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Original research

The inter-rater reliability of the Performance Oriented Mobility Assessment tool after brain surgery

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Abstract

Background/Aims: Falls are a significant cause of hospital admission in the UK and require clinically reasoned intervention from the multi-disciplinary team to ensure the patient receives an effective and efficient treatment including physiotherapy. This study aimed to assess the inter-rater reliability of the Performance Oriented Mobility Assessment in patients who had recently undergone brain surgery.

Methods: A prospective inter-rater reliability study involving 18 male and 12 female patients aged between 27 and 87 years who had recently undergone brain surgery was conducted. Three raters of varying clinical physiotherapy experience assessed participants using the Performance Oriented Mobility Assessment on an acute neurosurgical ward. Inter-rater reliability was measured using Bland–Altman plots and intraclass correlation coefficients.

Results: Bland–Altman plots and intraclass correlation coefficient values demonstrated excellent inter-rater reliability, regardless of the age and sex of the patients or the clinical experience of the rater.

Conclusions: Results suggest that the Performance Oriented Mobility Assessment is a potentially useful tool for assessing patients, particularly for the risk of falls, following brain surgery. Future research is needed to determine other clinimetric properties of this outcome measure before wider implementation.

KEY WORDS

Brain surgery, Inter-rater reliability, Neurosurgery, Performance Oriented Mobility Assessment

Introduction

With estimates indicating over 10000 new cases of brain and intracranial tumours in 2015, plus over 340 000 admissions for acquired brain injury in 2016–2017 in the UK alone, brain surgery is a crucial service of modern health care services (Cancer Research UK, 2015; Headway, 2016). Brain surgery can severely affect a patient's motor function, proprioception, vision, hearing, vestibular function, concentration and perception of their environment. Consequently, patients are at an increased risk of falling after brain surgery, which can lead to a reduced quality of life (Ponsford et al, 2014; Sahu et al, 2017).

Falls are a significant cause of hospital admissions and represent a growing burden on modern health care systems. Patients require evidence-based intervention from a multidisciplinary team (including physiotherapy) to ensure they receive effective and efficient treatments following a fall (Talbot et al, 2005; World Health Organization, 2018). In addition, evidence suggests that a significant number of fall patients are readmitted to hospital as a result of subsequent falls (and related injuries) following their initial discharge. For example, Van Roo et al (2015) showed that, out of 14 887 patients, 2123 were readmitted after discharge because of a subsequent fall. This study also indicated that a reasonable intervention such as falls-risk prevention programmes and discharge planning assessments could possibly have prevented the readmission (Van Roo et al, 2015).

To determine patients' risk of falling and potentially re-injuring or causing further damage following brain surgery, patients are routinely assessed by physiotherapists and, if necessary, are provided with treatment plans. All patients seen by a physiotherapist should be assessed using an appropriate outcome measure, whether that is a routine mobility assessment or part of their long-term rehabilitation plan (The Chartered Society of Physiotherapy, 2013). Despite the increasing number of patients who are discharged from hospital after a relatively short time after brain surgery, there is no literature to support the use of any outcome measures for assessing these patients' risk of falling.

An outcome measure which could potentially be used in patients who have recently undergone brain surgery is the Performance Oriented Mobility Assessment (POMA) (Tinetti, 1986). The POMA assesses patients' risk of falling, as well as their balance and gait. Each patient is given a score out of 28 to categorise their risk. Participants given a score of 19 or less are classified as having a 'high' risk of falling, while a 'medium' risk is indicated by scores of 19–24 and a score of 25 or above represents a 'low' risk. The POMA's clinimetric properties have been tested in similar patient groups, including those with Parkinson's disease, Huntington's disease, and the elderly (Gor-Garcia et al, 2016). In these populations, the POMA has been shown to have good inter- and intra-rater reliability, as well as good validity (Faber et al, 2006; Kegelmeyer et al, 2007; Yucel et al, 2012). The tool is also widely accepted as one of the most 'user-friendly' outcome measures as it requires no equipment and can be completed retrospectively. However, to date there is no data available that supports its use in patients who have recently undergone neurosurgery.

Aim

The aim of this small-scale study was to investigate the inter-rater reliability of the POMA among patients in the post-brain surgery period. To do this, intra-class correlation coefficients (ICCs) were used, as this statistical analysis method indicates both the level of agreement between two measurements and the degree of correlation between the measurements. Therefore, it is a desirable measure of reliability (Koo and Li, 2016).

Methods

Participants

Thirty participants (18 men and 12 women) were recruited for this prospective inter-rater reliability study from an acute neurosurgical ward at a teaching hospital in the UK. Participants were aged between 27 and 87 years (median 61 years) and had undergone a range of surgical procedures, as described in Table 1. Patients were included in the study irrespective of whether they used a mobility aid, but those with pre-existing comorbidities that caused mobility difficulties and those who had also undergone spinal surgery were excluded.

Ethical approval

Ethical approval was obtained from the NHS Health Research Authority, the South Central – Berkshire Research Ethics Committee, REF no. 16/SC/0077, before data was collected. Participants gave written informed consent before taking part in the study. Patients unable to give informed consent were not included in the study.

Data collection

Each patient was assessed as part of their routine discharge process. This was done simultaneously but independently by three raters (R_1, R_2 and R_3). This was done by three raters assessing the same patient at the same time but scoring them on separate records. R_1 was a senior neurological physiotherapist with over 5 years clinical experience, R_2 was a junior physiotherapist with 6 months clinical experience, and R_3 was a physiotherapist with 2 years clinical experience. Before the start of the study, all raters underwent standard training in the use of the POMA. POMA scores from all three raters for each patient were collated to allow subsequent analysis.

Data analysis

Two methods were used to investigate the inter-rater reliability of the POMA. First, Bland–Altman plots were generated. Bland–Altman is a graphical method used to compare two measurement occasions or techniques by plotting the differences (or alternatively, the ratios) between the two measurements against the averages of the measurements (Bland and Altman, 1986). In the present study, Bland–Altman plots were used to show the mean of the POMA scores given by two raters against the difference between their scores for each patient, and thus show the distribution of inter-rater differences in POMA scores. The mean difference (referred to as bias) and its 95% confidence interval (CI) were calculated and included in the plot. The bias represents a systematic difference between raters' scores and should be near to zero to indicate good inter-rater reliability. If the line of equality (zero line) is outside the 95% CI of bias, the systematic difference is considered significant. Bland–Altman plots also show the limits of agreement between two raters, calculated as the mean difference ± 1.96 standard deviations.

The second method calculated the ICCs and 95% CIs using a two-way random-effects model computed in STATA Version 14. Shrout and Fleiss (1979) suggest that an ICC of <0.4 represents poor realiability, while an ICC of 0.4<–<0.75 represents fair to good reliability and ICC>0.75 represents excellent reliability. Similarly, Cohen (1988) defined excellent reliability as ICC>0.85. When using ICCs, it is necessary that the data does not exhibit heteroscedasticity. In this case heteroscedasticity would be evidenced by a correlation between inter-rater differences in POMA scores and the magnitude of the POMA score. Therefore, before calculating ICCs, Pearson's correlation coefficient

(r) for mean and inter-rater differences in POMA scores was calculated and tested for significance. Finally, to explore any potential effect of patient age or sex on reliability, ICCs were also calculated separately for the different age groups and sexes.

Results

The POMA scores obtained by participants ranged between 11 and 28 (out of a maximum of 28), indicating varying degrees of patient mobility. Figure 1 shows the Bland–Altman plots obtained for all 30 patients for (a) R_1 and R_2 (b) R_1 and R_3 and (c) R_2 and R_3. In each plot the bias and its 95% CI are shown as the fine dashed line and bold dashed lines respectively. The solid bold lines show the limits of agreement between the raters. Inspection of each panel shows a near zero bias for each pair of raters, with the line of equality falling within the 95% CI. For R_1 and R_2 bias was –0.07 (95% CI: –0.74, 0.59), for R_1 and R_3 bias was –0.33 (95% CI: –0.97, 0.31) and for R_2 and R_3 bias was –0.27 (95% CI: –0.76, 0.22). For all three pairs or raters limits of agreement indicated POMA scores typically varied by less than approximately 3.5 points.

Inspection of the Bland–Altman plots suggest the data are non-heteroscedastic. This was confirmed for all three pairs of raters by near zero and non-significant r values, thus supporting the use of ICCs as a measure of reliability. An overall ICC value (calculated using all 30 patients and all three raters) was 0.98 (95% CI: 0.96, 0.99). Similar ICCs were obtained for patients aged less than 50 years old (ICC=0.98, 95% CI: 0.93, 0.99), between 50 and 70 years old (ICC=0.96, 95% CI: 0.90, 0.99) and older than 70 years old (ICC=0.99, 95% CI: 0.91, 0.99). Males and females had ICCs of 0.98 (95% CI: 0.97, 0.99) and 0.97 (95% CI: 0.91, 0.99) respectively.

Discussion

To date, no data exist that provide a clinimetric description of the POMA when used to assess patients' risk of falling after brain surgery. A literature search was conducted using OVID, PubMed, Science Direct and Web of Science. From 323 initial results, 7 full texts were reviewed. None of which included a study that was conducted in this patient-population however were in a similar, neurological patient-population. This small-scale study aimed to address this by investigating the inter-rater reliability of the POMA when administered by three physiotherapists with varying clinical experience, for patients who recently experienced a neurosurgical procedure. The findings of this study indicate that the POMA has excellent inter-rater reliability for these patients, regardless of the age and sex of the patients, or the clinical experience of the rater. These findings are consistent with the small number of previous descriptions of POMA inter-rater reliability reported by other authors for other patient groups. For example, excellent inter-rater reliability (i.e. ICC>0.85) has been reported for POMA used by five independent raters with 30 Parkinson's Disease patients (Kegelmeyer et al, 2007). Data from Parkinson's disease patients also indicated reliability was not materially influenced by the experience of the rater. This is consistent with our findings. POMA has also shown to be a reliable measure in elderly patients, with ICCs of 0.86 reported (Yucel et al, 2012) and in residents of nursing care homes (Faber et al, 2006).

Recommendation for future research

It is important to note that it was not the aim of this study to determine what size of difference between rater scores or extent of agreement between raters is clinically acceptable. This is a different research question that requires further investigation. Further, inter-rater reliability is just one clinimetric characteristic that needs to be established before recommending use of a clinical tool. Other important features include intra-rater reliability and predictive and concurrent validity. Further, this study has not specifically explored the potential effect of the severity of patients' balance or mobility disruption on the reliability of the POMA. Further research is required to assess these attributes before the POMA can be used routinely in the neurosurgical setting.

Conclusions

The findings of this study demonstrate that the POMA exhibits excellent inter-rater reliability when used to assess the risk of falls in patients following neurosurgical procedures, regardless of patient age and sex, and the experience of the rater. This is the first step in validating the POMA for use with patients following brain surgery. Further research is required to establish other clinimetric attributes of the POMA in this population.

Table 1. Type and number of surgical procedures

Procedure	Number of patients
Burrhole drainage of CSDH	7
Excision of frontal meningioma	3
Craniotomy for excision/resection of temporal tumour	3
Clipping/coiling of MCA	3
Craniotomy for excision/resection of parietal tumour	2
Craniotomy for ASDH	1
BrainLab guided drainage of cerebellar abscess	1
Evacuation of EDH	1
Decompression of Chiari	1
Debulking of frontal SOL	1
Excision of Acoustic Neuroma	1
Biopsy of cerebral abscess	1
Drainage of posterior fossa cyst	1
Excision of pituitary tumour	1
Microvascular decompression of trigeminal nerve	1
Excision of occipital tumour	1
Webbing of ACOM	1

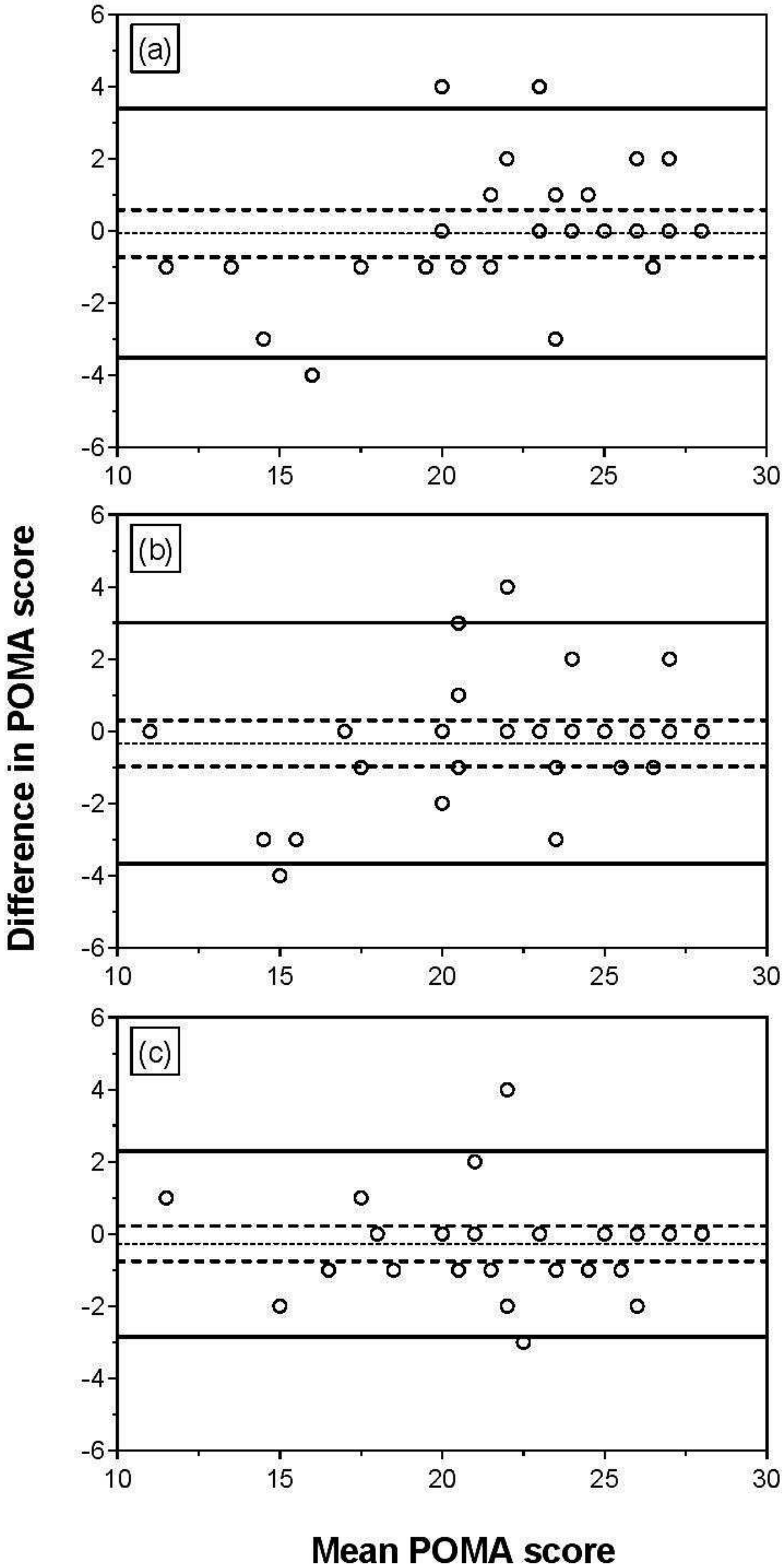

Figure 1. Showing the Bland–Altman plots obtained for all 30 patients for (a) R_1 and R_2 (b) R_1 and R_3 and (c) R_2 and R_3

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