed, and take a proper rest for about two weeks to fully absorb body fluids.

Diet Care

Understanding their dietary habits and adjusting their dietary structure in time are the main measures to meet children's nutritional needs. For children, several well-liked foods including fruit juice, chocolate, meat, and vanilla sauce are helpful to meet children's needs for high calories and protein. In addition, proper eating conditions and meal times must be established. Therefore, the diet should be carried out under the condition that the child's body is relatively comfortable, and it should be constantly adjusted to meet his physical condition.

Physical Therapy

After the operation, use ice to cool the affected area to relieve pain, stop bleeding, and reduce inflammation, swelling, and exudation. After arthroscopic surgery, local ice pressure cooling can not only reduce the body surface temperature of skin and muscle tissue, but also stimulate skin contraction by human physiological reaction to cold (Radecka & Lubkowska, 2022). The reaction

of the local sympathetic nervous system will lead to vasoconstriction, blood flow decrease, vascular porosity change, and tissue metabolic oxygen consumption decrease, thus inhibiting the formation of cytoplasm and lymph, and alleviating the swelling and pain of local tissues. Ice packs are generally placed on both sides of the knees and fixed with towels. These are used for two hours on the first day and one hour on the second day after surgery to reduce intra-articular bleeding.

Pain Nursing

Nurses should choose a comfortable environment for children, create a warm atmosphere, and encourage parents to pay more attention to taking care of children. They can accompany them to speak, watch TV, play electronic games, etc. This can provide physical and mental support, and distract children from pain. Nurses should know the degree of pain the children are experiencing at a particular time, read the instructions patiently, and observe carefully. Some children will feel pain because of bandages. In the case of small incisions and small joint pain, commonly used painkillers are ineffective. In the case of severe pain, children can take painkillers according to their doctor's advice and observe their reactions.

Functional Exercise

On the first day after operation, in order to increase muscle strength and prevent muscle atrophy, quadriceps femoris should be trained to contract the spinal cord. This method requires the child to lie on his back, straighten his knees, toes up, and relax after 5-10 seconds. Two to three days after the operation, using an upright leg to practice is helpful to stabilize the injured knee. The requirements are as follows: Lie down, straighten the knees, contract the quadriceps femoris, lift the injured limb, and slowly lower the heels from the bed, 20cm each time, for 10 seconds, 3-5 times every 2 hours. Active knee exercises should be carried out within 4-7 days after operation. Children need to lie on the therapist's back and bend their knees to complete a series of exercises. To sum up, children who actively participate in sports can gradually increase muscle content, speed up blood circulation, relieve limb pain, and then help restore their mobility and achieve satisfactory results in treatment. Within 8-14 days after the operation, with the help of family members, the children should try to grab the railing, squat down and lift his heels off the ground, and then stand up slowly after 10-15 seconds. Children can squat 20-30 times a day. After arthroscopic knee surgery, the stability of the knee joint declines until the quadriceps of the thigh recovers, which may lead to the re-injury of the knee joint if the weight increases prematurely (Harput et al., 2019). In this case, parents should watch their children's sports, and prohibit frequent going up and down stairs, excessive running, and other strenuous exercise, so as not to damage the recovery of joint function.

Nursing Care of Children With Discoid Cartilage Injury

Disc cartilage of the knee joint is a deformity of meniscus cartilage of the knee joint, and its formation reason is unknown. Most people usually think that it is born with growth and development. Discoid cartilage has no normal tissue structure and physiological characteristics in the new moon, which is the weakness of the human body. Therefore, it is more vulnerable to injury than the average crescent cartilage.

Pay Close Attention to the Condition

It is necessary to carefully observe the changes of patients after anesthesia after operation, such as blood supply, color, temperature, and movement of affected limbs and toes, to confirm the degree of nerve or blood vessel injury, slightly upward veins and lymph nodes, relieving pain, frequent swelling and soreness of the incision, and covering the wound surface with external fillers and drainage. The fluid less than 20 ml was measured on the first day after operation, and the catheter was taken out the next day. In general, in order to reduce the possibility of infection, drainage time should not exceed 48 hours.

Physical Therapy

After the operation, applying the chemical ice pack to the affected area can cool the pain, stop bleeding, and reduce inflammatory edema and exudation. After the operation and local cold compression, muscle tissue and skin area were examined (Manstein et al., 2008). Cold compress is not only a cold physiological agent to reduce human body temperature, but also can stimulate local cold water sympathetic nervous system agent, cause blood vessel contraction, reduce the final blood flow, reduce oxygen consumption, and reduce local tissue swelling and pain. In addition, cold compression can slow down nerve speed, inhibit cell activity, reduce sensitivity to nerve endings, increase pain threshold, and achieve the purpose of relieving pain (Khorrami et al., 2022). How to place the ice pack: put the ice pack on the knees, press down, and then fix it with a big towel. Replace the ice pack every 2-3 hours and apply cold compress continuously 24 hours a day to reduce intra-articular bleeding. Usually, in a short period of time, slight internal bleeding in joints can be absorbed without affecting the recovery of function.

Psychological Nursing

Pain is a kind of psychological feeling and one of the most common conditions in postoperative treatment (Miller et al., 2023). Nurses should create a comfortable, quiet, and warm ward environment for children. Parents and children not only need more time to encourage, but also to give psychological support by telling stories, listening to music, watching TV, and playing video games (Cohen et al., 2012). The joint surgery is a minor operation, which only causes slight pain. Therefore, there is usually no need for painkillers. Appropriate painkillers can be injected according to the doctor's advice, and feedback can be tracked after use. Due to symptoms and injuries in the patient's body, negative emotions such as anxiety, depression, resistance, and treatment discomfort may occur. Therefore, medical staff should use a more friendly and stable tone in their communication with patients, and resolutely refrain from using inappropriate or emotional words that cause emotional fluctuations in patients, in order to improve their negative emotions. If necessary, correct and easily acceptable psychological guidance should be given to patients before discharge.

Diet Care

Diet therapy is one of the main factors affecting wound healing, and good nutrition can effectively treat wounds (Rowan et al., 2015). After the operation, children usually feel unwell and lose their appetite. Therefore, the body's high metabolic demand for calories and protein cannot be met. Therefore, it is necessary to know the nutritional status of children and adjust the nutritional structure reasonably, so as to meet the nutritional needs of children (Zhang & Ma, 2018). Foods like fruit juice, milk, chocolate, meat, and eggs can meet children's physical needs for high calories and protein. In addition, create favorable nutritional conditions, reasonably plan the time, carry it out under more comfortable conditions, and eat a small amount to achieve the expected therapeutic effect (Bonci et al., 2008).

Wound State

It is used to prevent wound infection and treat postoperative intravenous anti-inflammatory drugs (Zhao-Fleming et al., 2018). Two to three days after the operation, the wound is replaced by a thin external tampon to promote the joint work, and the accumulation of body fluids should be observed. Two weeks after the operation, the wound is removed and the external interior is replaced (DeFranzo et al., 2001). When the amount of body fluid on the knee increases, children should reduce the activity in bed, increase the non-load-bearing exercise in bed, and rest properly, so that the body fluid can be completely absorbed after two to three weeks (Kenny, 2015).

Discharge Guidance

Some parents and children mistakenly think that the more exercise, the better, but in fact, exercise and rest must be combined, and training without fatigue is the best to return to normal life more quickly (Armstrong et al., 2007). Parents should actively participate in and give scientific guidance to children's sports (Wuerth et al., 2004). Because children may have poor self-control and may not be able to exercise well on their own, parents are required to supervise them. Therefore, exercise is the key to improve function, promote healing, and enhance curative effect.

RESULT AND DISCUSSION

Disease Composition of Children

Based on the International Classification of Diseases (ICD-10), the main diagnostic codes in the first page of medical records were summarized (Farzandipour et al., 2010). Among them, there were 48 cases of meniscus injury (44.4%) and 36 cases of lateral discoid meniscus injury (33.3%). Patella dislocation in 20 cases (18.5%); 14 cases (13.0%) suffered from avulsion fracture of tibial intercondylar crest. Ligament injury was present in 10 cases (9.5%), and there were 4 cases of articular cartilage injury (3.6%) and 12 cases of other diseases (11.0%). The disease composition of children is shown in Table 1.

Cause Analysis of Children's Injury

Damage factors are divided into low-energy and high-energy injuries. Low-energy injuries are mainly caused by sprains and running (Cochran et al., 2017). Most of the high-energy injuries are caused by car accidents, cycling, skateboarding, and ball games. There were 61 cases of energy injury (56.5%), of which sprain was the most (65.5%). There were 47 cases (43.5%) of high-energy injuries, among which traffic accidents were the most common (19.4%), followed by cycling (11.1%), skateboarding (8 cases) and ball games (5.6%). The types and proportions of damage factors are shown in Table 2.

CONCLUSION

This study retrospectively analyzed children with knee joint sports injuries admitted from 2019 to 2021 and found that the main causes of knee joint sports injuries in children include limited school

Table 1. The disease composition of children

Disease Name	Meniscus Injury	Lateral Discoid Meniscus Injury	Dislocation of Patella	Avulsion Fracture of Tibial Intercondylar Spine	Ligament Injuries	Articular Cartilage Injury	Other Diseases
Number of cases	48 cases	36 cases	20 cases	14 cases	10 cases	4 cases	12 cases
Proportion	44.4%	33.3%	18.5%	13%	9.5%	3.6%	11%

Table 2. Types and proportion of injury factors

Damage Type	Low Energy Damage	Wrench	High Energy Damage	Car Accident Injury	Bicycle Exercise	Skateboarding	Ball Games
Number of cases	61 cases	40 cases	47 cases	21 cases	12 cases	8 cases	6 cases
Proportion	56.5%	65.5%	43.5%	19.4%	11.1%	7.4%	5.6%

sports facilities, unreasonable distribution of physical education courses, and problems in the implementation of physical and mental health education courses. Common knee joint sports injuries in children include meniscus injury, patellar dislocation, and ankle intercondylar condylar avulsion fracture. Although low-energy injuries are common, high-intensity injuries can lead to severe knee joint function damage, and prevention should be given high priority in advance. In order to avoid or reduce the occurrence of knee joint sports injuries in children as much as possible, it is necessary to strengthen the scientific planning and implementation of physical education courses, improve children's self-protection awareness, and establish a sound sports guarantee mechanism. In addition, high-energy injuries can also easily lead to complications, such as fractures between the ankle and tibia, tendon injuries, and femoral joint injuries. Children lack self-protection awareness, and these factors are critical reasons for injuries during exercise. With the increasing emphasis on sports in society, children's participation in sports has become an important component, but it also means that the number of sports injuries are gradually increasing. Therefore, in response to children's knee joint sports injuries, education and all sectors of society need to work together to increase awareness of children's sports injuries, strengthen the promotion and popularization of relevant prevention knowledge. In summary, this study reveals the current situation and main causes of knee joint sports injuries in children, and proposes suggestions to strengthen the construction of sports facilities, plan sports courses reasonably, and strengthen physical and mental health education. These efforts are expected to effectively reduce the occurrence of knee joint sports injuries in children and provide better protection for their healthy growth. It is worth noting that future research needs to further explore the mechanisms and characteristics of sports injuries in children, as well as targeted preventive measures, in order to maximize the protection of children's health.

DATA AVAILABILITY

The figures and tables used to support the findings of this study are included in the article.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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Long Liu was born in Zhengyang, Henan, P.R. China, in 1976. PhD, Associate Professor Chongqing Preschool Education College;He received the bachelor's degree from Chengdu Sports Universit y, in 2005, the master's degree from Zhengzhou University, in 2012, and the Ph.D. degree from the Panyapiwat Institute of Management, in 2017. Part-time doctoral supervisor of physical education of Krirk University, Thailand and a Fellow of the Siam Think Tank, Thailand. He has published more than 40 papers,SCI has published 14 articles;His research interests include Basketball teaching and training, Smart sports. . Email: 2008liulong0808@163.com

Zhankui Zhai was born in Jining, Shandong, P.R. China, in 1989.Master degree, Lecturer Chongqing Preschool Education College;He received the bachelor's degree from Dezhou University, in 2012, the master's degree from Shaanxi Normal University, in 2015. He has published one Peking University Core Thesis, and his research interests include football teaching and training, and early childhood sports. Email:17783513769@163.com

Weihuai Zhu was born in Qixia, Shandong, P.R. China, in 1993,.Master degree, Lecturer Chongqing Preschool Education College, master, assistant assistant of Chongqing Preschool Education College, research direction: Recovery of motor fatigue mechanism and theoretical research.