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A brief neurocognitive assessment of patients with psychosis following traumatic brain injury (PFTBI): Use of the Repeatable battery for the Assessment of Neuropsychological Status (RBANS)

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ABSTRACT

Patients who develop psychosis following a traumatic brain injury (PFTBI) show impaired neurocognition; however, the degree of impairment has not been empirically investigated using a standardised battery. We administered the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) to patients with PFTBI ($n=10$), and to three groups of controls: traumatic brain injury (TBI) ($n=10$), schizophrenia ($n=23$), and nonclinical controls ($n=23$). The results confirmed that the cognitive neuropsychological profile of dually-diagnosed patients with PFTBI is significantly and substantially impaired. Seventy per cent of patients with PFTBI received a neuropsychological classification between the "extremely low" and "low average" ranges. Group-wise analyses on the RBANS indices indicated that patients with PFTBI had the lowest (Immediate Memory, Attention, Delayed Memory, Total Score), or equal lowest (visuospatial, equivalent with schizophrenia patients) scores, with the exception of the Language Index where no group differences were shown (however, the mean PFTBI score on the Language Index was two standard deviations below the RBANS normative score). These findings provide novel evidence of impaired cognitive neuropsychological processing in patients with PFTBI using a standardised and replicable battery.

1. Introduction

Psychosis following a traumatic brain injury (PFTBI) is estimated to occur in up to 10% of patients who sustain a traumatic brain injury (TBI) (Davison and Bagley, 1969; Fujii et al., 2004). Aetiological theories primarily highlight the role of the TBI in activating a premorbid psychosis proneness and/or initiating structural and functional neurological changes that underpin the development of new psychotic symptoms (see Batty et al. (2013) for review). However, the substantial morbidity of PFTBI patients has meant that empirical evidence is lacking.

The extent of neurocognitive deficits in PFTBI has rarely been empirically investigated, with the majority of existing data having been drawn from case studies and retrospective chart reviews. This is problematic given that the pooled analysis of single case studies compromises the comparability of assessment protocols, and small group case studies compromise statistical power, making it difficult to draw definitive conclusions with confidence. The standardised measurement of neurocognitive deficits in patients with PFTBI is critical to aspects of their diagnosis and long-term care. To date, deficits in language, verbal learning and verbal memory appear consistently in the existing literature (see Batty et al. (2013) for a comprehensive review) (Bamrah and Johnson, 1991; Sachdev et al., 2001; Fujii and Ahmed, 2002; Fujii et al., 2004). However, other aspects of neurocognition have been reported as intact in some cases. For instance, a retrospective chart review reported cognitive neuropsychological data for 17 patients with PFTBI, demonstrating memory impairment in 59%, executive dysfunction and visuospatial impairment in 41%, and language and attention deficits in only 12% (Fujii and Ahmed, 2002).

Large bodies of empirical work in patients with either schizophrenia or traumatic brain injury (TBI) have established much broader and encompassing neurocognitive deficits in these patient

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cohorts. Both schizophrenia and TBI are associated with extensive deficits in visual-perceptual processing (e.g., Brosseau-Lachaine et al., 2008; Ponsford et al., 2011; Landgraf et al., 2011), language and communication (e.g., DeLisi, 2001; Covington et al., 2005; LeBlanc et al., 2006), memory (e.g., Lezak, 1979; Vakil, 2005; Gur and Gur, 2013; Lett et al., 2014), and executive function (e.g., Ponsford and Kinsella, 1992; Rios et al., 2004; Eisenberg and Berman, 2010; Breton et al., 2011), with fatigue and loss of concentration/attention exacerbating these deficits further. Established impairments in schizophrenia and TBI suggest that further research into the cognitive neuropsychological profile in PFTBI is needed to address apparent discrepancies in the existing literature.

The Repeatable Battery for the Assessment of Neuropsychological Status (RBANS; Randolph, 1998) has potential as an appropriate test of neurocognition in PFTBI[1]. The RBANS assesses attention, language, visuospatial/constructional ability, and immediate and delayed memory, in a relatively brief, and yet comprehensive, one-on-one administration (Randolph, 1998). The clinical validity of the RBANS has been established by various studies that have illustrated sensitivity in the detection of neurocognitive impairments in both schizophrenia (Wilk et al., 2004; Gogos et al., 2010) and TBI (Randolph, 1998; Carone et al., 2004; McKay et al., 2007). Furthermore, the RBANS has demonstrated comparable sensitivity to more extensive alternative measures in both patient groups: Wechsler (1997a, 1997b) assessments in schizophrenia (i.e. Wechsler Adult Intelligence Scale, 3rd Edition [WAIS-III] and Wechsler Memory Scale, 3rd Edition; Gold et al., 1999), and the WAIS-III (Wechsler, 1997a) and California Verbal Learning Test, 2nd Edition (Delis et al., 2000) in TBI (McKay et al., 2007).

The purpose of the current study was to determine the neuropsychological profile of a sample of patients with PFTBI using the RBANS (Randolph, 1998). To our knowledge, this is the first systematic and standardised neuropsychological assessment of PFTBI. RBANS scores from patients with PFTBI were compared with TBI, schizophrenia, and nonclinical control groups. Given their dual diagnosis, we expected that patients with PFTBI would show significant impairment on each domain of the RBANS relative to all three control cohorts. To date, this is only partially demonstrated in the literature.

2. Method

2.1. Participants

Ten patients with PFTBI were recruited from the private practice of MH, the Royal Talbot Hospital via the Brain Disorders Program at Austin Health (Community Brain Disorders Assessment and Treatment Service, CBDATS), and a participant registry held at the Monash-Alfred Psychiatry Research Centre (MAPrc). This recruitment process proved extremely difficult given the extent of morbidity in patients with PFTBI. Only 25 of 43 patients identified with PFTBI were considered well enough to complete the assessment, and of these, only 40% ($n=10$) were successfully recruited. All patients with PFTBI had developed their psychosis post TBI (confirmed by patient records and in consultation with their treating clinician). Patients with TBI without psychosis (TBIWP) were individuals who had incurred a traumatic brain injury but had no evidence of current or prior psychotic symptoms according to hospital and database records. Ten patients with TBIWP were recruited from the Monash-Epworth Rehabilitation Research Centre (MERRC) database, and the MAPrc participant registry. No patient was involved in TBI-related litigation at the time of testing. Twenty-three patients with schizophrenia and no history of head injury, and 23 nonclinical controls, were recruited from the MAPrc participant registry. During PFTBI recruitment, general, family, injury, and clinical demographics were recorded, with a specific effort made to match the three control cohorts on as many of these as possible.

TBI injury severity was as follows: TBIWP cohort; mild ($n=4$), moderate ($n=2$), severe ($n=4$); PFTBI cohort; mild ($n=3$), moderate ($n=3$), severe ($n=4$). Patients with psychosis (schizophrenia and PFTBI) were clinically stable outpatients, and all had a confirmed psychotic diagnosis, these were: schizophrenia cohort; schizophrenia ($n=14$), schizoaffective ($n=9$); PFTBI cohort; schizophrenia ($n=6$), schizoaffective ($n=2$), schizophreniform ($n=1$), and paranoid psychosis ($n=1$). No participant had been diagnosed with a stroke or neurological disease (e.g., Multiple Sclerosis, Huntington's disease, Parkinson's disease), premorbid cognitive, learning, or memory difficulties, previous psychosis/mania (except in schizophrenia), substance abuse related TBI, participated in drug/cannabis use in the three months prior to testing, showed signs of current delirium, or severe current morbidity. The mean age of all 66 participants was 38.59 (*S.D.*=12.05) years, and all had a premorbid IQ score >70 as measured by the National Adult Reading Test (NART: Nelson, 1982). Full ethical approval for the research protocol was granted by the Alfred Hospital, Austin Health, Epworth Healthcare, and RMIT and Monash Universities.

2.2. Materials and procedures

2.2.1. Clinical measures

The assignment of injury severity adhered to the Department of Defense and Department of Veterans Affairs (DoD/DVA, 2008) definition for loss of consciousness (LOC), post-traumatic amnesia (PTA), and Glasgow Coma Scale (GCS; Teasdale and Jennett, 1974) (where available) as closely as possible. Injury information was determined by extensive case history files from the relevant hospitals/treating clinician. Where information from one or more of the parameters indicated inconsistent levels of severity for a particular case, the most appropriate classification was given according to additional patient file notes. Patients with psychosis were given the research version of the Structured Clinical Interview for DSM-IV-TR Axis I Disorders (SCID-I/P; First et al., 2002), and rated on the PANSS (Positive and Negative Symptom Scale; Kay et al., 1987) for positive, negative and global psychosis symptoms. Current IQ was measured by the Wechsler Abbreviated Scale of Intelligence (WASI; The Psychological Corporation (1999)), and anxiety and depression were measured on the Hospital Anxiety and Depression Scale (HADS; Zigmond and Snaith, 1983).

2.2.2. The Repeatable battery for the Assessment of Neuropsychological Status (RBANS)

The RBANS (Randolph, 1998) is a brief "paper-and-pencil" battery for the detection of neurocognitive deficits in a variety of disorders. The battery comprises twelve subtests, and produces five index scores as well as a total summary score, and total scaled score. The scaled score classifies neuropsychological performance as: extremely low (69 and below), borderline (70–79), low average (80–89), average (90–109), high average (110–119), superior (120–129), and very superior (130 and above). The RBANS is psychometrically sound, with established internal consistency, test–retest reliability, inter-rater reliability, and concurrent validity (Randolph, 1998; Randolph et al., 1998). All participants were tested using Form A in accordance with the manual guidelines. Index scores were age adjusted and standardised such that the normal mean was equal to 100 with a standard deviation of 15, based on a normative sample (Randolph, 1998).

2.2.3. Statistical analysis

All statistical analyses were conducted using IBM® SPSS® software, Version 19 (IBM Corporation, 2011).

Group-wise. Continuous variables were assessed for violations of normality via (i) skewness and kurtosis statistics (i.e., according to the convention of $\pm 2 \times$ standard error, Groeneveld and Meeden (1984)), (ii) Kolmogorov–Smirnov and Shapiro–Wilk significance tests, (iii) the visual inspection of histograms, and (iv) box and whisker plots. Four of the 12 RBANS subtests were non-normal in distribution due to ceiling performance on the easier tasks: Picture Naming (nonclinical and TBIWP controls at 100%), Figure Copy, List Recognition, and Line

[1] Notwithstanding the necessity for a complementary measurement of executive function to obtain a full neurocognitive assessment.