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운동 후 발생한 횡문근 융해증의 임상적 고찰

안영준 · 이승림 · 유재호 · 주민홍 · 김성완 · 박지만 · 양보규

국립경찰병원 정형외과

목적: 전투 경찰에게서 과도한 신체 활동 후 발생한 횡문근 융해증의 임상 양상 및 치료에 대해 알아 보고자 하였다.

대상 및 방법: 2004년 6월 1일부터 2005년 5월 23일까지 운동이나 훈련 후 발생한 근육통 및 근육종창을 주소로 본원을 방문한 전투 경찰 중에서 횡문근 융해증이 의심되어 입원한 13명의 환자를 대상으로 혈액검사(CPK, CK-MB, AST, BUN/Cr, Electrolyte) 및 임상 경과를 관찰하였다. 이들은 모두 남자였고, 평균 연령은 20세(19~21세) 였다. 발병 원인으로는 팔굽혀펴기 후 발생한 것이 7례, 축구 경기 후 발생한 것이 5례, 시위 진압 후 발생한 것이 1례였다. 이학적 소견상 다양한 신체 부위에 종창 및 압통을 호소하였는데 전완부에 발생한 경우가 4례, 상완부가 3례, 견갑부가 1례, 하지가 5례였다. 횡문근 융해증의 진단 기준은 내원 당시 임상증상과 함께 혈중 CPK가 1,000 IU/L 이상인 경우로 하였고 약물 복용력이나 내과적 질환이 있는 경우는 대상에서 제외하였다. 모든 환자에서 99mTc-MDP 20mCi를 정맥주사 후 4시간에 bone scan을 시행하였다. 치료는 침상 안정가료 및 수액요법을 시행하였고 동통을 심하게 호소하는 환자에게는 부목고정을 실시 하였다.

결과: 전체 입원환자 13명의 평균 재원 기간은 20일(14일~42일)이었고 내원 당시 급성신부전을 보인 1례를 제외하고는 수액요법 및 휴식을 시행한지 평균 8일(2일~11일) 후 혈액학적으로 CPK가 1000이하로 감소되었으며 임상적으로도 뚜렷한 회복을 보였다. 급성신부전을 보인 1례에서는 혈액투석 및 수액요법을 시행한 후 회복되었다.

결론: 심한 운동이나 훈련 후 부종 및 근육통을 호소하는 환자에서 운동 유발 횡문근 융해증을 의심하여 조기에 혈액검사 및 수액 치료를 시행하는 것이 중요하다.

색인단어: 운동 유발 횡문근 융해증, 수액요법

Introduction

Rhabdomyolysis is a disease caused by introduction of muscle enzymes and myoglobin into the blood plasma during damage to muscle cells. This can be due to over dosage of alcohol or drugs, infection, metabolic disease, myopathy, cerebrovascular accident (CVA), muscle compression, compartment syndrome, or intense physical activity. Rhabdomyolysis caused by intense physical activity is called exercise induced or exertional rhabdomyolysis[1,3,5,6,8-11]. Clinically, rhabdomyolysis can be suspected when muscle aches, swelling, or brownish urine is present. It can also be diagnosed by increase of creatinine phosphokinase (CPK) in the blood plasma, or an increase in myoglobin in the blood or urine. Sixteen to thirty-three percent of patient diagnosed rhabdomyolysis is accompanied by renal failure, and can increase chances of death due to acute renal failure (ARF). Therefore, rhabdomyolysis is an important clinical diagnosis[2,4].

Exercise induced rhabdomyolysis has been frequently reported in soldiers, but the spread of an active lifestyle suggests an increase in exercise induced rhabdomyolysis in the general population will be seen. Therefore, orthopedists should be aware of its symptoms, diagnosis and treatment.

We present the clinical symptom and treatment results of rhabdomyolysis seen in healthy individuals after intense physical activities.

Methods

The following clinical study was conducted on 13 military police recruit who were admitted between June 1st, 2004 and May 23rd, 2005. These patients complained of severe muscle pain after intense physical activities at the time of admission. A bone scan was done 4hours after

통신저자: 양 보 규
서울특별시 송파구 가락본동 58
국립경찰병원 정형외과
TEL: 02) 3400-1243 · FAX: 02) 449-2120
E-mail: bky@nph.go.kr

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injecting 99mTc-MDP 20mCi intravenously, and blood tests (CPK, CK-MB, AST, BUN/Cr and electrolyte) were conducted at day 1st, day 2nd, week 1st and week 2nd after admission. The basis of rhabdomyolysis diagnosis were muscle ache, swelling and weakness, and a blood CPK level of above 1,000 IU/L (normal levels: 0~190 IU/L). Patients with past drug histories and medical problem were omitted from the study. The patients were all males, and their average age was 20 (19~21) years. Seven cases were due to push-up exercises, 5 was due to a soccer game, and 1 was due to riot control activities. The patients complained of swelling and tenderness in various parts of the extremities. Four complained of swelling and tenderness in forearm, 3 in upper arm, 1 in shoulder, and 5 in lower extremity (Table 1). All but one patient was ordered bed rest and fluid therapy. The one exception was a patient who showed an elevated BUN/Creatinine and oliguria at the time of admission. Patients who complained of extreme swelling or pain were given splint immobilization. The administered fluid therapy was 0.9% normal saline at 3L/day until CPK level decreased to below 1000 IU/L, and then was replaced with 0.45% normal saline. The administered fluid therapy did not contain mannitol or sodium bicarbonate. One patient who showed signs of ARF was given hemodialysis.

Results

All 13 admitted patients complained of muscle pain, limited muscle mobility and muscle swelling. They also exhibited high level of CPK (Fig. 1). Bone scans taken 4 hours after intravenously administering 99mTc-MDP 20mCi showed radioisotope uptake into associated compartment(Fig. 2). The average hospitalization period for the 13 patients was 20 days, and all blood tests taken 2 weeks after fluid therapy returned to normal, along with their diagnosis (Fig. 1). The 12 patients who did not show signs of ARF at the time of admission did not show any signs of it after admission. The one patient who did show signs of ARF at the time of admission recovered completely after hemodialysis and fluid therapy.

Discussion

Rhabdomyolysis may occur after trauma, ischemia (including acute myocardial ischemia), excessive exertion (marathon runners), bacterial and viral sepsis, electrical burns, other injuries related to heat or cold, prolonged muscle compression as often seen in the unconscious state after alcohol or drug intoxication, seizures, hypokalemia and shock. It has also been reported in associated with metabolic disorders (phosphoglycerate kinase deficiency, and carnitine palmityl transferase deficiency) and exposure to various drugs and toxins (meperidine HCl). Among non-traumatic causes, Rhabdomyolysis caused by intense physical activity is called exercise induced or exertional rhabdomyolysis, and is becoming an important orthopedic problem[1,3,5,6,8-11].

Two causes of exercise induced rhabdomyolysis have been hypothesized by Milne et. al. The first cause of it could be explained by metabolic overload theory. This theory claims damage of muscle cells due to depletion of adenosine triphosphate (ATP) during exercise. The second is mechanical strain theory, which claims a direct destruction of muscle cell membrane[7]. Both theories explain destruction of muscle cells and the intrusion of intra-cellular components into the blood stream, which increases blood CPK and myoglobin level.

People who are not physically fit for intense physical activities have higher chances of getting exercise induced rhabdomyolysis. Some claim women have lower rates due to the effect of estrogen[6]. Also, a 200 time rate increase has been reported for people with sickle cell traits[3].

Rhabdomyolysis can be diagnosed by past history, muscle ache, swelling, or presence of brownish urine. Rhabdomyolysis can be confirmed if blood CPK level is

Table 1. Analysis of the patients by involved body parts and causes

	Push-up Ex.	Soccer	Riot control act.	Total
Upper arm	3	0	0	3
Forearm	4	0	0	4
Shoulder	0	0	1	1
Lower extremity	0	5	0	5
Total	7	5	1	13

increased above 1000 IU/L without acute myocardial ischemia or cerebrovascular disease. Increase in blood AST/LDH levels along blood and urine myoglobin can confirm rhabdomyolysis. A CPK level is the most sensitive indicator of muscle damage. Blood CPK has a relatively long half-life of 1.5 days, which makes it easy to detect high levels in the blood. On the other hand, myoglobin can be excreted or metabolized to billirubin in 1~6 hours. Therefore, a patient with rhabdomyolysis can have low myoglobin levels[8].

A bone scan test, when used as a tool for rhabdomyolysis diagnosis, has the advantage of identifying the degree and location of muscle damage[8,12]. For this study, all bone scan tests showed an uptake of isotopes in the affected muscle, indicating its sensitivity in rhabdomyolysis diagnosis.

Sixteen to thirty-three percent of rhabdomyolysis cases result in ARF. This complication can be caused by the obstruction of the renal tubule due to formation of casts, renal tubular damage by myoglobin and contraction of the renal artery[8]. In this study, 1 patient developed ARF, but he had no specific medical or drug history, and was just an untrained fresh recruit at that time.

The main goal of treatment is to prevent the causes of ARF, i.e. decrease of body fluids, obstruction of the renal tubule, acidification of urine, and free radical production. The loss of blood has been known to be the main cause of ARF for rhabdomyolysis patients. Therefore, to prevent ARF in rhabdomyolysis patients, it is important to provide enough 0.9% normal salines intravenously and maintain urine pH above 7.0. One should be careful not to inject and solutions containing potassium or lactic acid. For patients with hyperkalemia, dialysis or other excretion techniques may be required along with medication[8].

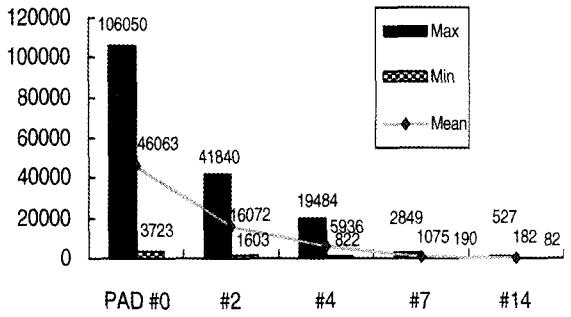

Fig. 1. Serial changes of serum CPK level.

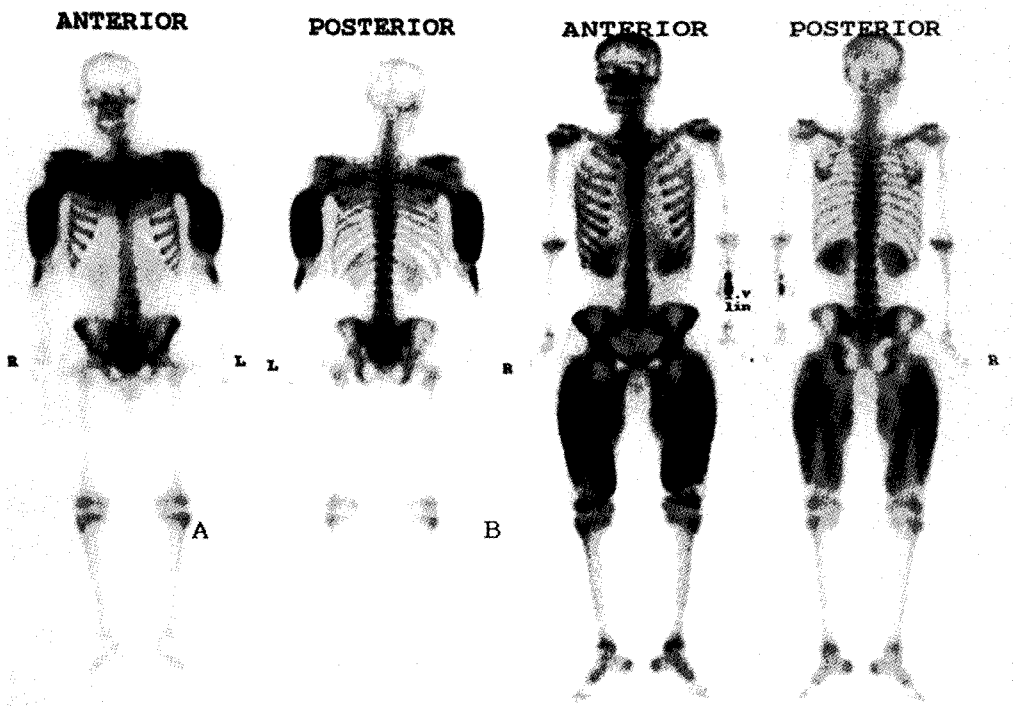

Fig. 2. Bone scans taken 4 hours after intravenously administering 99mTc-MDP 20mCi showed radioisotope uptake into the affected body part.

Conclusion

We observed rhabdomyolysis in patients after rigorous physical activities. All patients, with the exception of one who developed ARF and required hemodialysis, recovered completely with bed rest and fluid therapy. Rhabdomyolysis should be suspected in such cases where a patient complains of muscular swelling, muscle ache, and oliguria after rigorous physical activities. A prompt testing of blood CPK, myoglobin, AST/ALT, BUN/creatinine, electrolyte, and etc. should be conducted, along with early treatment of fluid therapy to prevent serious complications, such as ARF.

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= ABSTRACT =

Clinical Study of Rhabdomyolysis After Exercise

Young Joon Ahn, M.D., Seung Rim Yi, M.D., Jae Ho Yoo, M.D.,
Min Hong Zoo, M.D., Seong Wan Kim, M.D., Ji Man Park, M.D.,
Bo Kyu Yang, M.D.

Department of Orthopaedic Surgery, National Police Hospital, Seoul, Korea

Purpose: This study evaluate clinical findings & management of rhabdomyolysis after strenuous activities in military police recruit

Materials and Methods: This study was carried out from June 1st, 2004 and May 23rd, 2005. The study subjects were 13 military police recruit patients who were admitted to our hospital with intractable muscle pain and swelling, and had suspicions of Rhabdomyolysis. The patients were given various blood tests (CPK, CK-MB, AST, BUN/Cr, and Electrolyte) and clinically observed. The patients were all males, and their average age was 20 (19~21) years. Seven cases were due to push-up exercises, 5 was due to a soccer game, and 1 was due to riot control activities. The patients complained of swelling and tenderness in various parts of the extremities. Four complained of swelling and tenderness in forearm, 3 in upper arm, 1 in shoulder, and 5 in lower extremity.

The diagnosis of rhabdomyolysis was made if the patient complained clinical symptom and had a blood CPK level of above 1,000 IU/L at the time of admission. Patients who took medication or had medical problem were excluded from this study. Bone scans were taken of all patients 4 hours after giving 99mTc-MDP 20mCi intravenously. Treatment was bed rest and fluid therapy. Patients who complained of excessive pain were given splint immobilization.

Results: The average hospitalization day for the 13 patients was 20 days (14~42 days). Excluding one patient who exhibited ARF at time of admission, all patients showed a decrease of blood CPK below 1000 IU/L at an average hospitalization time of 8 days (2~11 days). The patient with ARF recovered after hemodialysis and fluid therapy.

Conclusion: Patients complaining of swelling and severe muscle pain after excessive exercise or training should be suspicious of exercise induced rhabdomyolysis, and should be given blood tests and fluid therapy immediately.

Key Words: Exercise induced rhabdomyolysis, Fluid therapy

Address reprint requests to **Bo Kyu Yang, M.D.**
Department of Orthopaedic Surgery, National Police Hospital,
50 Garak-dong, Songpa-gu, Seoul 138-708, Korea
TEL: 82-2-3400-1243, FAX: 82-2-449-2120, E-mail: bky@nph.go.kr