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ROLE OF MAGNETIC RESONANCE IMAGING IN DETECTING KNEE INJURIES IN BASKETBALL PLAYERS

Intesar-Victoria M. Houech[1*], I. Peltekova[2]

[1]Department of Diagnostic Imaging, University Hospital "Alexandrovska", Sofia, Bulgaria
[2]Sector: Team Sports and Mountain Sports, Department of Sport, Sofia University "St. Kliment Ohridski", Sofia, Bulgaria

ABSTRACT

The article covers matters related to traumatic injuries of the knee in basketball players, emphasizing on diagnostic imaging as a non-invasive test that allows evaluation of the player's condition.
Precise and prompt diagnosis of the trauma can help in reduced treatment period, which in turn decreases the time the player is absent from training and competition. The aim of our study is to present the potential of magnetic resonance (MR) as a reliable method for diagnosing knee injury in basketball players. Methods: Patients with anamnesis of a knee contusion after basketball game were examined on a 3 Tesla (3T) MR machine. The examinations were carried out using standard protocol – applying sequences T1, T2, fat suppression (STIR) and proton density (PD) techniques. The images were processed and analyzed on a Syngo workstation. The most commonly affected structure was the anterior cruciate ligament and the menisci. MR is a reliable diagnostic tool that successfully allows the detection of knee contusions. MR could also help in evaluating the athlete's condition in preseason. According to specialists the time frame to perform an MR after an incident varies from 2 weeks to 6 – 8 weeks, given that the patient does not have pain and highly limited movements.

Key words: players, contusion, treatment, diagnostic, basketball, students, pupils, trainings.

INTRODUCTION

Sport is a responsible and character building discipline. It teaches one order and control and it is an irreplaceable part of healthy lifestyle. Professional sport is a highly respected and evaluated career both by players and its fens. Unfortunately, regular preseason and season training load can be highly traumatic to players.

Basketball is a sport with complex movements, which include a quick change of direction, a sharp change in running speed, running with your back in the direction of movement, lateral movements and turns, numerous rebounds, dunking the ball into the basket, bouncing and landing on one and two legs, fakes and other elements of basketball technique. These basketball moves, the constant rebound for the ball and outplays between players sometimes cause injuries to players.

According to a study carried out by the national basketball association (NBA) of USA for a 17-year period of time basketball players are exposed to severe injuries mainly of the lower extremities with predilection knee and ankle (1). And even though in the past basketball has been considered a non-contact sport, nowadays it is accounted as a contact sport. Since every trauma can lead to team loss this requires prompt and accurate diagnosis of the injuries caused during game.

Correspondence to: Senior Assistant Prof. Intesar-Victoria Malla Houech, DM, PhD, University Hospital "Alexandrovska", Department of Diagnostic Imaging, 1431 Sofia, Bulgaria, Georgi Sofyiski str. 1, Email: victoria_malla@yahoo.com, Mobile: +359885648910.

Every trauma of a player causes ceasing of his/hers training and competitive activity for uncertain period of time. Thus the training activity is made difficult, the player is eliminated and this may lead to team loss. Every basketball trainer strives to have enough players for every position on the court. This is necessary so that in case of an eventual contusion the player would be replaced with another one and thus the training and competitive process wouldn't be impaired.

Many scientific examinations have addressed that a large part of contusions during basketball game affect the knees of the players regardless of their age, sex and active years.

Willem H. Meeuwisse (2003) have presented an interesting research concerning the injuries of the players depending on the basketball position (wings, guards and centers). He determines that Canadian players on wing position exhibit less percentage of injuries comparing to guards and centers, stating that highest registered knee injuries are seen in guards position (out of 35 players for a period of two years**,** 14 go to guard position, 11 – centers, 10 – wings). Considering the injuries based on the player's position the author describes them as contact and non-contact for each position. From this point of view, most of the contusions in guard and wing positions are due to non-contact situations, where as in center positions significantly higher rate of injuries are developed as a result of contact as well as non-contact injuries. The author concludes that "Risk factors for injury were previous injury, games as opposed to practice, player positions, player contact and court location" (2).

Andreoli, C., et al (2018) inspect the traumas induces during game in Brazilian basketball players of different ages and gender. They find out that most of the contusions have occurred in the lower extremities – in 63.7% of the cases, out of which 17.8% were located in the knees and 21.9% - in the ankle. Upper extremities have been affected in 12 – 14% of the examined players. Concerning head injuries, kids are much more susceptible comparing to other age groups and categories. In adult players there is predominance of body and spine injuries. In the upper extremities most affected are hands, fingers and wrists and to lesser extent shoulders, arm and forearms. In professional category athletes there is a high risk of thigh contusions (3).

Newman JS & Newberg AH. (2010) in their scientific papers also acknowledge that basketball injuries most commonly affect the lower extremities, especially ankle and knee. They determine that basketball injuries are orthopedic in nature and usually include ligamentous sprain, musculotendineous strains, contusions such as overuse and stress fractures. Owing to its excellent contrast resolution and imaging of soft tissues and trabecular bones, magnetic resonance (MR) is a leading modality in detecting sport related trauma (4).

Our scientific research in this paper are pointed towards the capabilities of the MR examination in assessing knee trauma in basketball players.

METHODOLOGY

The **aim** of the study is to present the potential of magnetic resonance (MR) as a reliable method in detecting knee injuries.

Methods: Patients with a history of knee contusion after a basketball game of varying time period were examined on a 3 Tesla MR machine. The studies were carried out on a standard protocol. The patient is placed in a supine position on the MR table and above the knee a knee coil is placed and secured. The immobility of the knee is an import condition to acquire an accurate image and this **is** achieved by placing a pad under the knee and if needed the leg of the patient can be strapped. The patient is directed towards the entry of the machine with legs forward. The work of the machine is not felt. Sounds from the machine's activity are heard which is coped by giving antiphons to the examined one.

Images were obtained with standard T1 and T2 sequences, fat saturation (STIR) and proton density (PD) techniques. Images were processed and analyzed on Syngo workstation.

Before starting every examination, it is required that the radiologist is familiar with the available health documentation of the patient – clinical exam from an orthopedic-traumatologist

physician, laboratory and other imaging examinations. Patients signs an informed concern that they are aware of the following examination. In case of presence of metal implants, pacemakers and other devices in the patient's body, a proof is required that these are compatible with MR machines. Patients who suffer from claustrophobia are examined under sedation.

RESULTS

The analyzed images proved the existence of trauma injuries in the knees of varying time period – acute and as well as chronic. Patients were divided in two groups based on presence or absence of symptoms –symptomatic and asymptomatic. Most commonly affected structures of the knee were anterior cruciate ligament (ACL) and to lesser extent the menisci. Posterior cruciate ligament was injured in the setting of chronic trauma. Additional findings indicating knee trauma were signs of bone marrow edema, intraarticular effusion and cartilage lesions.

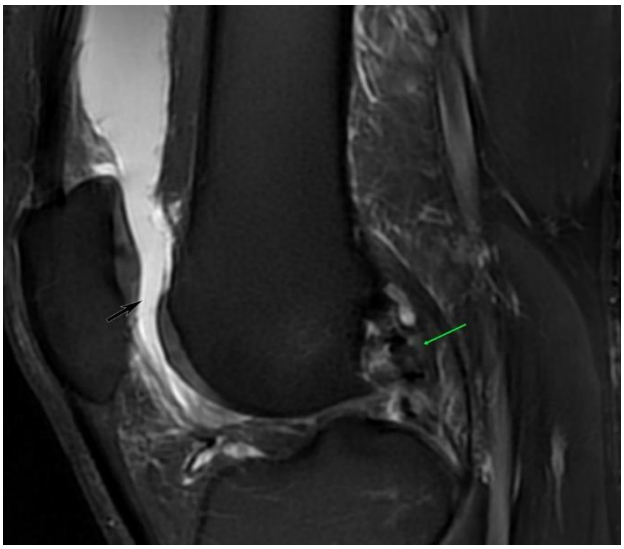

Figure 1. MRI of the knee. Sagittal plane. PD sequence.
Male athlete. Complete rupture of ACL (green arrow). Patellofemoral effusion (black arrow)

Figure 2. MRI of the knee. Coronal plane. PD sequence.
Male athlete. Longitudinal tear of the medial meniscus (green arrow).

DISCUSSION

MR is a gold standard in depicting knee derangements. MR's benefits as non-ionizing method make it an ideal modality to imaging children and as well as when a follow up of the treatment is needed with numerous MR examinations. MR excellently presents soft tissues, ligaments, menisci, etc. Usually MR is considered after a negative result for bone structures following an X-ray (5).

In a study, published by Guermazi et al (2016) magnetic resonance is once again presented with its advantages in assessing correct diagnosis and following up the result of the treatment – either conservative or surgical. Likewise, this method can be used as a prognostic tool for the player's condition and when he can go back to the team (6).

Unfortunately, the financial aspect of the examination is not to be ignored. However, the chance of the patients to return sooner to normal life after correct diagnosis and treatment pays off the financial expenses. According to a retrospective study in the USA, around $80000 annually could be saved from unnecessary arthroscopy if only an MR is performed prior and physicians do not rely only on clinical examination (7, 8).

The time frame to perform an MR examination after an incident is an important topic and authors have different opinions. According to some it is optative for the patient to have an MR examination in 2 weeks after the initial presentation of trauma. This would decrease the time off work, time to recover, rehabilitation, financial expenses. This in turn will lead to patient's satisfaction due to the prompt recovering actions, less limitations to movement activity and reducing pain symptoms (9). Other authors believe that lack of pain and restriction in motions do not require fast MR scanning and they suggest performing the study 6 – 8 weeks after the incidence. In addition, they would consider an MR in cases when there is no effect from the conservative treatment, if the movement impairment are very pronounced, when a surgical intervention could not be avoided or when there is a suspicion for another diseases (6, 10).

In the literature review authors are unanimous about the extreme advantage of MR – it has a high negative prognostic value in knee derangements and with its help an unnecessary arthroscopy which is an invasive procedure is avoided. (8, 11). The most common affected areas during a basketball game are the knee and the ankles. In the knee most injured are ligaments – predominantly the ACL, cartilages and the menisci. Other anatomical structures are affected to a lesser extent or in combination with the above mentioned.

Injury of the ACL is highly limiting for the competitive carrier of the basketball players and needs prolonged rehabilitation (12). Krosshaug et al (2007) explain that many of the ACL injuries are as a result of non-contact game, although Joseph et al (2013) disagree on that and state that player-to-player contact "still results in a significant number of ACL injuries" (13, 14). An interesting study shows that there is variation in the frequency of ACL injuries depending on the gender. Trojian & Ragle (2008) (15) conclude that women are two to four times more affected than men. According to another research amongst American college athletes taking part in different sports, including basketball, this predominance is proved (16). There are different theories concerning the difference in knee injury incidence depending on the gender some of which are – reduced intercondylar notch width in women comparing to men, predisposition to knee abduction in women athletes during landing and higher risk of trauma during pre-ovulatory phase of the menstrual cycle due to hormonal changes (17).

Depending on the degree of ACL injury, the players need rehabilitation, reconstruction in case of tear or a combination of both methods to be able **to** go back to the field. Majority of the professional basketball players regardless of gender, who undergo reconstruction of the ACL go back to playing (18, 19).

Meniscal injuries are not commonly encountered in basketball players but are not unusual. They are usually found in combination with other entities – such as torn ACL, cartilage injuries, etc. Rarely meniscal injuries are seen as an isolated

pathology (20). According to Yeh at al. (2012) body-mass index higher than 25 presents a high risk factor for meniscal injury (21).

Bone marrow edema, intraarticular effusion and cartilage injuries were found in our patients confirming a bony injury. In a paper by Pappas et al (22) preseason examination of college players has shown bone marrow edema in 75% of cases and an increase to 86% in post season. Another study shows that 41% of the players exhibit bone marrow edema, cartilage injuries – 18% and intraarticular effusion in 35% (23).

Cartilage injuries are rarely asymptomatic and are usually seen in the area of patellofemoral joint (24, 25).

Posterior cruciate ligament (PCL) and medial collateral ligament injuries are much less frequent than those engaging the ACL. PCL is the strongest knee ligament and is a stabilizer of the knee. According to literature, athletes who have been treated conservatively for PCL trauma, could achieve great recovering results after an accurate diagnosis (26).

CONCLUSION

MR is a reliable tool which allows prompt and accurate diagnostic of knee contusions. Since many of the cases with knee injuries are asymptomatic, MR could be used in assessing the condition for the athlete in the preseason as well as during the season period.

Despite its high financial cost, the method is highly suggested due to the fact that it is pain free, with proved effectiveness and efficacy when diagnosing knee derangements.

Assessing the right diagnosis leads to accurate treatment, avoids unnecessary surgical intervention, players recover faster, allowing them **to** engage in the training activities and to participate in the upcoming games along with their teammates. According to specialists the time frame to perform an MR after an incident varies from 2 weeks to 6 – 8 weeks, given that the patient does not have pain and highly limited movements.

REFERENCES

1. Drakos MC, Domb B, Starkey C, Callahan L & Allen AA. Injury in the national basketball association: a 17-year overview. *Sports Health.* 2010;2(4):284-290. Doi: 10.1177/1941738109357303.
2. Willem H. Meeuwisse, MD, PhD, Rory Sellmer & Brent E. Hagel, MSc. Rates and risks of injury during intercollegiate basketball. *The american journal of sports medicine*, Vol. 31, No. 3, 2003. American Orthopaedic Society for Sports Medicine; 0363-5465/103/3131-037902.00/0. *The University of Calgary Sport Medicine Centre, Calgary, Alberta, Canada.*
3. Carlos Vicente Andreoli, Bárbara Camargo Chiaramonti, Elisabeth Biruel, Alberto de Castro Pochini, Benno Ejnisman & Moises Cohen. Epidemiology of sports injuries in basketball: integrative systematic review. *BMJ Open Sport Exers Med*. 2018; 4 (1):e000468. Published online 2018 Dec. 27. Doi:10.1136/bmjsem-2018-000468. PMCID:PMC6326319; PMID:30687514.
4. Joel S Newman & Arthur H Newberg. Basketball injuries. Pub Med. gov. 2010 Nov; 48 (6):1095-111. PMID:21094400; Doi: 10.1016/j.rcl.2010.07.007.
5. Royal Australian College of General Practitioners. Clinical guidance for MRI referral. East Melbourne: RACGP, 2013 (accessed 10 July 2015).
6. Guermazi, A. et al. (eds.). *Imaging in Sports-Specific Musculoskeletal Injuries*, Doi: 10.1007/978-3-319-14307-17.
7. Warwick DJ, Ca, Oanagh P, Bell M & Marsh CH (1993). Influence of magnetic resonance imaging on a knee arthroscopy waiting fat. Injury 24(6):380-382.
8. Weinstabl R, Muellner T, Vecsei V et al (1997). Economic con-siderations for the diagnosis and therapy of meniscal lesions: can magnetic resonance imaging help reduce the expense? *World J Surg* 21(4):363-368.
9. Patel NK, Bucknill A, Ahearne D, Denning J, Desai K & Watson M. Early magnetic resonance imaging in acute knee injury: a cost analysis. *Knee Surg Sports Traumatol Arthrosc*. 2012 Jun; 20(6):1152-8. doi:

10.1007/s00167-012-1926-Epub 2012 Mar 1. PMID: 22382604.
10. Skinner S**.** MRI of the knee. Aust Fam Physician 2012;41:867-9.
11. Sharifah MI, Lee CL, Suraya A, Johan A, Syed AF & Tan SP. Accuracy of MRI in the diagnosis of meniscal tears in patients with chronic ACL tears. *Knee Surg Sports Traumatol Arthrosc.* 2015 Mar; 23(3):826-30. doi: 10.1007/s00167-013-2766-7. Epub 2013 Nov 17. PMID: 24240983.
12. Newman, J. S., & Spitz, D. J. (2016). Imaging of Basketball Injuries. Imaging in Sports-Specific Musculoskeletal Injuries, 145*–173.* doi:10.1007/978-3-319-14307-17.
13. Krosshaug T, Nakamae A, Boden BP et al (2007) Mechanism of anterior cruciate ligament injury in basketball: video analysis of 39 cases. *Am J Sports Med* 35:359–367.
14. Joseph AM, Collins CL, Henke NM et al (2013) A multi-sport epidemiologic comparison of anterior cruciate ligament injuries in high school athletics. *J Athl Train* 48(6):810–817.
15. Trojian TH, Ragle RB (2008) Injuries in women's basket-ball. Conn Med 72:147–150.
16. Swensen DM, Collins CL, Best TM et al (2013) Epidemiology of knee injuries among U.S. high school athletes, 2005/2006–2010/2011. *Med Sci Sports Exerc* 45(3):462–469.
17. Renstrom P, Ljundqvist A, Arendt E et al (2008) Non- contact ACL injuries in female athletes: an international olympic committee current concepts statement. *Br J Sports Med* 42:394–412.
18. Busfi eld KT, Kharrazi FD, Starkey C et al (2009) Performance outcomes of anterior cruciate ligament reconstruction in the national basketball association. *Arthroscopy* 25(8):825–830.
19. Namdari S, Scott K, Milby A et al (2011) Athletic perfor-mance after ACL reconstruction in the women's national basketball association. Phys Sportsmed 39(1):36–41.
20. Kaplan LD, Schurhoff MR, Selesnick H et al (2005) Magnetic resonance imaging of the knee in asymptomatic professional basketball players. *Arthroscopy* 21(5):557–561.
21. [2]1.Yeh PC & Shin SS, (2012) Tendon ruptures: mallet, fl exor digitorum profundus. *Hand Clin* 28:425–430.
22. [2]2.Pappas GP, Vogelsong MA, Staroswiecki E, Gold GE & Safran MR. Magnetic Resonance Imaging of Asymptomatic Knees in Collegiate Basketball Players: The Effect of One Season of Play. *Clin J Sport Med*. 2016;26(6):483-489. doi:10.1097/JSM.0000000000000283.
23. Major NM & Helms CA. MR imaging of the knee: findings in asymptomatic collegiate basketball players. *AJR Am J Roentgenol.* 2002 Sep;179(3):641-4. Doi: 10.2214/ajr.179.3.1790641. PMID: 12185035.
24. Kaplan LD, Schurhoff MR, Selesnick H et al (2005) Magnetic resonance imaging of the knee in asymptomatic professional basketball players. *Arthroscopy* 21(5):557–561.
25. Major NM & Helms CA (2002) MR imaging of the knee: fi ndings in asymptomatic professional basketball players. *AJR Am J Roentgenol* 179:641–644.
26. Doberstein ST & Schrodt J. Partial posterior cruciate ligament tear in a collegiate basketball player: a case report. *J Athl Train.* 1997;32(2):155-158.