

Patients presenting to an outpatient sport medicine clinic with concussion

Retrospective observational analysis

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Abstract

Objective To describe the characteristics of patients who presented to outpatient sport and exercise medicine clinics with concussion.

Design Retrospective chart review of electronic medical records.

Setting Three specialized sport and exercise medicine clinics in London, Ont.

Participants A total of 283 patients presenting with concussion.

Main outcome measures Data collected included demographic variables (age and sex), sport participation at the time of injury, previous medical history (including history of concussion), Post-Concussion Symptom Scale (PCSS) scores, and return-to-play (RTP) variables (delay and outcome).

Results The mean age of patients presenting for care was 17.6 years; 70.9% of patients were younger than 18 years of age (considered pediatric patients); 58.8% of patients were male; and 31.7% of patients had a previous history of concussion. The main sports associated with injury were hockey (40.0%), soccer (12.6%), and football (11.7%). Return to play was granted to 50.9% of patients before the 3-week mark and 80.2% of patients before 8 weeks. Total PCSS scores (maximum score was 132) and neck scores (part of the PCSS, maximum score was 6) were significantly higher in adults compared with pediatric patients (36.2 vs 27.6, $P=.02$, and 1.8 vs 1.2, $P=.02$, respectively). A significant difference was seen in RTP, with pediatric patients returning earlier than adults did ($P=.04$). This difference was not seen when comparing males with females ($P=.07$). Longer duration of follow-up did not influence RTP outcomes. Previous history of concussion was associated with restriction from contact or collision sports ($P<.001$).

Conclusion Given the age and sex variability found in this study, as well as in previous published reports, it is important to manage each patient individually using current best available practice strategies to optimize long-term outcomes.

EDITOR'S KEY POINTS

- Given the paucity of data from the outpatient setting and the increased media and public awareness of concussion, the purpose of this study was to observe the characteristics of patients with concussion who self-presented or were referred to outpatient specialized sport and exercise medicine clinics.
- Among the sample studied, males and pediatric (< 18 years of age) athletes were most commonly seen. Differences in return to play were observed when comparing adults with children, but not males with females. However, given that this is an observational study, no clinical conclusions can be drawn.
- The high variability between each concussion case, especially in a specialized sport and exercise medicine clinic, warrants individualized management based on best available evidence.

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Cas de commotion en clinique externe de médecine du sport

Analyse observationnelle rétrospective

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Résumé

Objectif Décrire les caractéristiques des patients ayant subi une commotion qui se sont présentés en clinique externe spécialisée en médecine du sport et de l'exercice.

Conception Révision rétrospective de dossiers médicaux électroniques.

Contexte Trois cliniques spécialisées en médecine du sport et de l'exercice à London, en Ontario.

Participants Un total de 283 patients présentant une commotion.

Principaux paramètres à l'étude Les données recueillies incluaient les variables démographiques (âge et sexe), le sport pratiqué au moment de la blessure, les antécédents médicaux (y compris de commotions), les scores à l'échelle des symptômes postcommotion et les variables dans le retour au jeu (délais et résultats).

Résultats L'âge moyen des patients en consultation se situait à 17,6 ans; 70,9% des patients avaient moins de 18 ans (considérés comme des patients pédiatriques); 58,8% des patients étaient de sexe masculin; et 31,7% des patients

avaient des antécédents de commotions. Les principaux sports associés avec la blessure étaient le hockey (40,0%), le soccer (12,6%) et le football (11,7%). Le droit de retourner au jeu a été accordé à 50,9% des patients avant la marque de 3 semaines et à 80,2% des patients avant 8 semaines. Le total des scores à l'échelle de gravité (le score le plus haut était de 132) et les scores liés au cou (élément de l'échelle, le score le plus élevé était de 6) étaient significativement plus hauts chez les adultes que chez les patients pédiatriques (36,2 c. 27,6, $p = ,02$, et 1,8 c. 1,2, $p = ,02$, respectivement). Une différence significative a été observée dans le délai avant le retour au jeu, notamment plus tôt chez les patients pédiatriques par rapport aux adultes ($p = ,04$). Cette différence était absente dans une comparaison entre les hommes et les femmes ($p = ,07$). Une plus longue durée de suivi n'a pas influencé les résultats sur le plan du retour au jeu. Des antécédents de commotions étaient associés à une restriction de pratiquer des sports de contact ou de collision ($p < ,001$).

Conclusion Étant donné la variabilité selon l'âge et le sexe observée dans la présente étude, de même que dans d'autres rapports publiés antérieurement, il importe de prendre en charge chaque patient de manière individualisée en fonction des meilleures et plus récentes stratégies de pratique disponibles pour optimiser les résultats à long terme.

POINTS DE REPÈRE DU RÉDACTEUR

- Étant donné la rareté des données issues des cliniques externes et l'attention médiatique et publique accrue, l'étude avait pour but d'observer les caractéristiques des patients ayant subi une commotion qui se présentaient d'eux-mêmes ou étaient envoyés en consultation dans des cliniques externes spécialisées en médecine du sport et de l'exercice.

- Au nombre des sujets à l'étude, les cas les plus fréquents étaient des athlètes masculins et pédiatriques (< 18 ans). Nous avons observé des différences sur le plan du retour au jeu dans les comparaisons entre les adultes et les enfants, mais aucune entre les hommes et les femmes. Toutefois, étant donné la nature observationnelle de l'étude, aucune conclusion clinique ne peut être tirée.

- La grande variabilité d'un cas de commotion à l'autre, surtout dans une clinique spécialisée en médecine du sport et de l'exercice, exige une prise en charge individualisée selon les meilleures données probantes accessibles.

Cet article a fait l'objet d'une révision par des pairs.
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Concussion is defined as a complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces.¹ According to Statistics Canada, concussions and other brain injuries represented 2.2% of activity-limiting injuries in people aged 12 and older in 2009 to 2010. In people 12 to 19 years of age, this proportion reaches 3.3%. It drops to 1.1% for those older than 64 years of age.² This represents a substantial burden on the health care system. Direct and indirect costs are estimated at \$76.5 billion per year in the United States.^{3,4} It is believed that the actual number of concussions sustained annually might be higher owing to under-reporting by athletes, parents, or coaches.⁵⁻⁷

Recent literature has assisted clinicians in assessment and management of patients with concussion. Since the first *concussion* definition by the Congress of Neurologic Surgeons in 1966,⁸ there has been an increased effort by international experts to improve concussion management by health care professionals. The International Symposia on Concussion in Sport have been held since 2001, producing 4 consensus statements,^{1,9-11} a definition of *sport-related concussion*,¹ evaluation tools (Sport Concussion Assessment Tool, version 3 [SCAT3], ChildSCAT3),⁹⁻¹¹ a return-to-play (RTP) protocol,¹⁰ and an overview of modifying factors that might influence decision making.¹¹ These recommendations are currently endorsed by several important organizations.¹²⁻¹⁴

The epidemiology of concussions among athletes has been described in multiple publications.¹⁵⁻¹⁷ Marar et al¹⁷ performed a descriptive study looking at concussion epidemiology among American high school athletes. Using computerized reports from certified athletic trainers, they established that 13.2% of injuries sustained within the study period (2008 to 2010) were concussions, of which 66% occurred during competition. The rate of concussion was 2.5 per 10000 athlete-exposures, which was consistent with previously published data.¹⁸ The highest concussion rates per 10000 athlete-exposures were found in football (6.4), boys' ice hockey (5.4), and boys' lacrosse (4.0). They also found that in sex-comparable sports, girls had a higher concussion rate than boys did (1.7 vs 1.0). They attributed it to biomechanical differences between the sexes and reporting bias, girls being generally more forthcoming regarding their symptoms than boys are. Return to play was within 3 weeks for 80.1% of athletes. Other studies corroborate these findings.¹⁹⁻²¹

Most studies describing concussion epidemiology are based on emergency department (ED) and inpatient settings.²²⁻²⁴ We found 3 studies describing outpatient visits.²⁵⁻²⁷ Mannix et al compared outpatient with ED visits for concussions between 2005 and 2009.²⁵ They demonstrated that there were 800000 outpatient visits for minor head injury each year, compared with 1200000 visits to the ED, 50% of which were for patients younger than

18 years of age. However, patient demographic characteristics were not reported. Cantu et al analyzed 215 moderate to severe sport-related concussions seen by an experienced sport and exercise medicine (SEM) physician.²⁶ There were no significant associations between sex and any of the measured characteristics (RTP, depression, loss of consciousness, etc). There were statistically significant differences found between adult and pediatric patients in regard to recovery time (315 vs 91 days) and number of concussions (4.33 vs 2.37); however, the authors stated that their results might have been influenced by higher overall concussion severity among those presenting to a specialized clinician and might not necessarily be transferable to the general population in a primary care setting. Carson et al retrospectively reviewed files from an office-based SEM physician with concussion management expertise.²⁷ Despite systematic rest recommendations based on existing international consensus, they found that symptoms relapsed in 48.2% of patients with concussion (following RTP in 43.5% and return to learn in 44.7% of cases). They attributed these findings to poor concussion management knowledge among primary care providers and academic institutions, an unclear *cognitive rest* definition, and difficulties in applying recommendations in primary care settings.

Given the paucity of data from the outpatient setting and the increased media and public awareness of concussion, the purpose of this study was to observe the characteristics of patients with concussion who self-presented or were referred to the Fowler Kennedy Sport Medicine Clinic (FKSMC), an outpatient specialized SEM clinic.

METHODS

This retrospective, observational, epidemiologic study of concussion-related outpatient visits received institutional ethics approval from the Western University Research Ethics Board. Data were collected from patients presenting with a concussion (between January 1, 2011, and July 31, 2012) to 1 of 3 FKSMC specialized outpatient SEM clinics in London, Ont; the 3 FKSMC locations were Western University (main site), Fanshawe College, and Downtown London. Altogether, SEM physicians in these clinics serve a population of more than 366000 citizens.

Data were retrieved from the electronic medical record database using the ICD-9 code for concussion. Two collaborators audited charts for inclusion in the analysis. Auditors received training with respect to general concussion care. Inclusion criteria were patients who were seen for a concussion by a primary care SEM physician at FKSMC during the study period. Overall concussion care for a patient exceeding the study period was accepted as long as the initial consultation was within it. Exclusion

criteria were non-concussion-related visits and incomplete charts based on required data.

Final chart review was performed in April 2014 to better assess RTP outcomes for all patients. A data abstraction sheet was created to assist in data retrieval. General demographic characteristics (ie, age, sex, sport performed when injured, level of competition, previous medical history), concussion-related information (ie, Post-Concussion Symptom Scale [PCSS] scores, individual symptoms), and RTP information (ie, time away from play, RTP outcome) were retrieved. Patients younger than 18 at first presentation to the clinic were considered to be pediatric patients. The PCSS is a self-administered 22-element questionnaire that can be used for initial assessment and follow-up of concussion. It is included in all versions of the SCAT. Patients have to grade various concussion-related symptoms from 0 (none) to 6 (severe). Data compilation and analysis were done by one of the authors (L.B.) using SPSS, version 20. To assess associations between sex, age group, and sport, χ^2 tests were used. Independent sample *t* tests were used to examine differences in RTP, PCSS scores, and neck scores between sex and age. Statistical significance was defined a priori as $P < .05$.

RESULTS

During the study period, the ICD-9 code for concussion appeared in the charts of 310 patients, for a total of 1146 visits. Of those, 283 patients met the inclusion criteria (24 were rejected because of non-concussion-related visits and 3 owing to incomplete data). **Table 1** presents data on patient demographic characteristics.

Upon reviewing patients' self-reported medical history, we found that 31.7% had suffered from past concussion. Mean PCSS score was 29.7 at the initial visit (maximum value of 132); mean score was 27.6 for pediatric patients and 36.2 for adult patients ($P = .02$). Neck score (which is part of the total PCSS score, with a maximum value of 6) averaged 1.2 for pediatric patients and 1.8 for adult patients ($P = .02$). Most patients (85.7%) complained of headaches as part of their concussion

presentation (60.3% of them were male and 75.6% were younger than 18 years of age). The main sports associated with injury were hockey (40.0%), soccer (12.6%), and football (11.7%) (**Figure 1**).

Medical clearance for RTP was given to 50.9% of patients (according to existing consensus recommendations,¹¹ following a stepwise RTP protocol) before the 3-week mark and to 80.2% of patients before 8 weeks. Longer duration of follow-up did not influence RTP outcome, with about 60% of patients being cleared for contact or collision sports regardless of duration of follow-up (**Table 2**). Previous history of concussion was associated with restriction from such sports ($P < .001$). As seen in **Tables 3** and **4**, there were no statistical differences in RTP delay and outcome (in terms of clearance for contact or collision sports) between males and females ($P = .07$ and $P = .62$, respectively). Pediatric patients were granted RTP (without considering the outcome) after a mean of 37 days postinjury (median 18 days) and adult patients after 90 days (median 30 days) ($P = .001$). When comparing age and RTP outcome, the mean age of patients cleared to return to contact and collision sports was significantly lower than the mean age of patients who were not cleared for such activities (16.4 years vs 18.8 years, $P = .04$).

DISCUSSION

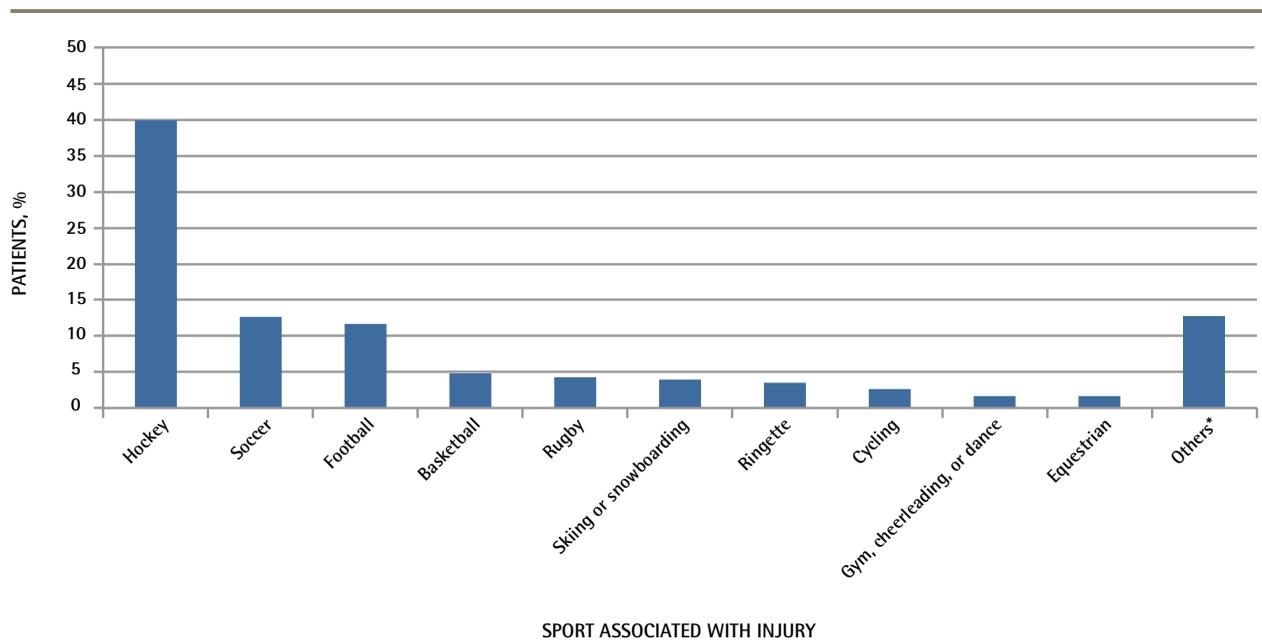
This is one of the few observational studies looking at the characteristics of patients with concussion presenting to outpatient specialized SEM clinics. Results from this study show that among the sample studied, males and pediatric athletes were most commonly seen. Similar findings have been observed in Canadian EDs.²³ Differences in RTP were observed when comparing adults with children, but not males with females. However, given that this is an observational study, no clinical conclusions can be drawn.

When looking at PCSS scores of children and adolescents versus adults, we found that older patients presented to our clinic with more symptomatic or complex issues. They also presented with increased neck symptoms. Neck involvement in concussion and postconcussion syndrome is being increasingly recognized in recent literature.²⁸⁻³¹ There are data showing that neck strength has an effect on head kinematics and biomechanics, which likely affects adults and children differently because children's weaker necks could lessen their ability to dissipate energy.^{31,32} However, we believe our findings are mostly related to the way patients seek medical care. Parents, teachers, and coaches might seek medical attention earlier for a younger athlete when a concussion is suspected. Different demands of adult life (family, work, chores, etc) might create challenges

Table 1. Demographic characteristics of patients

CHARACTERISTIC	VALUE
Age	
• Mean, y	17.6
• < 18 y, %	70.9
• ≥ 18 y, %	29.1
Sex	
• Male, %	58.8
• Female, %	41.2

Figure 1. Sports associated with injury



*Others includes baseball and non-sport-related concussions.

Table 2. Return-to-play outcomes in relation to medical follow-up duration

RTP OUTCOMES	FOLLOW-UP DURATION			
	< 4 WK	4-8 WK	8-12 WK	> 12 WK
Cleared for contact or collision, %	56.8	62.3	66.7	62.5
Not cleared for contact or collision, %	23.7	20.8	33.3	17.5
Lost to follow-up,* %	19.5	17.0	0.0	20.0

RTP—return to play.

*Patients who missed follow-up appointments after being assessed for a concussion.

Table 3. Return-to-play differences between sexes: P = .07.

RTP TIMING	MALE PATIENTS, %	FEMALE PATIENTS, %
< 2 wk	48.8	34.2
2-4 wk	15.1	23.9
4-8 wk	16.9	21.4
> 8 wk	19.3	20.5

RTP—return to play.

Table 4. Return-to-play outcomes, by sex: P = .62.

RTP OUTCOMES	MALE PATIENTS, %	FEMALE PATIENTS, %
Cleared for contact or collision	61.3	56.1
Not cleared for contact or collision	22.7	22.8
Lost to follow-up*	16.0	21.1

RTP—return to play.

*Patients who missed follow-up appointments after being assessed for a concussion.

Football has been described as the sport with the highest concussion rate in an American study.¹⁷ We believe our results are affected by sports participation in Canada. Hockey is ranked as the 2nd most practised sport (4.4% of Canadians aged 15 years and older) while football is ranked the 14th most practised sport (0.7%).³²

According to the latest consensus statement on concussion in sport,¹¹ 80% to 90% of concussions in adults resolve in a short period of time (7 to 10 days). It is agreed that this period is generally longer in pediatric athletes.^{9,12,13} Our observational data differ from these previously published studies. In our sample, children were allowed RTP sooner than adults were. A recent Canadian study elicited similar results.²⁷ Return-to-play clearance was also granted after longer rest periods than previously published. We believe that our clinic setting could bias these findings. Patients presenting to specialized SEM clinics might not be truly representative of the general population given their level of activity

in seeking medical care and following resting orders. In addition, patients presenting to a specialized outpatient SEM clinic might not represent the true population of individuals with concussion, who might seek care from their family physicians or other health care providers.

When looking at sport involvement, our sample results were different from previously published data.

and previous medical history (including previous history of concussion). Studies combining specialized SEM and family practice clinics would better assess the overall concussion population. The prolonged recovery in our adult patients might also be reflective of their initial presentation complexity. They presented with statistically significantly higher PCSS scores and neck scores, and it has been previously published that adults more often have a previous history of concussion.²⁶ Complexity of presentation will affect management and RTP parameters and influence outcome measures. Restriction from further contact and collision sports for patients with prolonged or incomplete recovery is in agreement with current recommendations.^{33,34}

Limitations

Our study has several limitations. It is an observational study of patients presenting to a specialized SEM outpatient clinic; therefore, no clinical conclusions can be made. Patients presenting to specialized clinics might be those with more complex issues who require prolonged management and therefore are not representative of the general population of individuals with concussion.

Conclusion

Epidemiologic data from this observational study differ only slightly from previously published studies, and the patient population seeking specialized care at our SEM clinic likely has an influence. It is important that patients with concussion are treated individually given the variability and complexity of their injuries. Findings from this observational study should lead to more studies examining epidemiologic variations in different populations presenting to an outpatient setting.

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Contributors

Dr Ouellet contributed to the literature review, data collection, and preparation, revision, and formatting of the manuscript. **Ms Boisvert** contributed to study design, data collection and analysis, and revision of the manuscript. **Dr Fischer** contributed to study design, as well as ideas for and revision of the manuscript.

Competing interests

None declared

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