

CLINICAL VALUE OF EMERGENCY CT EXAMINATION IN TAEKWONDO ATHLETES' KNEE FRACTURE AND LIGAMENT INJURY

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ABSTRACT

Knee fracture and ligament injury are very common in the competition and training of taekwondo athletes. In this study, specific causes of athletes' knee fracture and ligament injury were explored, the application of emergency CT examination in taekwondo athletes' knee fracture and ligament injury was analyzed through a specific examination method, in order to verify the practical value of emergency CT examination in the clinic. 1400 taekwondo athletes with knee fracture and ligament injury were randomly selected as subjects, clinical data were retrospectively analyzed, with patients' X-ray examination results, clinical and surgical results compared. Results showed that 1,000 out of 1,400 patients had fracture. 1200 cases (why 1200 ? only 1000 had fracture ?) of knee fracture were diagnosed by CT examination, with 10 false negative cases; 500 cases of fracture were detected by X-ray examination, 900 cases of ligament injury were diagnosed by CT examination with 50 false negative cases; 170 cases of medial collateral ligament injury were determined by X-ray with indirect signs. Based on the above findings we can conclude that CT examination had advantages when compared to X-ray examination, as it was more sensitive than X-ray examination in incomplete ligament injury diagnosis. For the diagnosis of complete laceration of ligament, X ray examination should be combined with clinical data to obtain a more accurate diagnosis.

Keywords: Taekwondo Athletes, Emergency CT Examination, Knee Fracture, Ligament Injury, Clinical Application.

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Introduction

In current situations, taekwondo athletes inevitably have knee fracture in daily training or during important competitions, with ligament injury occurring frequently, causing serious impact on their lives as well as daily training and competition to some extent. Thus, once patients have knee fracture and ligament injury, urgent treatment must be taken, so that patients receive the best therapeutic effect within a short time. It is worth noticing that the diagnosis of a patient's condition is critical in emergency, with implications on future treatment and rehabilitation⁽¹⁻³⁾.

X-ray examination is usually dominant in emergency, but studies have shown limitations in X-ray examination, as doctors cannot fully understand intra-articular damage via X-ray examination, causing missed diagnosis that delays the best treatment opportunity for patients, sometimes leading to knee disorders. Research has shown that joint diagnosis has mainly been based on clinical data. CT and X-ray examination should be taken into consideration for multiple knee injury patients, so that a comprehensive analysis and judgment can be obtained, which can help doctors better determine patients' conditions and ultimately provide a reference for treatment.

The structure of tissues surrounding the knee is shown in Figure 1. A depiction of knee ligament injury is shown in Figure 2.

This paper attempted to describe the specific application effect of emergency CT examination in taekwondo athletes' knee fracture and ligament injury, as follows.

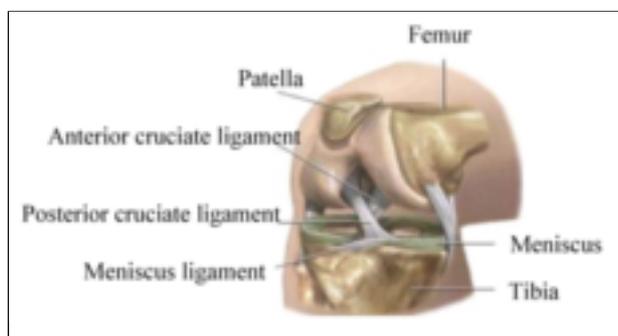


Figure 1: Structure of tissues surrounding the knee.



Figure 2: Knee ligament injury.

Materials and methods

Subjects

In this study, 1400 taekwondo athletes with knee and ligament injury treated in our hospital from April 2013 to April 2016 were selected, including 900 male patients and 500 female patients. The patients were aged between 14-30 years, with an average age at (20.2 ± 2.8) years. The patients received CT examination in the hospital 0.5-2.0h after injury, with symptoms and signs including knee pain, swelling and dysfunction. 800 cases were hospitalized and 190 cases received knee surgery.

Examination Method

The patients were admitted to the hospital emergency first after injury. At the emergency, true lateral knee X-ray plain film examination was conducted, to be used as a reference standard for the patients' knee CT examination. Examination was

done with sytes4000CT apparatus. During the examination, patients were in a supine position with feet raised, knees folded at the center of gantry and bent $15-20^\circ$. For plaster patients, scanning was usually implemented in a fixed position with lateral positioning. Scanning of the baseline was done parallel to the tibial plateau, followed by continuous scanning with 3mm thickness and 3mm interval. A comparative study of the knee was then possible⁽⁴⁻⁶⁾.

Observational Index

Compare differences between X-ray examination and CT diagnosis results.

Statistical Methods

In this study, a new statistical software package - SPSS19.0 was adopted for data analysis and processing. Count data were expressed as (n,%), with the chi-square test, while measurement data were expressed by mean \pm average ($x \pm s$), with the t test. The level of significance was set at 0.05.<

Results

Knee fracture mainly involves four areas, including the lower end of the femur, tibia plateau, caput fibulae, and patella fracture (see Figure 3). 400 of knee fracture patients were selected in this study, including 120 cases of double knee fracture, with 280 cases of joint fluid. There was a total of 1000 fractures. Table 1 lists the specific values for X-ray detection rate of fracture, and the CT detection rate of fracture. In addition, there were 20 cases with X-ray examination indicating possible fracture, but was later diagnosed as hyperostosis in CT examination.

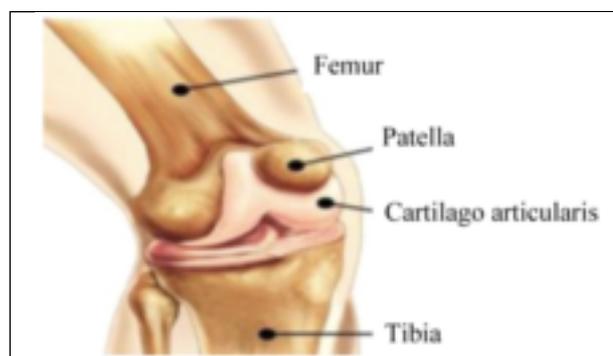


Figure 3: The main parts of knee fracture.

Knee ligament injury usually included the following situations under normal circumstances: collateral ligament injury (see Figure 4), medial collateral ligament injury, anterior and posterior cruciate

Diagnosis type	Fracture of lower end of femur	Plateau fracture	Caput fibulae fracture	Patella fracture	Total
CT diagnosis	150	420	200	110	980
X-ray examination	60	260	100	80	500

Table 1: X-ray and CT diagnosis of fracture site and number (n%).

ligament injury, patellar ligament injury. Ligaments and joint capsules can be clearly viewed through the CT examination. Suppose there was no abnormality in the examination, wire-lines and short strips were mostly shown, displaying a higher density shadow^(7,8).

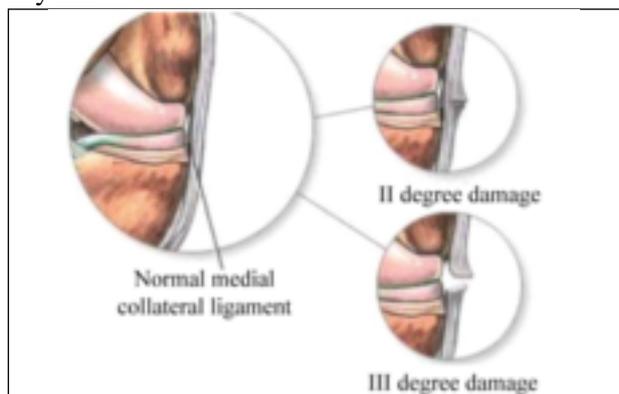


Figure 4: Knee collateral ligament injury.

Take collateral ligament injury for example, the common CT symptoms were as follows:

First, ligament swelling and thickening, fuzzy structure, loss of normal form, more obvious acute stage performance, continuously lower density of edema, accompanied by bleeding, local high density exudation, some with sustained interruption of capsular ligament;

Second, once tear point occurred in the ligament attachment point, avulsed sclerite can be seen, showing separation displacement after ligament traction. In the present study, 300 collateral ligament injury sites were detected with CT examination, with 140 medial and 160 lateral cases. X-ray examination had flaws, missing the diagnosis of 50-80 sites. The 180 cases conformed with clinical physical examination, while 130 cases were surgically verified to have ligament rupture. In addition, there were some lateral collateral ligament injuries that were surgically verified as complete tear, but showing no abnormality upon CT examination.

Discussion

Based on the status quo analysis, taekwondo is

an extremely dangerous type of sports. Athletes are prone to knee fracture and ligament damage during both daily routine training and important competitions. Urgent rescue measures need to be taken so that patients receive the best therapeutic effect in the shortest time, so as to avoid delay in treatment opportunity and prevent impact on prognosis therapeutic effect^(7,8).

In the clinic, X-ray examination is usually taken for patients' knee fracture and ligament injury to determine the specific conditions of the fracture and ligament injury. However, limitations of X-ray examination can lead to inaccurate test results and proneness to missed diagnosis, which is very unfavorable for clinical treatment⁽⁹⁻¹¹⁾. From the perspective of clinical medicine, CT diagnosis has been widely applied in emergency treatment, with especially remarkable effect in knee rupture and ligament injury as fracture and ligament can be clearly diagnosed. However, it should be noted that a comprehensive analysis involving CT diagnosis plus clinical data and X-ray examination can obtain more accurate information.

In this study, 1400 taekwondo athletes with knee fracture and ligament injury were selected as subjects. It was found that 980 cases were diagnosed by CT, whereas 500 cases were diagnosed by X-ray examination, with statistically significant differences between the two ($p < 0.05$). Normal knee joint consists of the following components: femoral condyle, tibial condyle, patella. The knee is wrapped by strong ligaments, while being surrounded by a joint capsule. The knee is prone to fracture and dislocation. In addition, joint capsule ligament injury is also very common. CT diagnosis enjoys a very high value in clinical diagnosis, featuring not only high resolution, but also no overlapping of images. It has significant advantages over X-ray examination, including the high discovery rate of fracture number, especially for small insignificant fractures, or special part fractures, so missed diagnosis is rare.

Secondly, as seen from signs of cross section, fracture can be fully displayed with no overlap, compensating for X-ray deficiencies. Thirdly, CT diagnosis can accurately locate fracture site, display bone defect site in full, and effectively display fracture displacement. Fourthly, CT diagnosis can determine tibial plateau collapse fracture, and accurately display the extent of fracture collapse with coronal or sagittal reconstruction.

CT also has excellent clinical value for reveal-

ing ligament injury. Whether it is contusion pattern or tearing type of ligament injury, CT diagnosis can clearly display ligament density changes, but X-ray examination cannot meet such criteria. Only when a ligament injury reaches a certain level, leading to joint instability, X-ray examination can then show the abnormalities, thus missed X-ray diagnosis can easily appear in the clinic. In addition, X-ray has a low diagnostic value for cruciate ligament injury. Nonetheless, there can also be false-negative CT diagnoses clinically, so a comprehensive analysis of clinical data plus X-ray examination on the basis of CT diagnosis is needed, such that they complement each other to reduce the rate of missed diagnosis and enhance the efficiency of clinical diagnosis⁽¹²⁻¹⁵⁾. From a medical point of view, combined analysis of CT diagnosis plus X-ray examination can reduce clinical missed diagnosis, provide reference and recommendations for clinical treatment, such that patients can be cured and discharged in a short time with an improved quality of life, enhancing overall treatment efficiency.

Conclusion

In summary, sufficient attention must be paid to taekwondo athletes' knee fracture and injury during regular training and competitions. The results of this study showed that CT diagnosis demonstrated an extremely remarkable effect for applications in clinical emergency, as it facilitated the display of specific circumstances of knee fracture and ligament injury through different angles, provided multi-level observations with coronal and sagittal reconstruction, in order to supplement clinical data and X-ray findings. Our data showed that CT diagnosis demonstrated better clinical diagnosis capability when compared with X-ray examination. Yet X-ray and clinical data should also be referred to for ligament injury discrimination, as a comprehensive analysis can maximize the diagnostic rate.

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