The Neuropsychology Needs of a Hyper-Acute Stroke Unit

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ABSTRACT

Background and aim: Guidelines recommend routine assessment and management of mood and cognition after stroke, but little is known about the value or feasibility of providing neuropsychology input during the hyper-acute period. We aimed to identify and describe the extent and nature of neuropsychological needs and to investigate the feasibility of providing direct neuropsychology input within a hyper-acute setting.

Methods: Over a 7-month period, Multidisciplinary Team (MDT) members of a central London Hyper-Acute Stroke Unit (HASU) identified stroke patients who they believed would benefit from neuropsychology input, and categorised the nature of neuropsychology intervention required. We examined the demographic and clinical characteristics of the patients identified and the type of intervention required.

Results: 23% of patients (101/448) were identified as requiring neuropsychology input. Patients deemed to require input were younger, more likely to be male and more functionally disabled than those not requiring input. Cognitive assessment was the main identified need (93%) followed by mood (29%) and family support (9%). 30% of patients required two types of intervention. During a pilot of neuropsychology provision, 17 patients were seen; 15 completed a full cognitive assessment. All patients assessed presented with cognitive impairment despite three being deemed cognitively intact (> standardised cut-off) using a cognitive screening tool.

Conclusion: We showed that direct neuropsychology input on a HASU is necessary for complex and varied interventions involving cognition, mood and family support. Furthermore, input is feasible and useful in detecting cognitive impairment not revealed by screening instruments.

INTRODUCTION

Cognitive and mood impairments are common following stroke[1-3], have a profound impact on quality of life and are significant predictors of long term functional outcomes [4,5]. Therefore, timely and accurate assessment is crucial for treatment planning and rehabilitation. In 2010, Hyper-Acute Stroke Units (HASUs) were established in the UK to provide rapid assessment and treatment of patients with suspected stroke symptoms. During their 72 hour admission on HASU, patients receive specialist stroke input to provide hyper-acute diagnosis and treatment and determine discharge options. While staffing levels were set for doctors and Multidisciplinary Team (MDT) professionals, it was not until 2016 when the RCP National Stroke Guidelines recognised a need for clinical neuropsychology expertise and recommended 0.2 WTE of neuropsychology per 5 beds[6] (significantly less than all other therapy professions). Little clarity was provided in the guidelines about the exact nature of the work on HASUs deemed necessary to be provided by the Neuropsychologist. Given the high volume and quick turnaround of patients on a HASU the recommended staffing provision does not allow the neuropsychologist to see every patient. However, there is growing evidence that lack of early intervention leads to significant unmet cognitive and emotional needs for stroke patients and their caregivers[7-9]. However, there are concerns regarding whether more comprehensive neuropsychological input in a hyper-acute setting is feasible or warranted[10]. Thus, it is imperative to investigate the exact nature of neuropsychological needs on a HASU in order to optimise the support provided to the patient and the team.

Current guidelines recommend that all stroke inpatients should have routine assessment and management of cognition and mood using validated and standardised tools[6,11]. Quick screening tools such as the Montreal Cognitive Assessment (MoCA)[12] for cognition or the Depression Intensity Scale Circles (DISCs)[13] for mood are often used. The lack of neuropsychology provision on many UK HASUs means that responsibility for cognitive and mood screening often falls to therapists and nurses. However, it is unclear whether such screening is fit for purpose.

First, for some patients a screening tool may not fully capture the breadth of cognitive deficits that result from stroke[14,15]. Alternatively, the use and interpretation of screening tools may be rendered inappropriate and inadequate as a result of common stroke impairments such as aphasia and neglect, or other factors such as education, language or culture[16]. Tailored expert neuropsychological input could thus be useful in ameliorating some of these shortcomings.

Second, around 30% of stroke patients also experience mood difficulties[3,17]. UK guidelines recommend a stepped-care approach to mood assessment and management[18]. According to this approach, all members of the MDT should be competent to provide routine mood screening and low level psychological care to patients and their families. Nevertheless, it has been shown that despite this model, the majority of referrals to Neuropsychology still pertain to mood concerns in Acute Stroke Units (ASU). This is likely because mood difficulties after stroke are complex and often signify other underlying issues such as changed cognition, environmental factors and poor insight[19]. Whether a similar need for direct neuropsychology input into mood difficulties exists within a HASU setting is unknown.

AIMS

We aimed to identify and describe the extent and nature of neuropsychological needs and to investigate the feasibility of providing direct neuropsychology input within a hyper-acute setting.

METHODS

Data were collected on consecutive patients within the Hyper Acute Stroke Unit (HASU) at University College London Hospital NHS Trust (UCLH) across two time periods (February-August 2018 and January-February 2019); data collection was disrupted intermittently due to organisational reasons. The HASU at UCLH is an 18 bed unit that provides a 72 hour front door assessment service for patients with new stroke in the North Central London Sector. The therapy team consists of Occupational Therapy (OT), Physiotherapy, Speech and Language Therapy and Dietetics. Typically,

cognitive screening using the MoCA is conducted by the OT and mood screening by nursing staff. Neuropsychology support is provided off site at the National Hospital for Neurology and Neurosurgery on a referral basis, but there is no funded neuropsychology time on the HASU. During the data collection period, the senior physiotherapist and occupational therapist on HASU were asked to identify stroke patients who they believed would benefit from Neuropsychology input. While there was no direct neuropsychology presence on HASU at the time of the audit, both therapists had experience of working with neuropsychologists in other MDT settings and therefore had an understanding of the role of neuropsychology. After identifying a patient as potentially benefitting from neuropsychology input, they were asked to categorise the nature of input required according to three pre-defined broad categories: 1) cognitive assessment; 2) mood assessment; and 3) family support. These categories were based on the main areas of generally accepted types of intervention a neuropsychologist can provide within an acute hospital setting. We asked the therapists to record in writing additional qualitative information relating to each patient's situation and neuropsychology need to understand in more detail the reasons behind their decisions to identify each patient.

We collected demographic and clinical data for identified patients from their medical records as part of the BRC funded UCL/UCLH platform SIGNaL (Stroke Information Group North and Central London). This included age, sex, stroke type, level of stroke severity using the National Institute of Health Stroke Scale (NIHSS)[20], disability using the Modified Rankin Scale (MRS)[21], functional disability using the Barthel Index[22], cognitive status using the MoCA[12] and mood and anxiety using the Hospital Anxiety and Depression Scale[23], all of which were administered routinely as part of standard clinical care.

To determine the feasibility of Neuropsychology input on HASU, a senior Clinical Neuropsychologist (E.C.) provided eight clinical sessions of input for patients referred following the MDT meeting on HASU over a two month period during June-August 2018. Neuropsychological assessment covered the following seven cognitive domains: general intellectual functioning; verbal

memory; visual memory; naming; visuoperceptual/visuospatial functioning; executive function; and speed of processing. Premorbid intellectual functioning was assessed using the National Adult Reading Test (NART)[24]. Current general intellectual functioning was assessed using the Wechsler Adult Intelligence Scale –Third Edition (WAIS-III)[25] or Advanced Progressive Matrices[26]. Verbal and visual memory functions were assessed with either the Short Recognition Memory Test[27] or the Doors and People Test[28]. Naming skills were examined either with the Graded Naming Test[29] or the Oldfield Naming Test[30]. Visuoperceptual/visuospatial functions were assessed using the Visual Object and Space Perception Battery[31]. Executive functions were examined using one or more of the following tests: the Stroop Test[32], Trail Making Test Part B[33], Weigl Colour Form Sorting Task[34] or Hayling and Brixton Test[35]. Speed of processing was examined using one or more of the following tests: '0' Cancellation, Digit Copy[36], Symbol Digit Modalities Test[37] or Trail Making Test Part A[33]. The results were scored using published normative data adjusting for age and education where applicable. Performance at or below the 5th percentile on any one test was taken to indicated impairment in that respective domain. For intellectual functioning, impairment was classified as a difference of >10 points between IQ score from relevant measure of current intellectual functioning and the respective premorbid functioning score on the National Adult Reading Test.

Statistical analysis

Statistical analyses were performed using SPSS (Version 13.0). Statistical comparison of the demographic and clinical variables was made between patients who were referred for neuropsychology input and those that were not referred using Chi-square for categorical variables and Independent Samples T-test for continuous variables. To explore the additional qualitative written data provided by senior MDT therapists relating to each patient's situation and neuropsychology need, one of the authors (N.M.), used a modified thematic analysis approach to search for themes, and to refine and define themes and subthemes, following guidance outlined by Braun and Clark[38]. This study was conducted in accordance with a Service Evaluation Agreement

approved by the local Clinical Governance Committee (joint UCL Institute of Neurology/National Hospital for Neurology and Neurosurgery).

RESULTS

A total of 101 of 448 (23%) consecutive patients with a diagnosis of stroke admitted to HASU were identified by the MDT as requiring Neuropsychology input. The demographic and clinical characteristics of these patients, as well as those not requiring neuropsychology input, are described in Table 1.

Table 1. Demographic and Clinical Data

Variable/Measure	Identified as needing for Neuropsychology input (n=101)			Not identified as needing Neuropsychology input (n=347)			Group difference
	N	Mean (SD)	Range	N	Mean (SD)	Range	
Age	101	67.4 (14.3)	36-97	347	72.93 (15.12)	20-104	**p<0.01**
Sex (M/F)	63/38			177/170			**p=0.044**
Stroke type (Ischaemic/intracerebral haemorrhage	82/19			290/57			p>0.1
Stroke laterality (Left/Right/Bilateral/Unknown*)	55/37/7/2			177/148/19/3			p>0.1
Modified Rankin Scale	100	3.32 (1.15)	0-5	323	3.17 (1.87)	0-6	p>0.1
Barthel Index	81	12.23 (6.31)	0-20	189	14.60 (6.42)	0-20	**p<0.01**
NIHSS	89	6.18 (6.22)	1-30	342	7.23 (7.37)	0-32	p>0.1
HADS-Anxiety	40	2.9 (3.63)	0-11	164	3.90 (4.23)	0-19	p>0.1
HADS-Depression	40	3.9 (4.50)	0-13	164	5.27 (4.64)	0-21	p=0.093
MoCA	51	20.80 (4.61)	9-29	66	22.38 (7.16)	0-30	p>0.1

*MRI negative clinical stroke

NIHSS: 0=no stroke symptoms; 1-4=minor stroke; 5-15=moderate stroke; 16-20=moderate to severe stroke; 21-42=severe stroke.

MRS: 0=no symptoms; 1=no significant disability; 2=slight disability; 3=moderate disability; 4=moderate to severe disability; 5=severe disability. Modified Barthel Index: <15=moderate functional disability; <10=severe functional disability

Patients identified as requiring neuropsychology input presented with moderate stroke severity (NIHSS[20]), a moderate level of disability (MRS[21]) on discharge from HASU, and a moderate

level of functional disability (Modified Barthel Index[22]). However, there was considerable variability, with some patients identified as having no symptoms at all (MRS = 0: 1%) while others presented with severe disability (MRS= 5: 7%). Similarly, patients selected as needing neuropsychology input ranged from those able to function independently in all activities of daily living (Modified Barthel Index =20: 21%) to those with severe functional disability (Modified Barthel Index =<10: 35%). Of those who completed mood screening, 25% reported depression symptoms while 17% reported anxiety. On the MoCA, 84% of patients scored below cut-off (≤25), suggesting cognitive impairment. In terms of ethnicity, 48% of patients requiring neuropsychology input were White British; 9% were from another White background; 13% were Black African, Caribbean or other Black background; 5% were from an Asian Indian, Bangladeshi or Asian British background; 15% were from another ethnic group; and ethnicity data was not available on 11% of patients.

Compared with patients not requiring Neuropsychology input, patients identified as needing Neuropsychology input were younger, more likely to be male and had greater functional disability. There was no difference between the groups in terms of stroke type, stroke laterality, stroke severity (as measured by NIHSS[20]), disability (as measured by MRS[21]), mood or cognitive impairment.

In terms of discharge destination, the majority of patients identified as having a Neuropsychology need were repatriated to one of 14 local Acute Stroke Units (ASU; 66%). Twenty-eight per cent were discharged home, either with or without Early Supported Discharge (with neuropsychology provision in each ESD team varying according to area). Five per cent were discharged to a private or Level 1 NHS rehabilitation unit, and one patient died prior during his HASU admission.

Neuropsychological Needs

When patients were identified as needing neuropsychology input, therapists were asked to categorise the nature of input required according to three pre-defined options. Table 2 shows how frequently each type of intervention was required, as well as the related qualitative theme and

examples to demonstrate these themes. Cognitive assessment was the most frequently identified

need (93%) while family support (9%) was the least frequent. Thirty-one patients (30%) needed two

types of intervention. In most cases, this was for cognitive with mood assessment (n=23), but family

support (n=8) was also identified as a need along with cognitive assessment.

Table 2. Reasons for neuropsychology intervention - themes and subthemes

Type of Neuropsychological Input Required	Themes/Reason for referral	Description/Examples
Cognitive Assessment (n=94)	Challenging evaluations	Assessment in the context of English as a second language, aphasia, or visual problems.
	Cognitive screen	Assessment in the context of a very low score on a cognitive screening test (e.g., MoCA score 12-14).
	Subtle deficits	Assessment in the context of patients with high premorbid functioning or where functional assessments or screening tests were within normal limits.
	Return to work	Detailed cognitive assessment and feedback required to support planning for return to work.
	Building insight	Assessment to support patient to build insight into cognitive difficulties.
	Cognition and mood overlap	Assessment in the context of low mood or flat affect to disentangle the contribution of mood difficulties from cognition and engagement with therapy.
Mood Assessment and Support (n=29)	Diagnosis and support	To clarify severity of mood difficulty or in the context of pre-morbid drug and alcohol addiction concern
Family Support (n=9)	Need for family support	Family support in the context of a palliative care admission; or family anxious about patient's recovery.

Feasibility of Neuropsychology input on HASU

To examine the feasibility of Neuropsychology input on HASU, a senior Clinical Neuropsychologist was made available to provide input on HASU for eight clinical sessions during a two month period. Seventeen patients were seen; all were referred for cognitive assessment, with one also referred for mood. While all seventeen patients were assessed, two were unable to engage with a full assessment of all seven cognitive domains because of the severity of their cognitive impairment. Fifteen patients were able to complete a full cognitive assessment at bedside that lasted approximately one hour. Of these, all presented with impairment in at least two domains (<5th%ile cut-off), despite three scoring above cut-off on a cognitive screening tool (MoCA). Indeed, one patient who passed the screening test showed impairment in five domains.

For all 15 patients who were able to participate in a full assessment of all cognitive domains, neuropsychology input clarified the nature and extent of cognitive impairment where cognitive screening and/or basic functional assessment failed to highlight deficits. For the remaining two patients, neuropsychology input enabled assessment of cognitive strengths and weaknesses in the context of severe cognitive impairment.

Furthermore, neuropsychology input had a significant impact on management for at least 11 of the 17 patients seen. For two patients, neuropsychology involvement informed capacity assessment relating to discharge and safeguarding decisions, enabling the safe discharge home of one patient and ensuring repatriation in the context of lack of capacity for another. Management relating to mood was a key outcome for a further two patients. For example, one patient was not started on anti-depressant medication after assessment revealed he was not low in mood but instead presented with flat affect related to his stroke. And for six patients, neuropsychology

intervention informed advice and support provided regarding their return to work. Indeed, it was noted that 9 out of the 17 patients referred (53%) were of working age (<65 years), indicating that return to work issues were likely very relevant for many of those seen.

DISCUSSION

Our main study finding was that nearly a quarter of patients admitted with stroke on a HASU needed neuropsychological input. Patients identified as needing neuropsychology input were younger, more likely to be male and had greater functional disability. However, there was no difference between those requiring and those not requiring neuropsychology input in terms of stroke type, laterality, severity, physical disability, mood or cognitive impairment. The reasons for and nature of neuropsychology need varied widely. A third of patients required more than one type of input (e.g. mood issues as well as need for cognitive assessment, or family support). The clinical implication of our results is that direct neuropsychology involvement is needed on a HASU over and above basic cognitive and mood screening; moreover, we demonstrated that this is both feasible and useful.

Our data revealed that the role of neuropsychology on a HASU varied widely. Detailed and tailored cognitive assessment was the main identified need; the MDT felt it was necessary both for patients who passed and failed brief cognitive screening tools. Cognitive assessment was required to support those planning to return to work, but also where there were questions about an individual's capacity to make decisions. Neuropsychology expertise was necessary where there were other stroke impairments or demographic factors making cognitive screening complex or not possible, such as aphasia, neglect, English as a second language. Detailed assessment helped with building insight and to prepare a patient and their family for discharge. Neuropsychology had a critical role to play where there were concerns regarding mood, both to assess and support patients, but also in helping the MDT's understanding of the interplay between mood and cognition. Family needs for support were also identified.

The main reason for neuropsychology intervention was for cognitive assessment (93% of cases),

though a third of patients required input in two or more domains (e.g., cognition and mood). This is

in contrast to two recent audits conducted on ASUs where support for mood or emotional

difficulties were by far the main type of neuropsychology need identified (67% of cases[19]; 56% of

cases[39]). The emphasis on cognition rather than mood on the HASU likely reflects the difference in

focus which is more about rapid triaging and identification of potential risk for discharge home. Clear

understanding of a patient's cognitive ability is crucial to issues such as capacity and formulation of

rehabilitation needs. In addition, the hyper-acute nature of the service also means that many

patients are likely still in shock and so notable mood or emotional difficulties are yet to become

apparent or cause concern for the MDT. This may also reflect an inherent difference in the

therapists' priorities and/or formulation within a HASU setting.

Patients identified as needing neuropsychology input were younger than those not identified as

needing neuropsychology input. This group difference may reflect referrals relating to cognitive

assessment to provide support around return to work. This is to some extent consistent with our

feasibility study, where for 6 out of 17 patients, neuropsychology intervention related directly to

return to work issues. Younger patients may also generally need to be more functionally

independent in society and have greater cognitive demands. These patients may therefore have a

more frequent need for detailed cognitive assessment to determine the level of appropriate

rehabilitation and discharge.

In accordance with the stepped care approach[18], our findings showed that there was both a

direct and indirect role for neuropsychology in assessing and treating mood concerns on HASU. The

mood scores of patients who were identified as requiring neuropsychology input did not significantly

differ from those patients not requiring input. This suggests patients were not identified for

neuropsychology purely because they scored highly on a mood screen. Rather, patients were

identified only when there were more complex mood difficulties such as premorbid mental health

problems, or where mood difficulties were interacting with cognitive impairment or were impeding

assessment/treatment. This need for direct input to support complex mood difficulties is endorsed by qualitative research identifying a clear need highlighted by healthcare professionals within stroke MDTs for psychological expertise at the early stage of the pathway to optimise rehabilitation and recovery further down the pathway[40].

Importantly, we demonstrated that direct neuropsychology input was feasible and useful. Of 17 patients who were referred for and received direct cognitive input, 15 (88%) completed multi-domain neuropsychological assessment during their short stay on HASU. Consistent with previous findings[14,15], impairments were identified that were missed by cognitive screening tools, which has implications for patients being discharged home or repatriated to ASUs without Neuropsychology provision. For patients where cognitive screening was not possible, neuropsychological assessment enabled the identification of cognitive strengths and weaknesses using tailored assessment tools. Neuropsychological intervention helped clarify the nature of cognitive impairment, provided personalised feedback, and informed safeguarding concerns and discharge planning. Our experience provides further support that neuropsychological assessments can be performed very early after stroke[41]. Indeed, early cognitive performance after stroke how been shown to be an informative predictor of long-term functional outcomes[42,43].

While neuropsychological assessment in the hyper-acute setting can be challenging, we would argue that in light of this study's findings, it is both feasible and worthwhile. The hyper-acute stage following stroke is when critical decisions are made about plans for rehabilitation and discharge, both of which are significantly impacted by cognition and mood. Neuropsychology input to these decisions can inform MDT formulations regarding the complexity of a patient's needs, the level and intensity of rehabilitation required, as well as factors such as engagement and capacity. Of course, this information would be most helpful in cases where there is some ambiguity around a patient's rehabilitation and discharge needs. It is also important to recognise that a comprehensive assessment that covers the main cognitive domains does not need to be long to be meaningful[44].

There are several limitations to our findings that should be considered. This study was a single site study; it is possible that neuropsychology needs may differ across HASUs, for example, due to variations in patient characteristics and geographical/social factors. Unfortunately, data on ethnicity was not available for those patients who were not identified as needing neuropsychology input, so we were unable to investigate any potential group differences.

The need for neuropsychological input relied upon the judgement of MDT members; there were no pre-specified criteria or thresholds. As this was the first study into the need of neuropsychology on a HASU, we purposely chose this exploratory "hypothesis-generating" approach. However, a limitation of this approach is that need may be biased by individual MDT member's understanding/concept of the neuropsychology role. A consequence may be that the results potentially underestimate the number of patients that would have benefited from neuropsychology input. Patients with more subtle neuropsychology deficits or needs would likely have been missed. So, while our finding that around one quarter of HASU patients required neuropsychology input is broadly in keeping with the recommended staffing provision of 0.2 WTE Neuropsychologist per 5 HASU beds[6], the actual neuropsychology need is likely to be higher than this. In an ASU audit where there was a Neuropsychologist embedded within the unit, 50% of patients were identified as needing neuropsychology input[19]. It would be important to compare the number of referrals made on a HASU following a period of neuropsychology input on the unit to see how it impacts the number and type of referrals made.

While in a small subset of patients we demonstrated that neuropsychological input was not just feasible but also useful and had a significant positive impact on the clinical management of patients, further more systematic work is needed in a much larger sample. For example, it would be interesting to examine whether the impact of neuropsychology input on a HASU might vary depending on discharge destination, level of impairment and availability of neuropsychology in follow-up services. It would also be interesting to get feedback about the value of neuropsychology

input from MDT members as well as patients and their carers. Furthermore, it is hoped that the themes identified from this study in terms of reasons for referral to neuropsychology will serve as a template for future studies investigating the role and impact of neuropsychology within stroke services.

In conclusion, our study revealed a clear need for direct neuropsychology input on a HASU. Dedicated neuropsychology staffing is necessary to meet the cognitive and emotional needs of patients even at this very early stage following stroke, over and above conducting simple screening. This may be best delivered by way of a "skill-mix" model of psychology staffing consisting of a senior neuropsychologist to provide strategic oversight and highly specialist assessment, supported by clinical and assistant psychologists[39]. Future research should examine how early neuropsychology input might help improve patient care in the longer term and potentially reduce the burden on community healthcare systems.

Declarations of interest: none

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