The Lessons Learned from the Canadian Forces Physiotherapy Experience during the Peacekeeping Operations in Bosnia

Guarantor: Major Luc Jean Hébert, Canadian Forces Health Services Delivery
Contributors: Major Luc Jean Hébert, Canadian Forces Health Services Delivery*†‡; Lieutenant Colonel Peter Rowe, Canadian Forces Health Services Delivery*

The musculoskeletal injuries and soldiers’ demographic profiles observed by physiotherapy (PT) officers during the Canadian Forces peacekeeping mission Op-Palladium in Bosnia between 2000 and 2004 were characterized. The number of PT visits (N = 4,167; range, 310–974) and gender distribution (N = 2,558 cases; male, 80.8%–91%; female, 9.0%–16.4%) varied between tours. On average, >30% of the entire Canadian Forces contingent required PT services. Lower limb injuries were the single leading reason for PT treatment (41.8%) followed by the spine (28.5%) and the upper limb (21.5%). The most commonly affected joints were the knee (17.2%) and ankle (16.1%), the shoulder (14.4%), and the lumbar spine (14.4%). The 26 to 35 age group and combat arms showed the highest incidence of musculoskeletal injuries (p < 0.001). The majority of cases seen were subacute and chronic (68%). Primary prevention activities and the capacity to provide the full scope of PT services were identified as two key factors contributing to the maintenance of operational readiness of the troops.

Introduction

Musculoskeletal (MSK) conditions are having a huge impact in terms of high incidence and high noneffective rate or days not available for duty, rate of personnel medically discharged from service, and health of service members and military/combat readiness.1–16 In the late 1990s, Canadian Forces (CF) physiotherapy (PT) services were providing in-garrison care to ~25% of the whole CF population. This percentage was found to be higher on high training bases, where tasks are similar to what we would expect during deployments.17 In 1999, although the CF were not yet deploying PT officers (PTOs) during peacekeeping missions, nonofficial CF statistics were suggesting that the incidence of MSK injuries would be equal to, if not higher, during operations as compared to in-garrison.

For many years, there was mounting pressure from soldiers, commanding officers, and health care providers on the CF to provide PT services during deployments to ensure continuity of care and maintain operational readiness.18 In 2000, the CF finally decided to deploy PT services during the peacekeeping operations in Bosnia. The mandate of the CF physiotherapists was to provide the full spectrum of PT services to all CF members deployed anywhere, for the Op-Palladium in Bosnia-Herzegovina starting with the Roto 6, and as long as deemed required. In that context, the aim of this descriptive study was to characterize the MSK injury profiles observed in PT during this CF peacekeeping mission in Bosnia. The secondary objective was to verify and quantify the existence and magnitude of MSK-related problems associated to this specific mission, and to learn from this deployment to better prepare PTOs for future CF missions. This latter information is essential to the CF PT chain of command to optimize the predeployment training of PTOs and CF PT scope of practice in an operational environment.

Methods

Data Collection

The data were collected using the CF PT Continuous Quality Improvement (CF PT CQI) database that serves as both a national surveillance and a standardization tool.19 A sample of convenience was used. All the cases seen by the PTOs during Roto 6 to Roto 13, inclusively, were entered in the study. The CF PT CQI database was used on a stand alone computer by trained PT staff to capture patient demographics and clinical data as well as the relevant information related to the delivery of PT services on a case-by-case and visit-by-visit basis. In addition to the patient demographics (gender, rank, age, environment, unit, and military occupation) and clinical data (body parts, MSK diagnosis, and cause of injury), other variables were considered to characterize the profile of MSK injuries such as the size of the Canadian contingent, the case priority (Fig. 1) and the number of PT treatments received per case. The data were compiled in an anonymous format to preserve CF members’ confidentiality.

Health Care Services and PT Environment

The health care services that were available included the basic spectrum of care offered to ensure the availability of a Role 3 Health Services Support. The Canadian health care providers only saw Canadians. The PTO was mainly based in Zgon, which was the busiest camp. Zgon was also centrally located in the Canadian area of responsibility (AOR) making a larger number of CF members more accessible with minimal time spent traveling. The other camps of Velika Kladusa, Coralicci, Bihac, Drvar, Glamoc, and Tomislavgrad were visited on a weekly schedule, from Monday to Saturday inclusively, that slightly varied between tours. Glamoc was visited approximately one Saturday per month. Each soldier referred for PT was put on a list before the physiotherapist’s visit. The camp at Tomislavgrad was closed at the beginning of the Roto 11, reducing the client base by ~250 personnel. The ethics committee of the CF Health Services approved this study protocol.

*Canadian Forces Health Services Group Headquarters, Health Services Delivery, Physiotherapy, 1745 Alta Vista Drive, Ottawa, Ontario, Canada, K1A 0K6.
†Canadian Forces Health Services Centre, Primary Reserve List, 1745 Alta Vista Drive, Ottawa, Ontario, Canada, K1A 0K6.
‡Faculty of Medicine, Department of Radiology, Laval University, Ferdinand Van-dry, Room 3370, Quebec City, Quebec, Canada, G1K 7P4.
Part of these results were presented to the Canadian Physiotherapy Association National Congress, June 29 to July 2, 2006, St. John, New Brunswick, Canada.
This manuscript was received for review in October 2006. The revised manuscript was accepted for publication in May 2007.
All statistical analyses were done using SPSS version 11.0 for Windows (SPSS Inc., Chicago, Illinois). Descriptive statistics were used to summarize CF members' characteristics, clinical data, and profiles of MSK injuries. For all demographic and clinical variables, t tests were conducted to verify statistical differences. The Pearson product moment correlation coefficient was used to verify whether there was a relationship between the tour duration in days, the contingent size, and the number of attendances in PT. All statistical analyses used an α level of 0.05.

### Results

During the Op-Palladium in Bosnia, the CF provided PT services from February 2000 (Roto 6) to March 2004 (Roto 13). Each PTO was deployed for a duration of ~190 days. Table I summarizes the number of initial PT assessments, follow-ups, total visits, the start and end date, and the mean number of treatments per case for each tour. Overall, a total of 2558 cases were seen for a total of 4,167 PT consultations. If we exclude Roto 8 for which we had missing data, the number of PT visits per tour varied from 414 to 1,077, and the mean number of follow-ups per case was 1.6 (Table I).

As reported in Table II, 85.8% of males and 13.7% of females were consulted for PT services with a mean age of 32.9 (SD, 7.2; range, 18–56). The mean percentage of soldiers of the Canadian contingent seen in PT was 28.3% (range, 11.4%–42.8%). The percentages of MSK cases seen per age group, all rotations combined, were: 18% for ages 18 to 25, 46.7% for ages 26 to 35, 30.1% for ages 36 to 45, and 5.2% for ages 46 years and older (Fig. 2).

As seen in Figure 3, there was no significant statistical relationship between the duration of the rotation (168–203 days), the number of attendances in PT (197–1077 visits), and the size of the Canadian contingent (1144–1732 soldiers), which was similar for the first three rotations and slightly decreased to remain almost the same for the Rotos 10 to 13 (p > 0.05).

Figure 4 shows that lower limb injuries were the single leading cause for PT treatment (41.8%) followed by the spine (28.5%) and the upper limb (21.5%). The most commonly affected joints were the knee (17.2%) and ankle (16.1%) in the lower limb category; the shoulder joint in the upper limb category (14.4%), and the lumbar spine (14.4%) in the spine category. The patients seen in PT were coming from a total of 113 different military occupations that were regrouped into 7 broader occupational subgroups. As seen in Figure 5, combat arms showed the highest incidence of MSK injuries, contributing to 46.1% of all injuries followed by 25.5% for the logistic and technical support group (p < 0.001). The other five groups had the following lower MSK incidences that were statistically different from the combat arms and the logistic group: 8.5% for search and rescue, 5.8% for clerical-administrative, 4.9% for the medical-dental, 3.3% for the security, and 6.3% for other (p < 0.001).

### Table I

<table>
<thead>
<tr>
<th>Initial PT</th>
<th>Follow-Up</th>
<th>Total Visits</th>
<th>Tour Start</th>
<th>Tour End</th>
<th>Mean Follow-Up/Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R6</td>
<td>337</td>
<td>212</td>
<td>549</td>
<td>February 11, 2000</td>
<td>September 2, 2000</td>
</tr>
<tr>
<td>R7</td>
<td>437</td>
<td>347</td>
<td>784</td>
<td>September 10, 2000</td>
<td>February 28, 2001</td>
</tr>
<tr>
<td>R8</td>
<td>197</td>
<td></td>
<td>197</td>
<td>March 19, 2001</td>
<td>September 5, 2001</td>
</tr>
<tr>
<td>R9</td>
<td>242</td>
<td>338</td>
<td>580</td>
<td>September 26, 2001</td>
<td>March 26, 2002</td>
</tr>
<tr>
<td>R10</td>
<td>498</td>
<td>392</td>
<td>890</td>
<td>April 15, 2002</td>
<td>September 30, 2002</td>
</tr>
<tr>
<td>R11</td>
<td>230</td>
<td>184</td>
<td>414</td>
<td>October 1, 2002</td>
<td>March 21, 2003</td>
</tr>
<tr>
<td>R12</td>
<td>354</td>
<td>399</td>
<td>753</td>
<td>April 1, 2003</td>
<td>September 21, 2003</td>
</tr>
<tr>
<td>R13</td>
<td>465</td>
<td>612</td>
<td>1,077</td>
<td>September 29, 2003</td>
<td>March 21, 2004</td>
</tr>
<tr>
<td>Total</td>
<td>2,558</td>
<td></td>
<td>4,167</td>
<td>Mean tour duration = 175.9 days (~6 months)</td>
<td>1.6</td>
</tr>
</tbody>
</table>

*a For Roto 8, there was missing data.*
According to the CF PT priority system (Fig. 1) that was used to classify the stage of MSK injuries, 30.1% of all injuries seen in PT were acute while 30.1% and 38% were subacute and chronic, respectively (Fig. 6).

Discussion

This study has allowed the CF PT chain of command to verify and characterize the existence and the magnitude of MSK-related problems associated with this mission during the first participation of CF PTOs on peacekeeping operations. The present results confirm that deployed PTOs were consulted by high numbers of CF members for MSK problems. Although this was not tracked systematically, the end tour reports confirmed that a large percentage (~60%) of patients referred to PT were on light duties even if ~75% of them stated they could still perform all of their job duties. Overall, all of the soldiers on all tours were promptly evaluated, treated, and all of them were rapidly returned to duty, contributing to the conservation of force strength. The role of the physiotherapist as a primary health care provider and MSK evaluator in an operational setting has also been recognized by other countries as being essential to optimizing efficient and effective treatment for both combat-injured patients and patients with common debilitating MSK problems.20,21

In the present study, the percentage of the CF population that needed PT services while deployed was higher than the CF ingarrison statistics as well as in comparison to our U.S. counterparts. In fiscal years 2001/2002, the CF PT clinics received 15,243 new referrals, suggesting that approximately one in four CF members required PT services in that same year.17 In total, there were 133,996 visits made to CF PT clinics with an additional estimated 22% more of these same services being provided off base at an annual cost of $1.5 million. During the peacekeeping operation Joint Endeavor/Operation Joint Guard in Bosnia, the U.S. Army reported that ~17% of all soldiers reporting to the 21st Combat Support Hospital were evaluated

<table>
<thead>
<tr>
<th>TABLE II</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUMMARY OF THE DEMOGRAPHIC DATA OF THE CF MEMBERS SEEN IN PT FOR ALL ROTATIONS (R)</td>
</tr>
<tr>
<td>Age &amp; Gender</td>
</tr>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>R6</td>
</tr>
<tr>
<td>R7</td>
</tr>
<tr>
<td>R8</td>
</tr>
<tr>
<td>R9</td>
</tr>
<tr>
<td>R10</td>
</tr>
<tr>
<td>R11</td>
</tr>
<tr>
<td>R12</td>
</tr>
<tr>
<td>R13</td>
</tr>
<tr>
<td>R6–13</td>
</tr>
</tbody>
</table>

Fig. 2. Mean distribution, all rotations combined of the MSK injuries per age group.

Fig. 3. Tour of duration of each Roto (R) in days and total number of attendances in PT. The T bars using the right vertical scale indicate the size of the Canadian contingent in terms of Canadian soldiers deployed. The Spearman coefficients of correlation (r_s) indicate the strength of the association between the three variables, which were all nonsignificant (NS; p > 0.05).
and treated by physical therapy. During the Op-Palladium mission, on one-half of the tours, the percentage of the CF population seen in PT was higher than 25%, and on Rotos 10 and 13, it was as much as 43% and 41% of the entire Canadian contingent, which is a significant difference in comparison to in-garrison (p < 0.05). This high percentage of MSK injuries observed in operations suggests that there is a role for injury prevention strategies. PTOs will need to be more actively involved in visiting physical training sessions at the gym to identify physical training faults and common injury patterns, as well as to provide ergonomic tips and more education and advice during predeployment training.

During this peacekeeping mission, the demographic profile of the patients seen in PT in Bosnia was representative of the demographic profile of the whole CF in terms of mean age and gender distribution. Almost one-half of all the MSK cases seen in PT were from the 26 to 35 age group, while the oldest soldiers only contributed to 5% of all cases. When summing the 26 to 35 and 36 to 45 age groups, we observed that almost 80% of all the MSK cases seen in PT were ages between 26 and 45 years old. In the CF, 72.3% of all CF members fall within that age group. For the two other age groups, the incidence of MSK injuries also increases with the size of the CF age group. In other words, the higher the number of soldiers in a particular age group, the higher the incidence of MSK injuries seen in PT from that age group during deployments. In operations, there is a need for highly qualified and experienced CF members and this explains the high prevalence of injuries for the older members. This differs from the relative frequency of in-garrison MSK conditions that are the greatest in the 19- to 24-year age category, with this...
age group being at a higher risk of injuries due to the high intensity and frequency of the training of recruits and conscripts.\textsuperscript{3,7,8}

Another interesting finding was the lack of statistical relationships between the tour duration in days, the contingent size, and the number of attendances in PT. Moreover and curiously, the coefficients of correlation between these variables indicate that the smaller the contingent size, the higher the number of PT attendances. This finding suggests that the size of the deployed contingent has a minimal impact on the caseload of the PT services. The PTO caseload may be influenced by several factors including the type of mission, the rigor of combat, the type of deployed military occupations, the visibility of the PT services, the PTO personality, and the type of collaborative practice between the health care providers. Throughout this mission, the PTOs have significantly increased their visibility with the troops, the commanding officers, and the health care providers. This partially explains why toward the end of the mission, while the contingent size was decreasing, the number of attendances in PT was increasing. In addition, the entire CF community has realized the positive benefits of consulting physiotherapists as early as possible to ensure quicker recoveries and avoid chronic conditions. In fact, except for R9, Figure 6 shows a progressive increase of the number of acute cases referred to PT from R8 to R13 (p < 0.05). The invaluable role of physiotherapists as primary care nonphysician providers is now being recognized. Other lessons learned in a deployed setting during U.S. Operation Iraqi Freedom supported the use of additional physiotherapists not only at the level III echelon of care to reduce the demand on orthopedic surgeons, but also at level I and II echelons of care to prevent soldiers from exposing themselves unnecessarily to dangerous convoys to seek PT treatment.\textsuperscript{20}

Another lesson learned from this mission was the impact of the size of the AOR, since Canada’s AOR was large and traveling time was a challenge. On average, 12 to 15 hours of road travel was necessary to deliver PT services throughout the Canadian AOR. On some tours, that was the equivalent of 1 hour of driving for 3.3 patient-contacts. This huge time spent on the road does not allow an efficient use of the physiotherapist resource, in terms of providing advanced management of MSK conditions. In future missions where the AOR is similar to Bosnia, a second physiotherapist could be deployed. To offer PT services to all soldiers anytime, anywhere, the two PTOs should be centrally located in the AOR and have daily access to a dedicated vehicle and driver who would also work as a PT assistant.

The profile of MSK injuries confirms that increased biomechanical stresses and physical demands are required to perform many operational tasks, with injuries to the lower limb (41.8%) being the leading cause for PT consultation followed by the spine (28.5%) and the upper limb (21.5%). The most affected joints were the knee and ankle in the lower limb category, the shoulder joint in the upper limb category, and the lumbar spine in the spine category. This is in agreement with previously published U.S. deployment data that reported the knee and lumbar spine as being the most commonly evaluated areas.\textsuperscript{20–23} This finding reinforces the importance of early interventions and injury prevention strategies for conditions such as mechanical low back pain, plantar fasciitis, ankle sprains, and patella-femoral pain syndrome. Also, these findings are in agreement with the most frequently diagnosed pathologies in high training units which are patella-femoral pain syndrome and lumbar spine mechanical and soft tissue lesions.\textsuperscript{17} The significant increase of shoulder lesions observed in this mission compared to the in-garrison incidence (p < 0.05) was a surprise. This could be partially explained by the increased amount of time many soldiers spent in the weight room during their spare time. During Roto 7, the PTO started visiting the gymnasium and identified several training errors. Prevention strategies were immediately initiated by producing educational posters explaining how to properly train for lifting loads and free weights. As seen in Figure 4, we observed a subsequent decrease in the number of shoulder lesions after Roto 7, although this decrease reached a plateau and was not maintained throughout the mission.

In the number of patients seen in PT, there were a total of 113 different military occupations. To allow comparisons and for a comprehensive statistical analysis, the military occupations were subdivided into seven broader occupational subgroups. When comparing the profiles of MSK injuries between these seven subgroups, we observed significant differences. Combat arms showed the highest incidence of MSK injuries contributing for almost one-half of the cases, followed by the logistic and technical support group for a one-quarter of all the cases seen; the other groups had lower percentages that were also statistically different from the combat arms and the logistic group. Given that the combat arms and logistic/technical support groups sustained ~70% of all MSK injuries, and since the age group at risk for MSK injuries is the 26- to 35-year-old group, special attention to both these variables could help decrease the incidence of injuries. The development of screening and prevention strategies for the predeployment training focusing on these specific military occupational groups and age groups that showed the highest incidence of MSK injuries would also be beneficial.

In-garrison, CF physiotherapists have implemented a priority system that is recognized and understood by all CF health care providers to ensure that all referred personnel are seen in a timely manner according to the acuteness and severity of their condition (see Fig. 1). According to this system, the level of priority of an MSK injury is determined by the onset of signs and symptoms, the presence or not of neurological signs, the level of pain, the capacity of the patient to work, perform activities of daily living and physical training, and to sleep well. During the peacekeeping mission in Bosnia, all patients were seen without delay regardless of their acuteness, but for statistical purposes, we used the in-garrison CF Physiotherapy Priority System to classify the MSK injuries. When soldiers are deployed, one would assume that they are completely healthy and fit to deploy. We therefore expected to see a higher rate of acute injuries and a lower rate of chronic injuries in the group of patients that were seeking PT services. Although the percentage of acute priorities varied considerably between tours, it was quite a surprise to discover that, overall, only 30.1% of all the MSK injuries seen in PT were acute while 38% were chronic. This result suggests that CF members are deploying with pre-existing MSK conditions or vulnerable conditions that are becoming exacerbated in theater with the increased activity. This further supports the need for PT services in operations and highlights the importance of ensuring a better continuity between MSK care in-garrison and during
deployments to ensure optimal operational readiness. The high incidence of subacute and chronic injuries suggests that PTOs should be involved as early as possible during predeployment training.

Although statistics confirm that MSK injuries are a leading cause of morbidity in modern militaries including the CF, there are not enough demographic and clinical details available to identify specific leading causes or suggest specific management strategies. Although the data recorded in the PT charts showed that ~60.1% of the cases referred to the physiotherapist were due to injuries that occurred from the duties (due to a trauma or training), the results presented here are mainly descriptive and we realize that care must be taken with their interpretation. The CF PT chain of command must have a thorough knowledge of the characteristics of the MSK-related injury profiles and their differences between environments, bases, units, and military occupations. From the current study, it is evident that in a deployed setting, the role of PTOs is essential to maintaining force strength and enhance operational readiness. Nine PTOs have been deployed to Bosnia from 2000 to 2004 with great success and they have shown that they can provide the full scope of PT services to the CF troops, proving that PT is a force multiplier. It is now anticipated that PT services will continue to be provided by regular and reserve force members whenever they are deemed necessary, especially for disaster relief and peace support operations scenarios, anytime, anywhere.

Acknowledgments

We thank the dedicated PT officers who were deployed and did such a great job: R6, Lieutenant B. Wierstra; R7, Captain D. Bickford; R8, Captain M. MacRae; R9, Captain S. Dostic; R10, Lieutenant (N) B. Eason/Major R. Crispin; R11, Captain S. McGrill; R12, Captain N. Hazledine; and R13, Captain R. Tresidder.

References