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Research paper

A comparative study of the use of three cognitive function screening tests on rehabilitation wards for older people

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ABSTRACT

Background: Cognitive function tests are often used to predict rehabilitation outcomes. We aimed to determine how predictive the MMSE, CLOX and a short Frontal Lobe Assessment (sFLA) were in determining likely improvement in activities of daily living and discharge home.
Materials and methods: In a prospective observational study, we evaluated a cohort of 241 patients [97 Male mean (SD) median age: 84.4 (7.27) 85 years]. Functional ability was assessed using the Barthel Activities of Daily Living (BADL) scale. Outcomes were an improvement in one domain on the BADL and discharge home.
Results: Whatever the tool, abnormal cognition was an independent factor for lack of improvement in BADL [MMSE – $P = 0.000$ (B = 1.11; 95%CI: 1.05–1.17); CLOX – $P = 0.007$ (B = 1.13; 95% CI: 1.06–1.22) and sFLA – $P = 0.0001$ (B = 1.19; 95% CI: 1.09–1.31)] and for failure to discharge home [MMSE – $P = 0.0001$ (B = 1.13; 95%CI: 1.06–1.19); CLOX – $P = 0.007$ (B = 1.12; 95%CI: 1.03–1.21) and sFLA – $P = 0.002$ (B = 1.18; 95%CI: 1.06–1.31)]. The MMSE correlated positively with the CLOX and sFLA ($r = 0.54$: $P = 0.000$ and $r = 0.7$: $P = 0.000$ respectively) and a weaker positive correlation between the CLOX and sFLA ($r = 0.43$: $P = 0.000$). The Receiver Operative Characteristic (ROC) Curves for all tests mirrored each other across the range of scores with similar and modest areas under the curves for the prediction of improvement in BADL and discharge home (BADL: range 0.65–0.68 and discharge home: range 0.70–0.77).
Conclusion: Although the MMSE, CLOX and sFLA assess different aspects of cognition, there seems little benefit of one test over another. Over reliance on these tests alone, to determine the likely outcome of rehabilitation is unjustified and patients should not be denied rehabilitation just because they may be abnormal.

1. Introduction

Rehabilitation is a complex process that requires a combination of physical and cognitive abilities [1]. Cognitive impairment due to dementia or delirium has been recognised to lead to less favourable outcomes such as poor functional recovery, increased length of stay, higher likelihood of nursing home placement and unplanned hospital admission compared with those observed in cognitively intact patients [2]. It has been suggested that people with cognitive impairment have been excluded from access to multi-professional rehabilitation on the assumption that they are unable to benefit [3] even though there is increasing evidence to the contrary [4]. Some rehabilitation services have admission criteria that exclude patients with a cognitive state or mental health status that might interfere with their medical, nursing and therapy treatment [5]. Assessment of cognitive function is therefore an integral part of the process of rehabilitation to determine patient need and also the likely outcome [6]. The results of such assessments are often relied upon to guide decisions about rehabilitation potential. It is however unclear as to what cognitive deficits have the greatest impact on maximal functioning and which of the commonly used cognitive function tests are best to evaluate this [7,8]. We compared three cognitive screening tests that are in widespread use in clinical practice, the Mini-Mental State Exam (MMSE) [9], Clock drawing Test (CLOX1) [10] and a short Frontal Lobe Assessment (sFLA) [11]. Numerous studies have validated the MMSE as a screening tool of cognitive function and shown it to provide a reference standard [12] for other tests. It

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assesses global function assessing orientation, memory, registration, attention and execution. It has been shown to have a lack of sensitivity for patients with mild cognitive impairment or early dementia [13] and a limited ability to assess frontal lobe/executive function and visual-spatial ability [14]. Therefore, we evaluated CLOX and sFLA to determine if there were additional benefits in the use of these tests. Clock drawing tests (CDTs) were developed to test for visuo-spatial dysfunction [15] and have also been shown to assess conceptualization along with verbal and numerical memory [8]. Frontal Assessment tests are also used to screen for dementia and executive dysfunction by assessing conceptualization, mental fluency, programming, sensitivity to interference, inhibitory control and environmental autonomy [16]. By studying three tools simultaneously, applied by the same investigators under the same ward conditions we hoped to determine whether there are differences in the value of assessing different aspects of cognitive function to determine rehabilitation potential and outcome. The aims of this study were to determine how predictive the tools were in determining likely improvement in activities of daily living and discharge home and to test whether assessment of executive and frontal function may be a better determinant than the MMSE of the outcome from rehabilitation.

2. Methods

In a prospective observational study, we evaluated a cohort of 241 consecutive patients admitted for rehabilitation. Patients were recruited by a researcher over a 1-year period (2008–2009) on a 50 bedded general rehabilitation unit for older people in the United Kingdom. Data were obtained by direct patient assessment, referring to notes and interviewing nurses and therapists. Participants were recruited into the study within the first week of admission and followed until discharge. All individuals admitted for rehabilitation had been transferred from an acute setting after an admission with an acute medical or surgical condition. Participants were transferred after being assessed by a multidisciplinary team as having the potential to benefit from rehabilitation by improving their functional ability. Cognitive impairment was not an exclusion criterion. Individuals with hip fracture and stroke were not admitted to these general rehabilitation wards for operational reasons. Individuals transferred were deemed to have sufficiently recovered from their acute illness to be able to participate in the rehabilitation process. As this was an observational study, there was no defined time period for rehabilitation but an analysis was made at discharge or at a cut-off point of 80 days whichever was the sooner. All patients had a MMSE [9], CLOX [10] and a short frontal lobe assessment [17] (sFLA) assessed by questions to test conceptualisation and mental flexibility on admission. The Mini-Mental State Examination (MMSE) as a test of global function was scored as described by the British National Institute for Health and Clinical Excellence guidelines 2006 [18]. Normal was considered as a MMSE 27–30, Mild Cognitive Impairment 21–26, moderate cognitive Impairment 11–20 and severe cognitive impairment 0–10. The Clock Drawing Test (CLOX) is divided into an unprompted task that is sensitive to executive control (CLOX1) and a copied version that is not (CLOX2). We therefore used the CLOX 1 in this study. A cut-off point of ≥ 11 was taken as indicating normal cognition in the CLOX 1 assessment. In the frontal lobe assessment, tests of conceptualisation and mental flexibility were asked. A score of ≤ 8 was taken as abnormal. Assessment of patient mood was done using the Hospital Anxiety and Depression Scale [19]. The HADS is a fourteen-item scale, seven of the items relate to anxiety and seven to depression. Each item is scored from 0–3 and a cut-off point of 8/21 was taken to indicate anxiety or depression.

Functional ability was assessed on admission using the Barthel Activities of Daily Living (BADL) score [20]. This score was calculated within 2 days of admission. Function was then reassessed at discharge. The BADL score is made up of 10 discrete items referring to Activities of Daily Living scoring a maximum of 10 points each domain. As it is not scored in a continuous fashion, our primary outcome was an improvement in the score of at least 5 points in one domain. Information relating to comorbidities was collected and scored using the Charlson Comorbidity Index [21]. Each participant had formal input from physiotherapists, physiotherapy assistants and occupational therapists. Each participant had a personalised rehabilitation plan depending on individual abilities but with the intention of addressing rehabilitation needs on a daily basis. The aim of rehabilitation was that wherever possible there was improvement in mobility and the carrying out of personal activities of daily living. All patients had informal therapy by nursing staff when mobilising and through support for ADL.

Ethical approval was obtained from the Dorset Research Ethics Committee, and consent was obtained from all participants. Participants with severe cognitive impairment who could not give informed consent were included after assent was obtained from their next of kin. If this was not possible they were excluded.

Statistical analysis: categorical data were analysed using Fisher's Exact Probability Test and medians for non-parametric data using the Mann–Whitney U or Kruskal–Wallis Test as appropriate. Univariate and multiple logistic regression analyses were used to investigate the association between the various patient characteristics and improvement in BADL. These variables were studied in a forward selection to build a multiple logistic regression analysis model to identify significant independent variables predisposing to BADL improvement. Receiver Operative Characteristic (ROC) curves were calculated for all 3 scores in relation to the main outcomes of the study of improvement in BADL and discharge home. Analysis was carried out using SPSS version 23 [22].

3. Results

We recruited 241 patients (97 Male) mean (SD) median age was 84.4 (7.27) 85 years. The overall demographic details for the whole cohort show a mean (SD) median length of stay of 36.6 (26.6) 29 days. 223/241 (92.5%) patients were admitted from home. Mortality in this cohort of 241 patients was 26/241 (10.7%). It was possible to perform a MMSE on 241/241 (100%), CLOX on 227/241 (94.2%) and sFLA on 240/241 (99.6%) of the patients. There was an overall statistically significant increase in the mean (SD) median BADL score with rehabilitation [admission BADL 43.5 (21.9) 45 vs. discharge BADL 62.8 (25.7) 70; $P = 0.000$]. Clinical and demographic characteristics that showed significant differences in relation to improvement in BADL and discharge home (Table 1), were included in a forward conditional logistic regression analysis model. Abnormal cognition was an independent risk factor for lack of improvement in BADL whatever the tool used [MMSE – $P = 0.000$ (95%CI: 1.05–1.17); CLOX – $P = 0.007$ (95% CI: 1.06–1.22) and sFLA – $P = 0.0001$ (95% CI: 1.09–1.31)]. Abnormal cognition was also an independent risk factor for a failure to discharge home [MMSE – $P = 0.0001$ (95%CI 1.06–1.19)]; CLOX – $P = 0.007$ (95%CI: 1.03–1.21) and sFLA – $P = 0.002$ (95%CI: 1.06–1.31). A correlation calculation of all of these scores demonstrated a positive correlation of the MMSE with the CLOX and sFLA ($r = 0.54$, $P = 0.000$ and $r = 0.7$, $P = 0.000$ respectively) and a positive but less strong correlation between the CLOX and sFLA ($r = 0.43$, $P = 0.000$).

We evaluated whether there was added benefit of using the sFLA in addition to the MMSE. We found that in the cognitively