

Original Research Article

The Incidence of Knee Injury in a Battalion of Indonesian Military Army

ABSTRACT

Background:

The third most common injury in military patients was observed in knees with ligament and meniscus injury were most prevalent. However, it has not been studied closely. Sports and physical training activities are an area in which a substantial number of injuries can occur. Any physical injury occurred among the military forces can lead to their temporary or permanent disability. Therefore, purpose of this study was to know the incidence of knee injury in a Battalion of Indonesian Military Army.

Methods:

This was a cross sectional study conducted in Battalion 403/WP of Special Region of Yogyakarta and Sardjito General Hospital. The samples were active duty Army personnel with knee injury. After we performed history taking, physical examination, and MRI, we diagnosed the type of knee injury. Then we evaluated the demographic data, BMI, and Modified Cincinnati score to evaluate the daily functional score. The parameters were statistically analyzed.

Results

The study showed from 589 active duty Army personnel there were 25 (4.24%) was suffered from knee injury with 12 of them (2.03%) sustained ligament rupture. Eight of the injury was caused by Non-Duty activities (66.67%). Nine was ACL rupture, 2 PCL rupture and 1 meniscus tear. Average BMI was 24.08 kg/m². Most of the patient has fair daily functional score with average of Modified Cincinnati Score was 52.83, we also compare between army and non-army patient, we found that army patients with knee injury has significantly better daily functional score than non-army patients ($P < 0.05$).

Conclusions:

The incidence of knee ligament injury in a Battalion of Indonesian Military Army was 2.03 percent and having significantly better daily functional score compared with non-army patient.

Keywords: Knee injury, ACL, PCL, Military army, Body mass index

Introduction

Service in the armed forces involves intensive, physically arduous work in austere, environmentally challenging locations remote from medical support. Thus, stringent medical selection standards preclude employment of those with conditions that represent an unacceptable risk to current or future fitness.^{1,2}

Vigorous weight-bearing exercise during military work or exercise, such as marching or jumping might increase the risk for injuries. Furthermore, as the frequency, duration, or total amount of training increases, the injuries also increase.³

Knee injury injuries are common among military patients but has not been studied closely. The anterior cruciate ligament (ACL) is the most commonly injured ligament of the knee and the injury is known to occur with people participating in athletic activities. As sports becomes 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. 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.⁴

Approximately 2,500 to 3,000 ACL reconstructions are performed annually on a total military force of 1.5 million active-duty Army, Navy, and Air Force personnel and their family members in US. This is an unusually high incidence of ACL injuries; however, given the demographics and rationale as to why these injuries occur, the numbers parallel those that have been reported for large groups of athletes engaged in high-risk sports. Considering the constant physical activities and demands placed on most servicemen, collectively, they are very similar to a collegiate athletic team. In their non-duty time, servicemen regularly participate in organized as well as recreational athletics that result in increasing risk of ACL injury.⁵

The aim of this study was to evaluate the incidence of ACL injuries during military-related training and to evaluate the correlation of ACL injuries to the military-related training.

Materials and Methods

Modified Cincinnati Rating System Questionnaire

Clinician's name (or ref) _____

During the past 4 weeks.....

Section 1 - Pain Intensity
<input type="radio"/> No pain, normal knee, performs 100%
<input type="radio"/> Occasional pain with strenuous sports or heavy work, knee not entirely normal, some limitations but minor and tolerable
<input type="radio"/> Occasional pain with light recreational sports or moderate work activities, running or, heavy labour, strenuous sports
<input type="radio"/> Pain, usually brought on by sports, light recreational activities or moderate work. Occasionally occurs with walking, standing or light work
<input type="radio"/> Pain is a significant problem with simple activity such as walking, relieved by rest, unable to do sports
<input type="radio"/> Pain present all the time. Not relieved by rest
Section 3 - Giving Way
<input type="radio"/> No giving way
<input type="radio"/> Occasional giving way with strenuous sports or heavy work. Can participate in all sports but some guarding or limitations present
<input type="radio"/> Occasional giving way with light sports or moderate work. Able to compensate but limits vigorous activities, sports, or heavy work not able to cut or twist suddenly, are conveniently positioned (e.g., on a table)
<input type="radio"/> Giving way limits sports and moderate work, occurs infrequently with walking or light work (approx 3 times per year)
<input type="radio"/> Giving way with simple walking activities and light work. Occurs once per month, requires guarding
<input type="radio"/> Severe problem with simple walking activities, cannot turn or twist while walking without giving way
Section 5 - Walking
<input type="radio"/> Walking unlimited
<input type="radio"/> Slight/mild problem
<input type="radio"/> Moderate problem: smooth surface possible up to approx 800m
<input type="radio"/> Severe problem, only 2-3 blocks possible
<input type="radio"/> Severe problem; requires stick or crutches
Section 7 - Running activity
<input type="radio"/> Normal, unlimited; fully competitive, strenuous
<input type="radio"/> Slight mild problem; run half speed
<input type="radio"/> Moderate problem 2-4 km
<input type="radio"/> Severe problem only 1-2 blocks possible
<input type="radio"/> Severe problem only a few steps
Section 2 - Swelling
<input type="radio"/> No swelling
<input type="radio"/> Occasional swelling with strenuous sports or heavy work. Some limitations but minor and tolerable
<input type="radio"/> Occasional swelling with light recreational sports or moderate work activities. Frequently brought on by vigorous activities, running, heavy labour, and strenuous sport
<input type="radio"/> Swelling limits sports and moderate work. Occurs infrequently with simple walking activities or light work (approx 3 times a year)
<input type="radio"/> Swelling brought on by simple walking activities and light work. Relieved by rest
<input type="radio"/> Severe problem all the time, with simple walking activities
Section 4 - Overall activity level
<input type="radio"/> No limitation, normal knee, able to do everything including strenuous sports or heavy labour
<input type="radio"/> Perform sports including vigorous activities but at lower performance level: involves guarding or some limits to heavy labour
<input type="radio"/> Light recreational activities possible with rare symptoms, more strenuous activities cause problems. Active but in different sports; limited to moderate work
<input type="radio"/> No sports or recreational activities possible. Walking with rare symptoms; limited to light work
<input type="radio"/> Walking, ADL cause moderate symptoms, frequent limitations
<input type="radio"/> Walking, ADL cause severe problems, persistent symptoms
Section 6 - Stairs
<input type="radio"/> Normal, unlimited
<input type="radio"/> Slight/mild problem
<input type="radio"/> Moderate problems only 10-15 steps possible
<input type="radio"/> Severe problem; requires bannister support
<input type="radio"/> Severe problem on 1-5 steps possible
Section 8 - Jumping or Twisting
<input type="radio"/> Normal, unlimited, fully competitive, strenuous
<input type="radio"/> Slight to mild problem; some guarding but port possible
<input type="radio"/> Moderate problem; gave up strenuous sports, recreational sports possible
<input type="radio"/> Severe problem; affects all sports; must constantly guard
<input type="radio"/> Severe problem; only light activity possible (golf, swimming)

Figure 1. Modified Cincinnati Knee Scoring questionnaire

This study was a cross sectional study conducted in Battalion 403/WP of Special Region of Yogyakarta and Sardjito General Hospital. The measurement was conducted by the research assistant, who is a general practitioner that has been trained in this research method before. The samples were consecutively collected from 127 active (age 18 – 63 years old) duty Army personnel with knee injury who have not underwent surgery for their injuries. The exclusion criteria were history of fracture around the knee, and musculoskeletal neoplasm. After we performed history taking, physical examination, and MRI, we diagnosed the type of knee injury. 25 samples were included in this study. Then we evaluate sociodemographic characteristics (age, BMI, and military rank), Quality of life (measured using Modified Cincinnati Knee Scoring questionnaire as seen in figure 1 that was validated into Bahasa Indonesia) as in Figure 1, Physical examination (Etiology of the injury, Special test), and incidence of the ACL injury.

Military rank was divided into high rank (Sergeant until staff sergeant rank) and lower rank (Private until specialist rank). In our study, we divided the type of injury into ligament and non-ligamentous injury. Ligamentous injury includes all injuries that involve damage to the knee joint ligament. Cases without any damage to the ligament such as isolated meniscal injury was categorized into the non-ligamentous injury. We also compared the Armies' Modified Cincinnati Knee Score to the random Civilians' who fulfilled the inclusion and exclusion criteria of the study and have equal age and body weight to the Military group.

Descriptive analysis was performed with retrospective study analysis. The result was then statistically analyzed using SPSS software, version 23 (SPSS Inc., Chicago, IL, USA). Further analysis was conducted to determine the relationship between the trajectory of functional independence and the quality of life.

Results

There were a total of 25 male patients eligible for this study. As mentioned in Table 1, from 589 active duty Army personnel there were 25 (4.24%) who suffered from knee injury with 12 of them (2.03%) sustained ligament rupture. Eight of them was caused by Non-Duty activities (66.67 %), most of the injuries was Anterior Cruciate Ligament (ACL) rupture (75%).

Table 1. Sociodemographic Characteristic

	Variables	Total
Age	<30	18 (72%)
	>30	7 (28%)

BMI	Normal	20 (80%)
	Overweight	5 (20%)
	Obese	0 (0%)
Military Rank	Private	9 (36%)
	Private First Class	6 (24%)
	Specialist	4 (16%)
	Sergeant	2 (8%)
	Sergeant First Class	2 (8%)
	Staff Sergeant	2 (8%)
Time of Injury	Duty	6 (24%)
	Non-Duty	19 (76%)
Ligament injury	Yes	12 (48%)
	No	13 (52%)
Affected Ligament	Anterior Cruciate Ligament	9 (75%)
	Non-Anterior Cruciate Ligament	3 (25%)

We found 18 personnel were under 30 years old and 7 personnel were above 30 years old. The BMI of the personnel was normal in 20 personnel and overweight in 5 personnel. The rank, ranked from the lowest rank were 9 personnel had Private rank, 6 personnel had Private First-Class rank, 4 personnel had Specialist rank, 2 personnel had Sergeant rank, 2 personnel had Sergeant First Class rank, and 2 personnel had Staff Sergeant rank (table 1). For the time of the injury, in 6 personnel occurred in duty time and 19 personnel occurred in non-duty time. From the knee injury, 12 personnel had ligament injury and 13 personnel did not have ligament injury. From the group with ligament injury, 9 personnel had anterior cruciate ligament injury and 3 personnel had non-anterior cruciate ligament injury (table 2).

Table 2. Comparison of Variables between Ligament and Non Ligament Group.

	BMI	Military Rank		Time of Injury		Affected ligament		P
		High rank	Low rank	Duty	Non-Duty	ACL	Non-ACL	
Ligament	24.08	5/6 (83.33%)	7/19 (36.84%)	4/12 (33.33%)	8/12 (66.67%)	9/12 (75%)	3/12 (25%)	<0.05
Non Ligament	22.97	1/6 (16.67%)	12/19 (63.16%)	2/13 (15.38%)	11/13 (84.62%)	-	-	<0.05

There are 589 personnel in the Battalion 403/WP of Special Region of Yogyakarta. The personnel were screened by the military doctor and found that 25 personnel had knee injury. From this 25 personnel, 12 personnel had ligament injury of the knee which consist of 9 ACL injury and 3 non-ACL injury. There are 5 personnel are high rank from this group and 7 low rank personnel. The time of injury was most likely during non-duty time with 8 personnel in this category and 4 personnel in duty time. The average of the BMI in this group was overweight. In the non-ligament injury group, the average BMI are within normal range 1 personnel from higher rank and 12 personnel from lower rank. The time of injury was also most likely during non-duty time with 11 personnel in this category and 2 personnel in the duty time.

Table 3. Modified Cincinnati Score

	Military with ligament injury	Civil with ligament injury
Modified Cincinnati score	52.83	38.75

The average Modified Cincinnati score in the Military personnel with ACL injury was 52.83 and Civil with ligament injury was 38.75 as seen in table 3.

Discussion

Although the importance of biomechanical factors for ACL injury is no longer debated, the specific factors that increase the risk profile remain unclear. In the study conducted by Owen et al, the reported incidence rate of anterior cruciate ligament injuries in the U.S. Armed Forces was between 2.96 to 3.65 per 1,000 person-years.⁶ In our study, the incidence is 1.69 per 1000 person-years.

Overweight/obesity is an independent risk factor for musculoskeletal injuries, while increased body mass index may be a predisposing factor for anterior cruciate ligament (ACL) injury.⁷ In this study, The prevalence of subject with ligament injury are overweight and most of them are from higher rank and occurred in non-duty time with ACL as the most common affected ligament. Sedek et al. observed that higher-ranked subjects, such as officers and senior enlisted personnel, showed higher prevalence of overweight and obesity compared to the lower-ranked junior enlisted personnel.⁸

From our data, most of the ligament injury, especially anterior cruciate ligament, occurred during non-duty time such as sport. The study of Rezasoltani et al. showed that highest frequency of sports-related knee injuries among the armed forces was ACL with 77.82% of the

cases.⁹ Study by Md Shihabudin et al. also showed that 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.⁴

There was a previous study that shows ACL injuries sustained by active-duty service members, 82% of all injuries were reportedly sustained during off-duty recreational sporting activities. The vast majority of these injuries, as expected, were noncontact, pivoting, or twisting injuries. The high-risk sports that resulted in the greatest incidence of ACL tears were soccer, football, and ultimate Frisbee. The most common time of injury that were reported to have occurred during military training were landing awkwardly from a fall, stepping unexpectedly in a hole or pivot, and a fall or misstep in conditions with poor lighting.⁸

Despite good results, our study also has some limitations. One of limitation of our study is the small sample size because we only use the population of army in the Yogyakarta region and due to the low incidence of these injury in the military population. **Second, this study did not evaluate the time since the injury.** Another limitation in this study is the study only based on male gender which is most of the army population in this study population.

CONCLUSION

This study showed that ligament injury especially ACL injury was found in personnel with high BMI (overweight), higher rank in the Battalion and in non-duty time. The study also showed that the military group has higher Modified Cincinnati score compared to the civil group.

CONSENT (WHEREVER APPLICABLE)

Written consent was informed, and all subjects provided their written consent before participation in the study.

ETHICAL APPROVAL

The study was conducted according to Helsinki Declaration 2013. All experiments have been examined and was approved by the institutional review board at Faculty of Medicine, Public Health and Nursing, Universitas Gadjah Mada, Yogyakarta, Indonesia.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The research was not funded by the producing company rather it was funded by personal efforts of the authors

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