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Suicidal ideation in persons with neurological conditions: prevalence, associations and validation of the PHQ-9 for suicidal ideation

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ABSTRACT

Objectives: Our primary aim was to validate the Patient Health Questionnaire (PHQ)-9 as a screening tool for suicidal ideation (SI).
Methods: Persons with epilepsy (n=188), migraine (n=208), multiple sclerosis (n=151), and stroke (n=122) completed questionnaires (e.g., PHQ-9) and the structured clinical interview for *DSM-IV* (SCID). Logistic regression was used to examine factors associated with SI [odds ratios (ORs) with 95% confidence intervals (CIs)]. The diagnostic accuracy of the PHQ-9 in identifying SI [sensitivity (Se), specificity (Sp), positive and negative predictive value (PPV and NPV)] was validated against the SCID.
Results: The 2-week prevalence of SI ranged from 5.7% (stroke) to 12.7% (epilepsy). Factors most strongly associated with SI were depression [OR ranging from 14.6 (migraine) to 38.6 (stroke)] and anxiety [OR ranging from 8.6 (migraine) to 15.3 (epilepsy)] (see text for 95% CI). The PHQ-9 had good Se for SI in epilepsy (90%) and migraine (75.0%). PPV was poor while Sp and NPV were >90% for every condition.
Conclusions: Screening for depression and anxiety is important in view of their strong association with SI. The PHQ-9 may be considered as a screening tool for SI, although it should not be relied on solely in view of its suboptimal PPV.

1. Introduction

In the United States, suicide was the 10th leading cause of death in 2013 [1], while in Canada, it was the ninth leading cause in 2011 [2]. In the general population, the annual prevalence of suicide in the United States (year 2013) and Canada (year 2012) is approximately 0.01% [1,3], while the expected annual prevalence of suicidal ideation (SI) is 2.0% [4].

Studies show that there is a higher-than-average presence of SI and suicide in neurological patients [5–12], with their risk of suicide reported to be 2 to 14 times higher than in the general population [5–8], while their prevalence of SI ranges from 6% to 16% [9–12].

The strongest predictors of suicide are histories of psychological illness and prior suicide attempt(s) [13,14]. There is a high risk of progression to suicide attempts within the first year of ideation onset [15]. As such, the identification of SI is a strongly recommended preventive strategy [16].

Several tools are used to screen for SI including the Patient Health Questionnaire (PHQ)-9. However, some suggest a need for further testing of existing measures for SI [17,18]. One study in depressed primary care patients reported a sensitivity (Se) of 69% and a specificity (Sp) of 84% for the PHQ-9 as a screen for SI when compared to the structured clinical interview for *DSM-IV* (SCID) [19]. To our knowledge, the difference between self-report and interviewer assessment by phone for SI screening is unknown in neurological patients. Individuals with neurological conditions are managed in specialized neurological and general medical settings where SI may be stigmatized and questions about SI may not be part of routine assessment. Therefore, it is important to establish formal procedures for SI screening in these settings and to determine which procedures are appropriate and efficient. Since the PHQ-9 has been shown to be predictive of suicide attempts and deaths by suicide [20], we sought to compare its performance as a self-report instrument to the interviewer-assessed SCID in neurological cohorts including epilepsy, migraine, multiple sclerosis (MS) and stroke and assess factors associated with SI.

2. Materials and methods

2.1. Participants

Participants were recruited consecutively from four outpatient clinics (Epilepsy Clinic, MS Clinic, Headache Clinic and Stroke Clinic) in

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Calgary from August 2012 to September 2013. Patients had to be (a) 18 years of age or older; (b) fluent in English; (c) free of hearing impairment because they had to complete a telephone interview; and (d) free of physician-diagnosed moderate or severe dementia, moderate or severe developmental delay or aphasia. The study protocol received approval from the Conjoint Health Research Ethics Board of the University of Calgary.

2.2. Procedures

Patients were invited to complete a self-report questionnaire and a telephone interview (SCID) conducted within 2 weeks of their clinic visit, often within 24–48 h (to ensure consistency between time period referenced in questionnaires and SCID). The questionnaire included demographic information and various screening tools (see below). Medical chart review was performed to abstract disease characteristics, medications and nonpharmacological treatments for psychiatric conditions.

2.3. Measures

The PHQ-9 is a self-report screening instrument for depression symptoms containing nine items (3 points each) [21]. The items of the PHQ-9 map onto the *DSM-IV* major depression criteria [22]. A total score equal to or greater than 9 (epilepsy), 14 (migraine), 11 (MS) or 13 (stroke) were considered suggestive of depression based on earlier validation studies in our cohorts [23–26]. Item 9 of the PHQ-9 was used to assess SI. It asks, "Over the last 2 weeks, how often have you been bothered by the following problem: thoughts that you would be better off dead, or of hurting yourself in some way?" Patients may respond to the question with "not at all," "several days," "more than half the days" and "nearly every day." A response of at least "several days" on Item 9 counted as SI endorsement.

The Hospital Anxiety and Depression Scale (HADS) is a 14-item self-report scale used for assessing depression (7 questions) and anxiety (7 questions) [27]. A score of 8 or higher out of 21 was used to indicate depression or anxiety.

The SF-12 is a shorter version of the widely validated SF-36 that measures health-related quality of life over the last 4 weeks [28]. It consists of 12 questions and provides a physical component score and a mental component score (MCS) ranging from 0 to 100, with higher scores indicating better health [28].

The Disease Severity Scale (DSS) is a single-item scale that asks "Taking into account all aspects of your condition, how would you rate its severity now?" Responses range from "not severe" to "extremely severe." This scale has been validated in epilepsy and found to be an accurate measure of disease severity [29].

The SCID is a semistructured diagnostic interview administered by a trained health professional interviewer that is commonly considered to be the gold standard in diagnosing psychiatric conditions because it is representative of the *DSM-IV* [22]. To determine if SI was present, the SCID asks if the participant has had "recurrent thoughts of death, suicidal ideation, suicide attempt, or specific plan" to which the participant would respond if he/she specifically endorsed SI. The SCID was administered by senior clinical psychology graduate students who were trained and blinded to depression status on the screening tools.

2.4. Statistical analysis

Descriptive statistics were calculated for demographic variables. SI on the PHQ-9 and the SCID were compared using tests of proportions. Logistic regression was used to assess the relationship between SI and different factors and obtain their odds ratios (ORs). Adjusted estimates were examined to identify any confounding. Age and sex were considered potential confounders. An α value of $<.001$ was set as the significance level for all *P*-values to account for multiple simultaneous comparisons.

Se, Sp, positive predictive value (PPV) and negative predictive value (NPV) were calculated for the PHQ-9 SI item using the SCID's assessment as the gold standard. Se measures the proportion of patients endorsing SI on the SCID who screen positive on the PHQ-9 [30]. Sp measures the proportion of patients not endorsing SI on the SCID who screen negative on the PHQ-9 [30]. PPV is the probability that those with a positive test on the PHQ-9 endorse SI on the SCID, whereas NPV is the probability that those with a negative test on the PHQ-9 do not endorse SI on the SCID [30]. PPV and NPV estimates in our study were based on the current sample prevalence. Statistical analyses were conducted in Stata 12 [31].

3. Results

The proportion of patients who agreed to participate were 85.4% (*N*=257) for epilepsy, 89.3% (*N*=268) for migraine, 74.2% (*N*=222) for MS and 67.3% (*N*=204) for stroke. The number of patients who completed both the questionnaire package and the SCID (included in the current analysis) were 188 for epilepsy, 208 for migraine, 151 for MS and 122 for stroke.

Baseline characteristics are listed in Table 1. SI as captured by the PHQ-9 and SCID is reported in Fig. 1. According to the PHQ-9, the 2-week point prevalence of SI was 12.7% [95% confidence interval (CI)= 7.9–17.6] for epilepsy, 15.9% (95% CI=10.9–20.9) for migraine, 8.1% (95% CI=3.7–12.6) for MS and 5.7% (95% CI=1.6–9.9) for stroke. The estimated prevalence of SI on the SCID was 5.5% (95% CI=2.7–9.9) for epilepsy, 12.0% (95% CI=7.5–16.7) for migraine, 5.4% (95% CI=2.4–10.4) for MS and 6.6% (95% CI=2.9–12.5) for stroke. SI in all conditions was not significantly different on the PHQ-9 compared to the SCID (epilepsy *P*=.01; migraine *P*=.20; MS *P*=.48; stroke *P*=.79).

Depression showed the strongest association with SI in all of the conditions with OR ranging from 14.6 (95% CI=6.1–34.9) for migraine to 38.6 (95% CI=6.3–235.5) for stroke (Table 2). Anxiety was also strongly associated with SI in epilepsy (OR=15.3, 95% CI=4.3–54.4) and migraine (OR=8.6, 95% CI=3.2–23.5). Higher MCS scores were significantly protective against SI in epilepsy (OR=0.8, 95% CI=0.7–0.9) and migraine (OR=0.9, 95% CI=0.8–0.9). Since disease severity, depression, anxiety and SI may be associated with one another, these variables were included in the same model to obtain the following adjusted ORs and control for their confounding effect on one another [epilepsy: disease severity (6.2, 95% CI=1.3–29.2, *P*=.02), depression (15.4, 95% CI=4.4–54.5, *P*<.001), anxiety (5.9, 95% CI=1.5–23.5, *P*=.013); migraine: disease severity (0.94, 95% CI=0.37–2.4, *P*=.893), depression (9.3, 95% CI=3.6–24.2, *P*<.001), anxiety (4.2, 95% CI=1.4–12.5, *P*=.009); MS: disease severity (3.2, 95% CI=0.57–18.0, *P*=.185), depression (9.3, 95% CI=2.0–43.8, *P*=.005), anxiety (3.6, 95% CI=0.70–18.0, *P*=.125); stroke: disease severity (1.6, 95% CI=0.10–26.2, *P*=.731), depression (22.4, 95% CI=3.1–162.9, *P*=.002), anxiety (5.3, 95% CI= 0.48–57.3, *P*=.173).

The PHQ-9 item had an Se of 90% in epilepsy and 75% in migraine (Table 3). The Sp was high in all of the conditions, being highest for stroke at 97.4%. The PPV was low for all conditions (lowest in epilepsy at 39.1%). The NPV was consistently high (highest in epilepsy at 99.4%).

4. Discussion

The current study found that the 2-week point prevalence of SI in the neurological subgroups was much higher (5.4 to 12.0%) than that which has been reported in general populations. For example, the prevalence of SI over a 1-week period in the general population ranged from 0.8% (as measured by a structured clinical interview) to 2.8% (as measured by a self-report questionnaire) [32,33]. In primary care settings, the prevalence of self-reported SI over a 1-month period was 2.4% [34]. Thus, SI in the general population is much less compared to the neurological cohorts studied here. Significant factors associated with SI in neurological patients were depression and anxiety. Our validation of