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Trajectory classes of violent behavior and their relationship to lipid levels in schizophrenia inpatients

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ABSTRACT

Objective: To characterize the trajectory patterns of violence in schizophrenia inpatients, examine the relationships between the violence trajectories and baseline clinical features and lipid levels, and generate a model to predict the more violent trajectories.
Methods: In a sample of 107 consecutively admitted patients with schizophrenia spectrum disorders, violent behavior was weekly rated using the Violence Scale. The patients' blood levels of total cholesterol (TC), triglycerides (TG), low-density lipoprotein cholesterol, and high-density lipoprotein cholesterol were measured at admission. A trajectory analysis was used to classify the patients' longitudinal courses in violence, and the correlates of these trajectories were assessed using multinomial logistic regression analyses. A stepwise logistic regression was used to select the best predictor variables for the more violent trajectories.
Results: Four violence trajectories of inpatients were obtained: class 1 (no violence, 37.4%), class 2 (low-leveling off, 39.2%), class 3 (high-falling sharply, 10.3%), and class 4 (high-falling slowly, 13.1%). Although the relationship between decreasing TC and TG levels and increased violence in the trajectory classes did not reach statistical significance, a decreasing trend in the proportion of high dichotomized-TG levels was significantly associated with more violence in the trajectory classes ($p = 0.04$). A five-variable model consisting of female gender, early onset, higher scores of positive symptoms, lower scores of negative symptoms, and low dichotomized-TC levels had a predictive accuracy of 0.85 (95% CI = 0.72–0.97).
Conclusions: Distinct violence trajectories exist in schizophrenia inpatients, and the more violent trajectories can be predicted using baseline clinical features and lipid levels.

1. Introduction

Patients with schizophrenia are more likely to be violent than the general population, mainly in certain subpopulations (Chen et al., 2011; Vevera et al., 2005; Walsh et al., 2004). Family members and medical staff are the major victims of patients' violence (Vevera et al., 2005); this often makes caring for these patients difficult and negatively affects other patients, nurses, and the therapeutic environment (Chen et al., 2005; Hage et al., 2009). Several sociodemographic and clinical features such as male gender and early onset (Arango et al., 1999; Steinert et al., 1999a; Vevera et al., 2005), psychotic symptoms (Krakowski and Czobor, 2004; Nolan et al., 2005), and co-morbid substance abuse (Steinert et al., 1999a; Vevera et al., 2005; Walsh et al., 2004) are associated with violence in schizophrenia. Whether the biochemical characteristics of schizophrenia patients are associated with the patients' violence remains largely unexplored.

Previous studies on violence in schizophrenia have varied in their definitions of violence, and though most of them included only physical aggression against others (Schanda et al., 2004; Troisi et al., 2003), some of them incorporated object aggression (Cooper et al., 1983; Grassi et al., 2001), self-aggression (Barlow et al., 2000; Barnard et al., 1984), or verbal aggression (Douglas et al., 2009). Recent studies have indicated that there is a common neurobiological susceptibility to all of these forms of aggression (Siever, 2008). Furthermore, aggressive acts might evolve over time, and

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many studies have used a trajectory analysis to identify the heterogeneous sources of aggression (Nagin and Tremblay, 1999; van Lier et al., 2009). To date, none of the studies on violence in schizophrenia have applied trajectory analyses to analyze repeated measures on patients' violence.

Low total cholesterol (TC) concentrations have been associated with many forms of violence in the general population across many types of studies (Golomb, 1998; Golomb et al., 2000), not limited to patients with psychosis. This relationship was postulated to be a result of reduced central serotonin activity caused by low or lowered TC levels (Kaplan et al., 1997). When psychiatric inpatients of heterogeneous diagnostic groups were examined using more than one index of the patients' lipid profile, an association of the patients' violence with low TC levels was consistently found, but the associations between violence and the levels of triglyceride (TG), low-density lipoprotein cholesterol (LDL-C), and high-density lipoprotein cholesterol (HDL-C) were conflicting (Mufti et al., 1998; Paavola et al., 2002; Roaldset et al., 2011). However, studies that focused on schizophrenia patients showed a lack of association between TC levels and violence (Atmaca et al., 2003; Huang and Wu, 2000; Steinert et al., 1999b; Turkoglu et al., 2009). The sample sizes of these studies were small to modest, and the violence measures were mainly based on a chart review or criminal records. None of the existing studies examined the relationship between lipid levels and the longitudinal pattern of violence in schizophrenia inpatients.

To address these gaps in the literature, we examined a sample of schizophrenia-spectrum inpatients with weekly ratings of violence during their whole admission period. The specific aims of this study were to (1) characterize the trajectory patterns of violence in schizophrenia inpatients; (2) examine the relationship between the violence trajectories and baseline clinical features and lipid levels; and (3) generate a model to predict the more violent trajectories in schizophrenia inpatients.

2. Methods

2.1. Participants

Participants were schizophrenia patients over the age of 16 who were admitted to the acute psychiatric ward in National Taiwan University Hospital and recruited in succession from April 2002 to March 2003. The details of the recruitment have been described elsewhere (Chen and Hwu, 2009; Chen et al., 2011). Patients fulfilling the diagnostic criteria of the DSM-IV (American Psychiatric Association) for schizophrenia spectrum including schizophrenia, schizophreniform disorder, schizoaffective disorder, and schizotypal personality disorder were recruited consecutively. Among the 120 eligible patients, 13 patients refused to participate in this study; thus, the final sample size was 107, which yielded a response rate of 89.2%.

Because the setting for participants' recruitment was an acute ward, intervention occurred immediately after patients' hospitalization (i.e., medication was administered). For the majority of the participants, the second-generation antipsychotics were already on board (n = 71, 66.4%). Lipid levels were assessed on a routine basis from each inpatient after 8-h overnight fast at admission. Medications were in some instances adjusted after the assessment of lipid levels.

2.2. Measures

2.2.1. Chinese version of the Violence Scale

The patients' violence was assessed using an 18-item version of the Violence Scale (Morrison, 1993) in its Chinese adaptation (VS-C) (Chen and Hwu, 2009). The scale consists of three categories of aggressive acts: (a) aggression toward property (item 1–5), (b) aggression toward other persons (item 6–13), and (c) aggression toward the self (item 14–18). The sequence of items in each category starts from non-specific verbal aggression to specific physical aggression. The VS-C was reported to have fair internal consistency, with a Cronbach's α of 0.67, and good predictive validity for aggression ($r = 0.51$) (Chen and Hwu, 2009). For this study, each patient's violence was recorded daily by the head nurse on the ward, whose rating was based on participant observation and supplemented by information from the primary care nurses' report, a duty-shift report, the records of ward-round team meetings, and the patient's medical charts (Chen and Hwu, 2009). On each Monday, the head nurse summarized each patient's daily aggression data.

2.2.2. Clinical assessments

Each patient was interviewed using a structured questionnaire on demographic characteristics. In addition, information on the patient's clinical features, including type of admission, age at onset, and length of hospitalization, were collected from their medical charts.

The patients' psychotic symptoms were assessed weekly during their hospitalization by their primary treating psychiatrists using the Comprehensive Psychopathological Rating Scale for Inpatients with Severe Mental Disorder (Hwu, 1991), which includes eight positive symptoms and six negative symptoms. All of the items were assessed using a four-point rating scale that ranged from 0 (none) to 3 (severe).

2.2.3. Body mass index and lipid profile

Each psychiatric inpatient's weight and height were measured at admission. Each patient's body mass index (BMI) was then computed as the weight in kilograms divided by the height in meters squared (kg/m^2). In addition, a blood sample of 20 ml was drawn from each inpatient after a 8-h overnight fast. Enzymatic methods were used to determine serum cholesterol and triglyceride levels (Merck 14354 and 14366, respectively) by the central lab of the hospital. Each patient's lipid profile included the levels of TC, TG, LDL-C, and HDL-C.

2.3. Statistical analysis

2.3.1. Trajectory analysis

We classified participants based on information about their violence over the course of their hospitalization using a trajectory analysis and adopting semi-parametric group-based modeling as implemented in PROC TRAJ of SAS software. This approach can optimally use all of the available information by allowing for missing data at various time points. The best-fitting model was selected by individually comparing the Bayesian Information Criterion (BIC) of each model (Jones et al., 2001). All of the subjects were grouped into their respective violence trajectory groups according to the highest posterior probabilities of their belonging to a particular group. The group membership derived from the trajectory analysis was then used for the subsequent analyses.

2.3.2. Correlates of violence trajectories

Initially, we conducted multinomial logistic regression analyses of violence trajectories (i.e., treated as the dependent variable) on patients' baseline characteristics (i.e., treated as independent variables) with adjustment for potential confounders. Then we tested the trend of the odds ratios (aORs) using ordinal logistic regression analyses by recoding class 1 as 0, class 2 as 1, class 3 as 2, and class 4