

The Activity Leading to ACL Injury and the ability to Resume Duty following Reconstructive Surgery in Malaysian Military Patients

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SUMMARY

Introduction: Anterior cruciate ligament (ACL) injuries are common among Malaysian military patients but has not been studied closely. The purpose of this study was to assess the type of activities leading to the ACL injury and the outcome of reconstructive ACL surgery at one year follow up.

Methods: From the registry record, military patients who had undergone ACL reconstruction in two Malaysian military hospitals were identified. Their medical records were reviewed. The activities that they performed when the ACL injury occurred were identified. After ACL reconstruction, the patients' ability to resume previous duty at one year follow up was evaluated.

Results: From 111 patients, 82% of the ACL injuries were due to sporting activities whereas military activities and road traffic accident accounted for 14 % and 4 % respectively. Out of 69 patients with isolated ACL injury who were followed up at one year, all except two were able to resume their previous duty.

Conclusions: Among the military patients who underwent ACL reconstruction, ACL injury was mainly due to sporting activity. ACL reconstruction showed good outcome at one year follow up.

KEY WORDS:

Anterior cruciate ligament reconstruction, Military patients

INTRODUCTION

The anterior cruciate ligament (ACL) is a commonly injured ligament of the knee and injury known to occur in people participating in athletic activity. As sports become an increasingly important part of daily life, the number of ACL injury has also steadily increased. However, most of the literature on ACL injury has been focused on civilian populations. Previous studies have shown that this injury is not uncommon among military personnel, resulting in knee instability and affecting performance in military duties, lost of duty time as well as the military readiness^{1,2}. Additionally, our data showed that arthroscopic ACL reconstruction is one

of the commonest orthopaedics procedures performed in Malaysian military hospital³. It would be useful to know the activity that these military personnel participated in that resulted in ACL injury. It has not been recorded if military activities commonly lead to ACL injury like sporting activities do. Military activities in Malaysia, on the other hand could be different compare to other countries.

Since ACL injury among armed forces personnel have not been closely studied, it was unclear whether the injury was due to their active military duty or sporting activities. Moreover, to our knowledge, there has not been any study that shows the ability of these patients to be involved in the military duty again following their ACL reconstruction surgery. Thus, the purpose of this study is to determine the activity leading to ACL injury among army personnel who underwent ACL reconstruction and their ability to resume previous duty at one year follow up after the surgery.

MATERIALS AND METHODS

A cross sectional study was performed at two Malaysian Armed Forces Hospitals, located in Terendak and Lumut. Military patients from these hospitals who underwent arthroscopic ACL reconstruction surgery and fulfilled the selection criteria were identified and follow up from 2007 until 2009.

The first phase of the study was to determine the activity that the army had participated leading to ACL injury. The ACL injury in this cohort was diagnosed by symptoms of instability and laxity of the ligament on physical examination. The injury was then confirmed by arthroscopic examination during the reconstructive procedure. We excluded the cases that involve significant meniscal injury, multi ligamentous injury, revision surgery and those who had the ACL injury before joining the military services. One hundred and eleven patients who met the selection criteria were included in this study. The demographic data of these patients were recorded. The activities that the patients were engaged in when the ACL injury took place were identified and divided into three groups, i.e sports-related activity, military activity and other activities. Any associated intraarticular lesions noted during the surgery were also

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Table I: Type of graft used and the Military Health Grading before and one year after the reconstruction

Type of graft	Military Health Grading					
	Before Surgery			After Surgery		
	FE*	LE**	BE***	FE*	LE**	BE***
BPTB^	0	39	3	40	0	2
Hamstring	0	25	2	27	0	0
Total	0	64	5	67	0	2

* Forward Everywhere (A person in this category is fit to carry out any military duty and is employable at full combatant duties in any part of Malaysia)
 **Line of Communication (A person in this category is able to mobilize but not fit for strenuous activity)
 ***Base Everywhere (A person in this category is only employable in the base area, usually doing a desk job)
 ^Bone Patella Bone Tendon

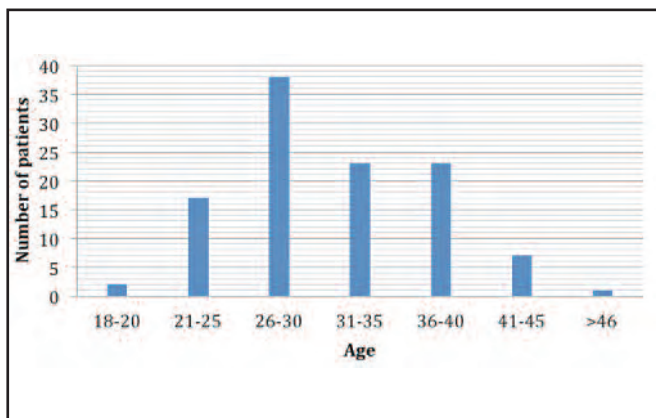


Fig. 1: Age group distribution of patients who underwent arthroscopic ACL reconstruction surgery.

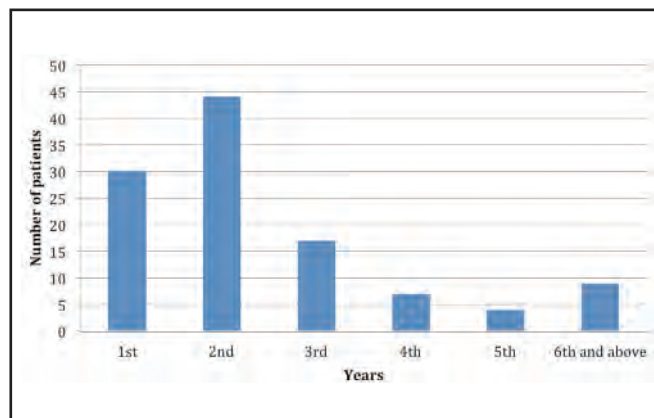


Fig. 2: The distribution between numbers of patients and the year after injury where ACL was reconstructed.

documented. All the surgeries were performed by two trained sports surgeon using either bone-patella-bone or hamstring autograft, according to the surgeons' preferences.

The second phase of our study was to assess the ability to resume their previous military duty. From the initial number of 111 patients who were included in first phase of this study, 42 patients had significant associated injury like meniscal or chondral injuries that were noted during the surgery. They were excluded for the second phase of study. The remaining 69 patients with isolated ACL injury who underwent ACL reconstructions were followed up. The outcomes at one year after ACL reconstructions were assessed.

The outcome of interest was the ability of these army patients to resume their previous military duty after the ACL was reconstructed. Patients were graded using Military Health Grading system (MHG), which is a standard grading system used by the Malaysian Armed Forces to evaluate military personnel who have sustained any injuries or illness that may affect their services⁴. It is a subjective assessment that comprises history and physical evaluation completed by the military medical personnel, in order to determine the ability of the army personnel to carry out their previous physical activities and whether their knees function could withstand those activities base on the symptoms reported. A grade is given according to clinical judgment. The grading is divided into three categories depending on the patients' fitness level. The category that has the highest level of fitness is called 'FE' (forward everywhere). Patients in this category are able to

return to their previous level of activity. The next category is called 'LE' (line of communication) Such a patient is normally employed in the communication zone for a base in any part of Malaysia but may also be employed in a combat zone in any role that is not primarily a fighting one. The category with the lowest fitness level is called 'BE' (base everywhere). A person in this category is only employable in the base area, usually doing a desk job, in any part of Malaysia.

Statistical analysis was done using STATA software version 11.0. The p value of ≤ 0.05 was considered significant.

RESULTS

The age of the patients ranged from 18 to 46 years (mean of 32 years) (Figure I). The distribution of the right and left knee involvement was 50.4% and 49.6%, respectively. The non-officer ranking group contributed to 91% of the patients, and the remaining patients came from the officer ranking group. Eighty two percent of the ACL injury was attributed to sporting activity. Military activities and other causes only contributed to 14 % and 4 % of the ACL injury, respectively. Out of the initial 111 patients that were selected, 38%(42) had associated intraarticular injuries consisting of meniscus and chondral injury. The remaining 62%(69) were isolated ACL injuries.

The duration from injury to ACL reconstruction surgery was between one to 118 months with the median of 18 months

(Figure 2). All the patients underwent physiotherapy to strengthen the quadriceps and hamstrings muscles after the injury and were not involved in strenuous military activity while waiting for their ACL reconstructive surgery. Table I shows the type of the graft used in the surgery and the MHG before and one year after the surgery. There was a significant improvement in MHG from BE and/or LE to FE before and at one year after the surgery (Mc Nemar test; $\chi^2=67.0$, $p=0.01$).

DISCUSSION

The majority of the patients (55%) in our series had their ACL reconstructed between the age of 26 to 35 years. Our cross-sectional study highlighted that sporting activity is the main event that leads to ACL injury among the Malaysian army patients who had their ACL reconstructed. This finding is in accordance to a previous study done on 325 Americans army personnel who had underwent ACL reconstruction, which also showed that the cause of the ACL injury was all due to sports-related activity⁵. Another study on the sports and physical training injury among the hospitalized Americans male army personnel found that 5.5% was due to physical training² while the others were due to sporting activities. However, in contrast, it is interesting to note in our study that there was a relatively higher percentage of ACL reconstruction where the ligament injury occurred following military activity (14%). As each country may not have a similar military training method, the higher percentage in our series may warrant further study to evaluate what type of army activities that could possibly lead to the ACL injury.

Previous studies have shown that acute ACL injury might be associated with meniscal tear in 42% to 77% of cases^{7,11}, and chondral injury in 20% to 23% of cases^{8,11}. Our series however demonstrated that only 38% of the patients with the ACL injury had associated meniscus and chondral lesions. Nevertheless, as our data was retrieved from medical records, we could not rule out the possibility of under-reporting of those with minor injury that could account for the relatively lower incidence of associated intraarticular injury in our series. The results of our study showed that most of the patients with ACL injury had delayed surgery, with a median duration from injury to surgery of 18 months. This finding may raise a concern as a delayed surgery in an ACL-injured knee may lead to other structural injuries⁶ and this might have accounted for the intrarticular lesions noted during the reconstructive surgery in our series, which could have occurred as a sequelae rather than during the acute ACL injury. It would be interesting to identify the reason for the delay in surgery despite the cohort are constantly involved in strenuous activities. Our data to further evaluate this unexpected finding were lacking, as it was not the focus of our study. We believed that the causes of delay may be multifactorial. Further study in this aspect would be useful to clarify this matter so that appropriate steps could be taken to minimize the delay in surgery, thus reduce further knee complication.

Many studies have shown that ACL reconstruction resulted in variable ability to return to previous level of activity, ranging from 53% to 100%¹²⁻¹⁴. On the other hand, this outcome measure may be greatly influenced by the type of the activity that a patient is engaged with before the ACL injury. MHGs

is chosen in this study because it is the standard approved practice in the Malaysian Armed Forces hospitals that determine a patient's level of fitness and ability to engage in the military duty. Our findings were similar to the results of a study conducted among U.S military aviators, which showed 97.6% of the patients could return back to their original duty while another 2.4% remain at base only¹⁵.

Our study on the patients with isolated ACL injury also showed that the early outcome of ACL reconstruction surgery was still good despite a delayed surgical intervention. Although most of the patients in the current study underwent reconstructive surgery after one year of injury, yet most of them were able to resume their pre-injury duty. This finding was supported by Frobell *et al.* The authors studied the outcome for patients who received two strategies of treatment, either rehabilitation plus early ACL reconstruction or rehabilitation plus optional delayed ACL reconstruction¹⁶. They found that both group had similar good outcome.

Two patients remained in BE group in our cohort as a result of graft failure following re-injury. Graft failure is a known fact as one of the complications following ACL reconstruction. The causes of graft failure are many. Although patients reported that they had re-injured their knee, we could not excluded other factors related to surgery that leads to graft failure.

Our study has highlighted two main findings with some limitation. First, there was a comparatively higher incidence of ACL injury as a result of military activities that needs reconstruction in our series. We believe further study to evaluate in detail the type of military training that could possible subject the knee to the injury would be useful to implement measures to minimize the injury related to military activities. Secondly we found that our ACL reconstructive surgery had very good outcome at one-year post surgery base on the MHG. As the grading only categorize the patients into three groups (FE,LE and BE), it is obvious that the grading could not further evaluate those in the FE group whether they are in the pre-injury level fitness or not. It must be emphasized that being able to perform any military duty as define by FE group does not mean that they have restore their previous level of fitness. This MHG is also depends on subjective physical assessment that could have potential bias. The use of validated scoring systems such as Lysholm score, SF-36 and IKDC subjective knee score in this study in combination with MHG would greatly improve the outcome measures. However because of the retrospective nature of our study, the data with those scoring system were lacking. We however did not think that this d affect the study objectives, as our outcome of interest in this cohort was to determine the ability to return to the previous level of duty. The level of the activity was not easy to assess. Despite many athletes returning to their previous level of sports, it was difficult to determine if they were able to perform at their best¹⁷. Similarly in our series, although these army patients were able to resume their pre-injury duty, question remains if these were performed with much difficulty. Despite these limitations, our study has highlighted the activities leading to ACL injury and the ability to resume their previous military duty after the reconstruction surgery.

CONCLUSION

In conclusion, sporting activity, rather than military-related activity, was the main cause of ACL injury in Malaysian military population who had their ACL reconstructed. Most of these patients were nevertheless able to resume their previous duties at one-year follow up after the surgery.

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REFERENCES

1. Owens BD, Mountcastle SB, Dunn WR, DeBerardino TM, Taylor DC: Incidence of anterior cruciate ligament injury among active duty U.S. military servicemen and servicewomen, *Mil Med* 2007, 172: 90-1.
2. Lauder TD, Baker SP, Smith GS, Lincoln AE: Sports and physical training injury hospitalizations in the army, *Am J Prev Med* 2000, 18: 118-28.
3. Muzaffar T, Shaifuzain A, Musa K, Mohammed Amiruddin H: Orthopaedic Surgeries in Lumut Military Hospital, International Medical and Health Congress 2007, 14: 79.
4. BPK: The Pulheems System Of Medical Classification. Edited by Health Division Services MoD, Malaysia. Kuala Lumpur, 1995.
5. White LDW, Wenke JC, Mosely MDS, Mountcastle SB, Basamania CJ: Incidence of Major Tendon Ruptures and Anterior Cruciate Ligament Tears in US Army Soldiers, *Am J Sports Medicine* 2007, 35: 1308-14.
6. Yuksel HY, Erkan S, Uzun M: The evaluation of intraarticular lesions accompanying ACL ruptures in military personnel who elected not to restrict their daily activities: the effect of age and time from injury, *Knee Surg Sports Traumatol Arthrosc* 2006, 14: 1139-47.
7. Cerabona F, Sherman MF, Bonamo JR, Sklar J: Patterns of meniscal injury with acute anterior cruciate ligament tears, *Am J Sports Med* 1988, 16: 603-9.
8. Noyes FR, Bassett RW, Grood ES, Butler DL: Arthroscopy in acute traumatic hemarthrosis of the knee. Incidence of anterior cruciate tears and other injuries, *J Bone Joint Surg Am* 1980, 62: 687-695, 757
9. Noyes FR, McGinniss GH, Grood ES: The variable functional disability of the anterior cruciate ligament-deficient knee, *Orthop Clin North Am* 1985, 16: 47-67.
10. Warren RF, Levy IM: Meniscal lesions associated with anterior cruciate ligament injury, *Clin Orthop Relat Res* 1983, 32-7.
11. Indelicato PA, Bittar ES: A perspective of lesions associated with ACL insufficiency of the knee. A review of 100 cases, *Clin Orthop Relat Res* 1985, 77-80.
12. Fabbriani C, Milano G, Mulas PD, Ziranu F, Severini G: Anterior cruciate ligament reconstruction with doubled semitendinosus and gracilis tendon graft in rugby players, *Knee Surg Sports Traumatol Arthrosc* 2005, 13: 2-7.
13. Kvist J, Ek A, Sporrstedt K, Good L: Fear of re-injury: a hindrance for returning to sports after anterior cruciate ligament reconstruction, *Knee Surg Sports Traumatol Arthrosc* 2005, 13: 393-7.
14. Lee DY, Karim SA, Chang HC: Return to sports after anterior cruciate ligament reconstruction - a review of patients with minimum 5-year follow-up, *Ann Acad Med Singapore* 2008, 37: 273-8.
15. Belmont PJ Jr., Shawen SB, Mason KT, Sladicka SJ: Incidence and outcomes of anterior cruciate ligament reconstruction among U.S. Army aviators, *Aviat Space Environ Med* 1999, 70: 316-20.
16. Frobell RB, Ewa M. Roos, Harald P. Roos, Jonas Ramstam, L. Stefan Lohmander: A Randomized Trial of Treatment for Acute Anterior Cruciate Ligament Tears, *N Engl J Med* 2010, 363: 331-42.
17. Caborn DN, Johnson BM: The natural history of the anterior cruciate ligament-deficient knee. A review, *Clin Sports Med* 1993, 12: 625-36.