Evidence-Based Practice Group Answers to Clinical Questions

"Post-Concussion Syndrome (PCS) – Validated Symptom Measurement Tools"

A Rapid Systematic Review

By

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Clinical Services – Worker and Employer Services

About this report

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The Evidence-Based Practice Group was established to address the many medical and policy issues that WorkSafeBC officers deal with on a regular basis. Members apply established techniques of critical appraisal and evidence-based review of topics solicited from both WorkSafeBC staff and other interested parties such as surgeons, medical specialists, and rehabilitation providers.

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Objective

To determine which validated measurement tools are currently available for measuring symptoms related to Post-Concussion Syndrome (PCS).

Methods

- A systematic literature search was conducted on August 24, 2018.
- The search was done on commercial medical literature databases, including BIOSIS Previews® (1969 to 2008), Embase® (1974 to 2018 August 23), Medline Epub Ahead of Print®, Medline In-Process & Other Non-Indexed Citations®, Medline Daily Update® and Medline Versions® (1946 to August 23, 2018), available through the Ovid® platform.
- Keywords employed in this literature search include:
    1. (((post-concussion) OR postconcussion OR postconcussive OR (post-concussive)) AND (syndrome$ OR symptom$)) OR (post-concussional disorder)
    2. sensitivity OR specificity OR validity OR validation
    3. questionnaire OR measur$ OR measurement OR measure
    4. 1 AND 2 AND 3.
        - Two hundred and ninety-nine[1-299] published studies were identified through Search No. 4. Upon examination of the titles and abstracts of these 299[1-299] studies, eighteen [7,8,9,46,57,69,78,137,142,195,197,209,240,241,249,251,259,267] published studies were retrieved in full for further appraisals.
- No limitations, such as on the date and/or language of publication, were employed in this literature search.
- A manual search was also conducted on the references of the articles that were retrieved in full.
- Eleven[300-310] further published studies were identified and retrieved in full for further appraisals.

Results

- Overall, there were twenty nine[7,8,9,46,57,69,78,137,142,195,197,209,240,241,249,251,259,267,300-310] published studies that were retrieved in full for further appraisals. Upon examining the full articles, six[9,57,137,142,209,251] were deemed not relevant to the objective of this systematic review and will not be discussed further.
- There were ten validated tools to measure PCS symptoms identified in this systematic review. Features of these tools are summarized below:
    1. <u>The Rivermead Postconcussion Symptoms Questionnaire</u> (RPQ)[197,249,259,306,310].

       The RPQ lists 16 symptoms commonly experienced following a mild TBI. Using a scale ranging from 0 (no more of a problem) to 4 (a severe problem), participants identify symptoms that have been more of a problem over the previous 24 hours than they were pre-morbid. For instance, using the Likert scale, participants are asked whether headaches were more of a problem over the last 24 hours compared with before "their accident or injury". These items' scores were summed to yield a total score out of 64. The RPQ has been shown to be a valid measure of PCS, with high reliability and has been widely used in PCS research. Thompson et al.[259], by employing a receiver-operating characteristics curve analysis suggested a total score of ≥ 16 as the optimal cut off point to distinguish between those with and without PCS. The authors found a sensitivity of 97% and specificity of 87% at this cut off point. It should be noted that this study still needs to be replicated in order to establish further generalizabilty.

    2. <u>The World Health Organization disability assessment schedule 2.0</u> (WHODAS 2.0)[240,302].
       The WHODAS 2.0. is a generic measure of disability, based on the International Classification of Disability, Functioning and Health (ICF), and was developed by the World Health Organization. The WHODAS 2.0, a disease-nonspecific measure of disability, represents six ICF activity and participation domains including cognition, mobility, self-care, interpersonal functioning, life activities, and participation. Both long (36 items) and short (12 items) versions are available and involve five difficulty-level response options: None, Mild, Moderate, Severe, or Extreme/Cannot Do. Responses can be scored using a simple-summed approach, and the WHODAS 2.0 can be administered as an interview or as a self-report questionnaire. The WHODAS 2.0

36-item version and, to a lesser extent, the 12-item version, has been widely used and validated in psychiatry, neurology, rehabilitation, and chronic disease research, and in general community samples as well as in mild traumatic brain injury (MTBI) research. Considering participant burden with the long 36-item version, the shorter 12-item version has been shown to have good psychometric properties with high internal consistency. The 12-item WHODAS 2.0 has been shown to be able to differentiate between patients with good outcomes and those with poor outcomes based on post-concussion syndrome, psychiatric, and pain status. Hence, it has potential as a short but robust global outcome measure for MTBI.

3. The British Columbia Postconcussion Symptom Inventory-Short Form (BC-PSI-Sf) [249,300].
   The BC-PSI-Sf was designed to measure both the frequency and intensity of the ICD-10 criteria for PCS and the Beck Depression Inventory, and it has been used in several PCS studies. It is a 16-item measure assessing the presence and severity of PCS symptoms. The test was based on the International Classification of Disease-10 (ICD 10) criteria for PCS, and requires the test taker to rate the frequency and intensity of 13 symptoms (i.e., headaches, dizziness or light-headedness, nausea or feeling sick, fatigue, sensitivity to noises, irritability, sadness, nervousness or tension, temper problems, poor concentration, memory problems, reading difficulty, and sleep disturbance), and the effect of three life problems on daily living (i.e., greater present vs. past effects of alcohol consumption, worrying and dwelling on symptoms, and self-perception of brain damage). The three life problems are rated on a scale from 1 to 5, where 1 = not at all and 5 = very much. The 13 psychological symptoms are rated on a 6-point Likert-type rating scale that measures the frequency and intensity of each symptom in the past two weeks. Frequency ratings range from 0 (not at all) to 5 (constantly). Intensity ratings range from 0 (not at all) to 5 (very severe problem). To score the BC-PSI-Sf, the two ratings are multiplied together (How often × How bad) by the examiner to create a single score for each item. These product-based scores are then converted to item scores that reflect both the frequency and intensity of symptom endorsement (range = 0 to 4). Item product scores convert to item total scores as follows: 0–1 = 0, 2–3 = 1, 4–6 = 2, 8–12 = 3, and 15+ = 4. Item scores of 3 or higher are considered to reflect at least moderate symptom endorsement, and these scores are more likely to be “clinically meaningful”. Scores from 1 to 2 reflect only mild endorsement of

the symptom (i.e., the frequency and severity of the symptom is more likely to be sub-clinical).

4. The Postconcussion Syndrome Symptom Scale (PCSSS) [249,309].
   The PCSSS is a 97-item PCS checklist composed of common neuropsychological complaints, such as “noise sensitivity” and “trouble remembering things” as well as distractor items. Drawing from symptoms related to cognitive, emotional, and somatic disturbances, items are consistent with DSM-IV-TR PCS criteria. Symptom severity is graded on a 5-point Likert scale, with “A” being never descriptive of the patient, and “E” being always descriptive of the patient; scale points between “A”and “E”are not specifically defined. “A”to “E”responses were converted to a score of 1–5, and scores of 3 or more were categorized as an endorsement of that particular symptom. This measure has been used in several PCS studies.
5. The Postconcussion Syndrome Checklist (PCSC) [78,249].
   The PCSC assesses the frequency, intensity, and duration of PCS symptoms. Participants are given a list of 9 PCS symptoms, including headache, dizziness, and irritability, and rate them on all 3 scales (frequency, intensity, and duration), using a Likert scale ranging from 1 (not at all) to 5 (all the time, crippling, or constant). Four scores were derived for each participant: frequency total, intensity total, duration total, and overall total, with higher scores indicating higher PCS grading. The PCSC has been widely used in PCS research. Additionally, variable time spans may be utilized to more closely reflect measurements of more recent symptoms occurring in the last 24 hours, differentiating those from symptoms which may been occurring over the previous 2 months. This allowed for the evaluation of the fluctuations in symptoms, as well as determination regarding whether reliable estimates of complaints had been obtained.
6. Post-Concussion Symptom Scale (PCSS)[308].
   The PCSS is part of the Immediate Post-concussion Assessment and Cognitive Test (ImPACT), a computerized test program used to assess neurocognitive performance and concussion symptoms. The 22-item scale includes headache, nausea, vomiting, balance problems, dizziness, fatigue, trouble falling asleep, sleeping more than usual, sleeping less than usual, drowsiness, sensitivity to light, sensitivity to noise, irritability, sadness, nervousness, feeling more emotional, numbness or tingling, feeling slowed down, feeling mentally ‘‘foggy,’’ difficulty concentrating, difficulty remembering, and visual problems. The PCSS uses a Likert-type scale, ranging from 0 to 6, with 0

indicating no difficulty with the outlined symptom and ratings of 1 to 6 representing mild-to-severe difficulty with the symptom.

7. Postconcussive Symptom Questionnaire (PCS Questionnaire)[8,69,267].
   The PCS Questionnaire contains 44 items that describe symptoms or events that a patient with PCS may have experienced in the preceding 2 years. It is a four-factor model questionnaire, including psychological, somatic, cognitive and so called infrequency factors. The Infrequency factor of the PCSQ is composed of 10 items that were the *least* frequently endorsed by respondents during the questionnaire development, including: impotence, hair pain, teeth itching, the bumping of one's head, and the bumping of the patient into things, among others. The other three factors in the PCSQ include sets of symptoms that are primarily psychological (e.g., anxiety, depression, anhedonia, sleep disruption), somatic (e.g., gastrointestinal changes, nausea, headaches, back pain), and cognitive (e.g., memory problems, word-finding difficulties, decreased reading comprehension). Items in the PCSQ were scored dichotomously, as either present or absent. The summary scores that were computed included the total number of items endorsed as well as the totals for each of the four factors (psychological, somatic, cognitive, and infrequency). Standard scores were computed for total PCS Questionnaire responses as well as for each of the four factor scores. Subseqent to the original 44-item questionnaire, a shorter, 19-item scale version (PCSQ-19) was also developed and validated, and found to be as reliable as the longer version.
8. Neurobehavioral Symptom Inventory (NSI)[241,303-305].
   The NSI is a 22-item self-report measure of symptoms commonly associated with PCS that may emerge after MTBI. The questionnaire asks patient to rate their difficulties with a variety of PCS-related symptoms. The 22 items were derived from a larger structured clinical interview originally created by Levin et al., in 1987, to capture common complaints after MTBI and is widely used within the US Veterans Affairs system. With this questionnaire, patients are asked to rate each symptom on a scale of 0–4 (none, mild, moderate, severe, and very severe) with four different types of symptoms: vestibular, somatic/physical, cognitive, and affective. Scale scores for each of the four factors of the NSI were formed by summing the raw scores.
9. Head Injury Scale (HIS)[195,307].
   The Head Injury Scale is a theoretically driven, 16-item, self-report scale derived from those instruments most commonly

described in the literature and is considered to be representative of these commonly described instruments. The items represent symptoms that have been commonly affiliated with sport-related concussion and postconcussion syndrome. A shorter, 9-item scale is also available. Regardless of the length, there are three domains, including somatic, cognitive and neuropsychological, measured in these scales. The longer 16-item version includes headache, nausea, vomiting, balance problems, sensitivity to light or noise, numbness or tingling, sleeping more than usual, drowsiness, fatigue, sadness, nervousness, trouble falling asleep, feeling "slowed down," feeling like "in a fog," difficulty concentrating, and difficulty remembering; the shorter 9-item version uses the measures of headache, nausea, balance problems, fatigue, drowsinesss, trouble falling asleep, feeling "slowed down," feeling like "in a fog," and difficulty concentrating. Each item in these domains is rated on a 7-point Likert-type scale with response options of never (0) to always (6). Patients are asked to address each symptom based on how they have felt during an average 24-hour period over the past 7 days. A rating of zero (0) means that on an average day they have never experienced the symptom, a one (1) rating indicates they experienced the symptom very briefly during an average 24-hour period, three (3) means the symptom, on an average day, has been present for about half of the preceding 24-hour period, and a rating of six (6) means the symptom, on an average day, has been present continuously through the same time period.

10. The New Swedish Post-Concussion Symptoms Questionnaire (Swedish PCSQ).[7].

    The PCSQ consists of psychiatric and neurological questions based on a review of the literature as well as clinical experience. There are twenty-one symptoms listed in this Swedish PCSQ, including fatigability, concentration difficulties, increased sleep, irritability, failing memory, depression, anxiety, reduced sleep, neck pain, loss of sensation or movement, light sensitive, sound sensitive, emotional instability, dizziness, headache, reduced simultaneous capacity, anosmia, impaired hearing, orientation problems, visual impairment and language difficulties. These 21 items were thought to be PCS symptoms most commonly reported in the published literature. Answers to these 21 items are based on a basic dichotomy of either ''Yes'' and ''No''. The items in this Swedish PCSQ are delivered in a semi-structured interview or as a self-administered questionnaire.

- In an effort to investigate the potential of symptom exaggeration within the self-report questionnaire responses of patients with PCS, Cooper et al.[46] developed the Mild Brain Injury Atypical Symptoms Scale (mBIAS). The mBIAS consists of five ~~rationally~~ ~~developed~~ items which were selected from a larger pool of items felt to be uncommonly endorsed symptoms following MTBI. These five items were selected by a panel consisting of a board-certified neurologist, board-certified physiatrist, and senior neuropsychologist each with extensive experience working with MTBI. These five items include: being unable to hear anything (complete deafness) for periods of time, seeing only in black and white, completely losing voice for > a minute, complete loss of feeling in both arms and difficulty swallowing due to a lump in throat. Analysis of psychometric properties of mBIAS demonstrated that a score of 8 on the mBIAS is optimal for the detection of symptom over-reporting (sensitivity = 0.94, specificity = 0.92) and appears to be the most favorable cut score for interpretive use.

Summary

- Ten validated PCS-related symptom measurement tools are identified in this systematic review. These tools can be self-administered; however, only some of these tool have developed normative data or cut off points to establish PCS diagnosis.
- Some experts recommend the additional measuring of symptom exaggeration among PCS patients and tools have been developed to measure this specific phenonmenon.

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Appendix 1

WorkSafeBC - Evidence-Based Practice Group Levels of Evidence

(adapted from 1,2,3,4)

1	Evidence from at least 1 properly randomized controlled trial (RCT) or systematic review of RCTs.
2	Evidence from well-designed controlled trials without randomization or systematic reviews of observational studies.
3	Evidence from well-designed cohort or case-control analytic studies, preferably from more than 1 centre or research group.
4	Evidence from comparisons between times or places with or without the intervention. Dramatic results in uncontrolled
5	Opinions of respected authorities, based on clinical experience, descriptive studies or reports of expert committees.

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