Functional stroke symptoms: a prospective observational case series.

Short running head: "Functional stroke: a prospective case series."

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Abstract

Objective

Functional symptoms are a common mimic of stroke in acute stroke settings, but there are no clinical guidelines on how to identify or support patients with these symptoms and scant research on their demographic and clinical profile. This paper explores the presentation of patients with functional stroke symptoms at admission to an acute stroke unit and 2-month follow-up.

Methods

We conducted a prospective observational study across four South East London acute stroke units, with a two-month follow-up. Demographic information, clinical data and GP attendances were recorded. Patients completed self-report measures: Cognitive Behavioural Responses Questionnaire short version, Brief Illness Perception Questionnaire, Hospital Anxiety and Depression Scale, Work and Social Adjustment Scale and Short Form Health Survey.

Results

Fifty-six patients (mean age: 50.9 years) were recruited at baseline; 40 with isolated functional symptoms, the remaining functional symptoms in addition to vascular stroke. Thirty-one completed self-report follow-up measures. Of 56 participants, 63% were female. Patients presented symptoms across modalities, with unilateral and limb weakness the most frequent. There was inconsistent and ambiguous recording of symptoms on medical records. Approximately 40% of patients reported levels of anxiety and depression above the threshold indicating a probable diagnosis. Higher anxiety was associated with greater resting or all-or-nothing behaviours, embarrassment avoidance and symptom focussing on the CBRQ measure. Only one general health measure on the SF-36, physical functioning, improved at follow-up. Less than half of participants who responded at follow-up were accessing a treatment, though 82% had ongoing symptoms.

Conclusion

Patients with functional symptoms in stroke settings report substantial distress, associated with cognitive-behavioural responses to symptoms. Follow-up data suggest recovery can be slow, indicating access to supportive interventions should be improved.

Key words: Case series, Functional neurological symptoms, Observational, Prospective, Stroke.

Introduction

A recently described functional syndrome presentation is acute 'functional stroke (mimic)', affecting around 8% of patients presenting to hyperacute stroke units {5}. Systematic review {6} and meta-analyses report 15% of patients presenting to stroke settings without vascular stroke have functional symptoms {7}. Functional symptoms can also occur alongside organic structural illness {8}. For example, a quarter of individuals with organic motor disorders were shown to have a comorbid functional condition (see also {9}) and this may affect their overall prognosis {10}.

Functional stroke patients present with a range of symptoms, {5} with an acute or gradual onset {11, 12}. A retrospective single-site study reported higher rates of weakness, speech and sensory symptoms in patients with functional versus vascular stroke. However, presenting symptoms alone cannot distinguish functional from vascular stroke and associations between symptomatology and clinical outcomes are unknown.

Current evidence suggests functional neurological symptoms are commonly preceded by a significant life or health-related event/injury {12-14}. A history of cardiovascular disease may also predispose individuals to view stroke-like symptoms as a more significant health event, with consequences for help-seeking and clinician responses.

Illness Cognitions and Psychiatric comorbidity

Explanatory models of functional disorders associate symptom onset and maintenance with cognitive biases and behavioural responses {15-17}. Clinicians describe a reluctance to discuss functional symptoms out of concerns that such conversations may damage patient-clinician relationships {18}. Unfortunately, this leaves patients without an explanation {19-21} and may impact how they view and respond to symptoms. Compared to those with other neurological conditions, patients with functional neurological symptoms report lower levels of personal control {22} and are less likely to associate symptoms with life events/stress {23}.

Individuals with functional symptoms and physical comorbidities show greater 12-month prevalence rates of anxiety, mood and substance use disorders compared to individuals with no health-related symptoms {24}. However, the presence of a psychiatric comorbidity or psychological stressor is not invariable, as reflected by the new DSM-V criteria {25}. It may be difficult to determine if psychiatric symptoms precede or follow functional symptoms, but in any event, psychological distress is associated with poorer clinical outcomes {26}. In interviews, patients commonly report panic symptoms at the onset of functional motor symptoms {12, 27}.

Anxiety may precipitate functional stroke symptoms, as physiological stress-responses induce physical sensations, reinforce threat-perceptions and initiate unhelpful behavioural responses {15, 16, 28}. In a prospective study of patients with a new diagnosis of stroke/TIA {29}; 22% patients met criteria for an anxiety disorder, and this was associated with phobic avoidance, poorer quality of life and lower independence. Different profiles of cognitive and behavioural responses to symptoms have also been associated with anxiety and depression in chronic fatigue syndrome {30}. We expect similar associations in individuals with functional stroke symptoms, particularly given the added uncertainty surrounding them and limited access to support {19-21}.

Given the sparsity of literature we set out to recruit a consecutive cohort of patients presenting to acute stroke services with functional stroke symptoms to gain an overview of their presentation and movement through the stroke care pathway; more specifically we set out to study their clinical presentation, current treatment and referral approaches, and cognitive-behavioural responses to

symptoms. We hoped our findings could be the basis for better identification and management of patients with functional symptoms in stroke services. We predicted that:

1. Patients will show a wide range of stroke-like symptoms and be subject to extensive medical stroke investigations during admission.
2. A high proportion of patients with functional stroke symptoms will have comorbid physical health conditions, cardiovascular risk factors or a recent history of a significant health event.
3. Patients with functional stroke symptoms will score low on their understanding and sense of control over symptoms, sustained at 2-month follow-up.
4. Patients with functional stroke symptoms will report high levels of anxiety.

Methods

Study setting

Participants were prospectively recruited from 3 hyperacute stroke units (HASUs) and one non-hyperacute unit across four hospital sites in South London and Kent: King's College Hospital, Princess Royal University Hospital, St George's Hospital, and St Thomas' Hospital.

Data collection

Participants were recruited between 4th January 2019 and 31st May 2019. Two researchers attended daily clinical meetings and ward rounds to screen eligible patients. In some cases where researchers were not present at patient admission, stroke clinicians notified researchers of potential participants.

Inclusion Criteria

i. Admitted to a stroke unit with suspected stroke
ii. No stroke aetiology but possible functional presentation; or stroke aetiology with functional symptoms
iii. Aged ≥18 years
iv. Able to communicate in English

Exclusion Criteria

i. Unable to read English questionnaires
ii. Unable to give fully informed consent
iii. Functional explanation ruled out by symptoms being attributed to another stroke mimic diagnosis

Timeline of data collection

Baseline

Potential participants were identified following physical examination by stroke clinicians, and often after reviewing of imaging results. If a potential participant was identified, the researcher would approach the medical team to confirm suitability. If deemed eligible, a member of the medical team approached the patient and introduced the researcher to give more details. The researcher described the study, discussed the study information sheet and provided a consent form before completing baseline measures at the bedside. If a potential participant was discharged before being seen, study documents were sent by post and they were consented remotely by phone. With consent, researchers collected clinical notes on patients' admission to the stroke ward and requested the patient's previous five years of GP records.

2-month follow-up

Two months after admission, participants who consented were approached to complete the validated self-report questionnaires and report on any ongoing symptoms, treatments or interventions. Follow-up measures were completed by post, phone or online.

Measures

Cognitive Behavioural Responses Questionnaire – short version (CBRQ)

The CBRQ is an 18-item questionnaire measuring responses to symptoms. Each item is rated from 0 (strongly disagree) to 4 (strongly agree). There are six subscales of three items each measuring different behavioural/cognitive factors: Fear avoidance (e.g. "Physical activity makes my symptoms worse"), Damage beliefs (e.g. "Even though I experience symptoms, I don't think they are actually harming me"), Embarrassment (e.g. "I am embarrassed about my symptoms"), Symptom focusing (e.g. "I think a great deal about my symptoms"), All-or-nothing behaviour (e.g. "I find myself rushing to get things done before I crash") and Resting behaviour (e.g. "I stay in bed to control my symptoms"). Scores are summed across items for each subscale, with higher scores indicating less helpful symptom-related cognitions. The CBRQ has been validated across two chronic fatigue syndrome cohorts and shows good validity, reliability (Cronbach's α=0.67-0.88) and high factor loadings {31}.

Hospital Anxiety and Depression Scale (HADS)

HADS is a 14-item, brief self-report measure consisting of two subscales, developed to identify anxiety and depression in hospital or outpatient settings {32} and shows good validity and reliability {33}. Items are scored from 0-4. Scores of ≤7 for each subscale are considered in normal range, scores of 8-10 are possible cases and scores of ≥11 are probable cases {32}.

Brief Illness Perception Questionnaire (IPQ-B)

IPQ-B consists of 9 items scored from 0-10 {34}. Participants are asked to rate the effect of symptoms on their life, symptom duration, control, understanding and experience of symptoms, etc. Scores on the subscales correlate quality of life and future disability {35, 36}.

Work and Social Adjustment Scale (WSAS)

The WSAS is a simple 5-item scale measuring functioning, assessing the impact of symptoms on work, home, social activities and relationships. Each item is scored on a scale from 0 (not at all impaired) to 8 (very severely impaired). It has good validity, reliability and correlates with psychiatric symptom severity {37}.

36-Item Short Form Survey (SF-36)

The SF-36 is a questionnaire used to assess general health status across 8 domains: general health perceptions; physical functioning; limitations from physical health; limitations from emotional health; bodily pain; energy/vitality; social functioning; and mental health {38}. An algorithm transforms raw scores into scores ranging from 0-100; lower scores indicate poorer health {39}. Summary scores are calculated for the 8 health dimensions {40}.

Additional clinical information

Clinical information gathered for a participant's admission included: symptoms at admission, pre-admission risk factors, tests/scans undertaken during admission, comorbid conditions and length of hospital stay. Diagnoses were collected at two time-points: first, initial diagnoses at admission, usually indicated in notes from the emergency department or after the patient's first assessment by the stroke team and second, from the discharge summary sent to GPs. These diagnoses were

recorded verbatim from medical notes and then grouped. To avoid bias in summarised clinical notes, and ensure an accurate, comprehensive insight to diagnosis, a third 'consensus' diagnosis was allocated by the researchers based on discussion with consultants, the stroke team and after collating all medical notes for the admission.

Ethical considerations

Ethical approval was granted by Health and Research Authority on 10th December 2018 (IRAS reference: 245303) and Riverside Research Ethics Committee (Reference: 18/LO/1878).

Statistical analysis

Relationships between psychological distress and illness perceptions were examined using Spearman's Rho correlation. Independent t-tests were used to compare responses to CBRQ items in those with/without anxiety or depression (i.e. HADS anxiety/depression scores >8). Baseline and 2-month follow-up survey responses from respondents at both time-points were compared using paired sample t-tests or Wilcoxon signed rank tests depending on the distribution of variables. An adjusted p-value of .002 for time-point comparisons was used. No cases were excluded for missing data. Where participants had missing items within a measure, scores were prorated on the average of other complete items.

Results

Sample characteristics

Fifty-six participants (35 females) were recruited (see Table 1 for demographic information). One participant withdrew from the study before completing self-report questionnaires. GP records were available for 42 (75%) participants, with 16 (28% GPs records) accessed from electronic patient records. Two-month follow-up measures were completed by 34 participants (61%), with three giving only partial follow-up information by not completing self-report questionnaires. Of the 34 participants who completed follow-up measures, 25 were judged to have isolated functional symptoms and 9 had functional symptoms in addition to stroke or other medical conditions. The mean number of days between baseline and follow-up measures was 64 (SD: 20.4 days). Comparing responders at follow-up to non-responders, there were no statistically significant differences in age, duration of symptoms, sex, ethnicity or occupational status (results available from authors on request).

Table 1. Participant demographic and clinical information

Characteristic	**Mean (SD)**
Age	50.9 years (13.7)
	Median (range)
Symptom duration	7 days (0.5 days-11 years)
	n (%)
Sex	
Female	35 (63)
Ethnicity	
White	28 (50)
Black/ African/ Caribbean/ Black British	21 (38)
Mixed/ Multiple ethnic groups	4 (7)
Asian or Asian British	3 (5)

Marital status	
Married/ Cohabiting	21 (38)
Single	18 (32)
Divorced/ Separated	12 (21)
Widowed	5 (9)
Occupational status	
Employed full-time	21 (38)
Unemployed/ sick-leave or disabled	13 (23)
Retired	9 (16)
Employed part-time/ self employed	8 (14)
Other†	5 (9)

† Including Student, Carer.

Clinical information

Admission and discharge information

Thirty-four patients (61%) arrived at hospital emergency departments by ambulance, Face-Arm-Speech-Test (FAST) screening test positive; one arrived by ambulance but was FAST negative; two were inpatient referrals; eight were transferred from another hospital; eleven were self-presentations at A&E. Five (9%) patients received thrombolysis and none of these had suffered a vascular stroke; as such 13% patients identified as experiencing only functional symptoms according to their consensus diagnosis received thrombolysis. With respect to medical attention, 50 (89%) patients had computed tomography-head (CT-head) and 43 (79%) received a magnetic resonance imaging (MRI) scan. One CT-head demonstrated a definite infarct and one demonstrated a possible infarct. Two MRI scans confirmed an acute infarct and five reported incidental findings. Further investigations included electrocardiogram (ECG) (n=31, 55%), CT-angiogram (n=28, 50%), chest x-ray (n=15, 27%), doppler ultrasound (n=8, 14%), echocardiogram (n=4, 7%) and CT-spine (n=2, 4%). Length of stay before discharge from the stroke team ranged from two hours to 41 days (median=1.5 days). Fifty-two patients (93%) were sent directly back into the community. Two patients were transferred to another hospital ward and two were referred to a local hospital.

Presenting symptoms

Patients reported a range of sensory, motor and language symptoms. Mean number of symptoms at admission was 5.4 (min=1, max=11). Unilateral symptoms affected 89% patients; three experienced both bilateral and unilateral symptoms during admission. Eight clinical files reported explicit positive 'functional disorder' signs: five recorded positive Hoover's signs, one recorded give-way weakness and one recorded drift with no pronation. Seven further clinical notes included phrases indicative of positive signs for functional symptoms: one recorded "Abnormalities do not fit anatomically", five used terms: inconsistent, variable, fluctuating, intermittent or atypical and one recorded "semi-volitional right arm drift". Appendix C shows the frequency of presenting symptoms reported for participants with isolated functional symptoms and those with functional 'overlay'. These two groups could not be meaningfully compared statistically due to small and different sample sizes.

Medical history

Combining patient self-report comorbid health conditions and notes from hospital records, 18 (32%) patients had psychiatric conditions currently or in the past, 44 (79%) had cardiovascular risk factors (e.g. high blood pressure, family history of cardiovascular disease, type 2 diabetes) and 15 (27%) had past history of stroke or transient ischemic attack (TIA). Twelve (21%) patients had a previous hospital admission for similar symptoms, while eight (14%) had experienced other unexplained symptoms, including 5 who had a history of non-epileptic (dissociative) seizures or unexplained chest

pain. Two patients had psychological trauma recorded in medical notes or self-reported. Twenty-seven GP records provided consultation statistics. From these records, patients had a mean of 25 GP contacts (range: 1-69 consultations) at surgery or by phone in the last 5 years, i.e. 5/year.

Follow-up symptoms and treatment

At follow-up, 28 (82%) responders (51% participants completing baseline measures) were experiencing ongoing symptoms. New symptoms, not reported at baseline, were exhaustion/fatigue (n=6) and memory problems (n=3). Laterality of symptoms remained the same apart from two cases where symptoms became bilateral. The greatest proportion of patients reported being much improved (n=13, 42%), followed by no change (n=7, 23%), very much improved and minimally worse (both n=5, 16%) and very much worse (n=1, 3%). Fourteen participants reported not being offered any treatment or follow-up investigations, 12 of these participants had isolated functional symptoms according to summary diagnoses (Appendix D). Three were referred to a specialist, tailored for functional symptoms treatment (two with isolated functional symptoms and one with functional symptoms in addition to another medical condition) and three were referred to mental health services (two with isolated functional symptoms and one with functional symptoms in addition to a stroke). Eight participants reported being referred for physiotherapy or rehabilitation.

Table 2. Frequency (F) of presenting symptoms recorded in patient clinical notes.

Laterality		**Pain**		**Systemic / autonomic**		**Speech/ swallow**		**Motor**		**Onset**		**Sensory**		**Visual**		**Other**	
Symptom	*F*	*Symptom*	*F*	*Symptom*	*F*	*Symptom*	*F*	*Symptom*	*F*	*Symptom*	*F*	*Symptom*	*F*	*Symptom*	*F*	*Symptom*	*F*
Unilateral	50	Headache/ migraine	23	Dizziness	9	Dysarthria/ Slurred speech	17	Lower limb weakness	45	Confusion/ disorientation	6	Upper limb sensory change	22	Visual loss	15	Inconsistent/ intermittent	1 1
Bilateral	6	Pain in limbs or body	13	LOC[†] syncope	5	Aphasia	10	Upper limb weakness	41	Onset on waking	5	Lower limb sensory change	19	Diplopia	2	Photophobia	1
				Feeling slow/tired	5	Stuttering	5	Facial droop/ weakness	13	Noticed by someone else	3	Facial numbness	12	Nystagmus	1	Twitching	1
				Panic	4	Swallow symptoms	2	Limb ataxia	8	Dissociation	1			Ptosis	1	Phonophobia	1
				Nausea	3			Tremor/ shaking	6							Vertigo	1
				Vomiting	2			Hand weakness	3							Erratic behaviour	1
				Seizure	1			Gait	4							Shortness of breath	1

[†]LOC= Loss of consciousness

Diagnoses at admission and discharge

There were 53 initial diagnoses recorded at admission and 47 diagnoses noted on discharge summaries (Appendix A), collated into the groups seen in Table 3. A list of all diagnoses verbatim from notes alongside their categories can be seen in Appendix A. As expected at admission, initial diagnoses included multiple differentials or "possible/query" diagnoses. In discharge summaries the terms "stress", "anxiety" and "transient" were possibly used as euphemisms for functional symptoms. In three cases, 'negative' diagnoses were stated on discharge summaries (i.e. no organic pathology or non-stroke). Only 64% patients had 'functional symptoms' recorded on their discharge summary.

Table 3. Diagnoses given in clinical notes at admission and discharge.

Initial diagnoses at admission		**Discharge summary diagnoses**		**Consensus diagnoses**	
Diagnosis listed	n	Diagnosis listed	n	Diagnosis listed	n
Stroke	14	Functional diagnosis	24	Functional symptoms	40
Functional symptoms	11	Stroke	6	Stroke with functional sx	11
Possible stroke	10	Migraine with functional sx	5	Migraine with functional sx	5
Stroke or functional	6	Migraine	4		
TIA	3	Functional overlay	4		
Stroke/TIA, migraine or functional	3	Stroke with functional sx	3		
Migraine or stroke	3	Negative diagnosis	3		
Other physical condition with functional	2	Stress exacerbated physical pathology	2		
Migraine and functional sx	2	No diagnosis stated	2		
Leg weakness	1	Anxiety exacerbated physical pathology	1		
Seizure	1	TIA	1		
		Transient neurological sx	1		

sx=symptoms

Self-report measures

Baseline

Totals for questionnaire scales completed at baseline (n=55) and follow-up (n=31) are described in Table 5. Responses to the final BIPQ question on contributory factors were grouped into 15 categories (Table 6). Twenty-three patients stated stress (work, family or social) as the most important cause of symptoms. The second most frequently reported cause was physical illness, injury or cardiovascular risk factors (n=17). Overwork, lack of rest or tiredness, anxiety and worry were also frequently endorsed. Eight patients had no understanding or could not identify any cause for their symptoms. One of the patients endorsing stroke/TIA as a cause had not experienced a vascular stroke.

Associations between distress and cognitive-behavioural responses

Total baseline HADS anxiety scores significantly correlated with Embarrassment Avoidance, Symptom Focusing, All or Nothing Behaviour and Resting Behaviour. Baseline HADS depression scores were correlated with Embarrassment Avoidance (Table 4).

Table 4. Spearman's Rho correlation coefficients between HADS anxiety and depression scores and CBRQ subscale scores.

	Fear avoidance	Damage beliefs	Embarrassment	Symptom focusing	All or nothing behaviour	Resting behaviour
HADS anxiety	.245	.100	.393**	.393**	.284*	.309*
HADS depression	.245	-.103	.532**	.127	-.065	.146

* statistically significant to .05 level. **statistically significant to .01 level

Potential anxiety vs non-anxiety cases

The 21 (38.2%) patients who were 'probable' cases of anxiety (HADS-A ≥11) had higher scores on Embarrassment Avoidance (means: 4.24 vs 7.00, $t(53)= -2.41$, $p=.019$) and Symptom Focusing (means: 7.03 vs 8.86, $t(53)= -2.28$, $p=.027$).

Potential depression vs non-depression cases

Ten (18.2%) participants scored ≥11 on HADS-D and scored more highly on Embarrassment avoidance than those who were not depression cases (means: 8.50 vs 4.58, $t(53)= -2.76$, $p=.008$).

Follow-up self-report measures

Social and emotional functioning scores on the SF-36 and fear avoidance scores worsened at follow-up (Table 5), but not to a statistically significant level. A statistically significant improvement between baseline and follow-up was observed for physical functioning ($Z= 420.5$, $p=.001$) (Figure 1) and damage beliefs ($t(30)=2.99$, $p=.005$, 95% CIs: 0.50, 2.66), though differences in damage beliefs were not statistically significant. At follow-up, physical illness, injury or cardiovascular risk factors were the most common attribution of symptom cause, followed by stress, overworking and stroke/TIA.

Table 5. Questionnaire subscale totals at baseline and follow-up.

		Baseline (n=55)		2-month follow-up (n=31)	
Questionnaire	Sub-scale (each score out of 100)	Mean	SD	Mean	SD
Short-form Health Survey	Physical functioning	41.5	30.3	58.5	29.2
	Role limitations due to physical health	35.9	40.5	33.1	40.5
	Role limitations due to emotional problems	52.2	42.9	52.7	43.7
	Energy/fatigue	35.2	22.6	35.6	25.1
	Emotional well-being	61.8	25.5	54.7	31.3
	Social functioning	56.8	32.5	46.4	34.8
	Pain	42.5	30.3	46.2	34.7
	General health	47.5	23.3	41.2	22.7
Hospital Anxiety and Depression Scale	HADS Anxiety total	9.2	4.9	9.7	6.6
	HADS Depression total	6.4	4.2	6.9	5.2
Cognitive Behavioural Responses Questionnaire	Fear avoidance total	4.5	2.3	5.6	2.9
	Damage beliefs total	8.3	2.2	6.6	2.4
	Embarrassment avoidance total	5.3	4.3	4.6	4.7
	Symptom focusing total	7.7	3.0	7.4	3.6
	All or nothing behaviour total	8.0	3.3	7.5	4.0
	Resting behaviour total	5.3	3.5	5.2	3.5
Work and Social Adjustment Scale	Work impaired	5.5	2.7	4.9	3.3
	Home management impaired	5.0	2.7	4.4	2.8
	Social leisure impaired total	4.7	3.2	4.0	3.1
	Private leisure impaired total	4.1	3.1	3.1	2.8
	Relationships impaired total	2.7	2.8	2.9	3.2
	WSAS total	23	23	18.9	12.3
Brief Illness Perception Questionnaire	Consequences	6.8	2.8	6.2	3.2
	Timeline	4.9	3.3	5.2	2.7
	Personal control	6.8	2.9	6.7	3.2
	Treatment control	2.9	2.8	4.4	3.7
	Identity	6.6	2.7	6.5	2.6
	Concern	7.2	3.4	6.4	3.4
	Understanding	5.2	3.6	5.4	3.6
	Emotional response	6.8	3.1	6.5	3.3

Table 6. Most important causes of symptoms reported by patients

	Baseline		2-month follow-up	
Cause of symptom categories	Frequency category endorsed	Number patients endorsing cause	Frequency category endorsed	Number patients endorsing cause
Stress	38	33	11	11
Physical illness, injury or risk factor	17	16	13	12
Overworking, lack of rest, tiredness	13	11	9	7
Anxiety or worry	11	8	1	1
No understanding or response	8	8		
Sleep	6	6	2	2
Migraine or headache	5	5		
General health-related factors	5	5	5	4
Stroke or TIA	4	4	6	6
Medical procedures or medication	3	2	3	3
Bereavement	3	3		
Psychiatric history	2	2	1	1
Psychological trauma	2	2		
Lack research/knowledge	2	3		
Family history/ hereditary	1	1		

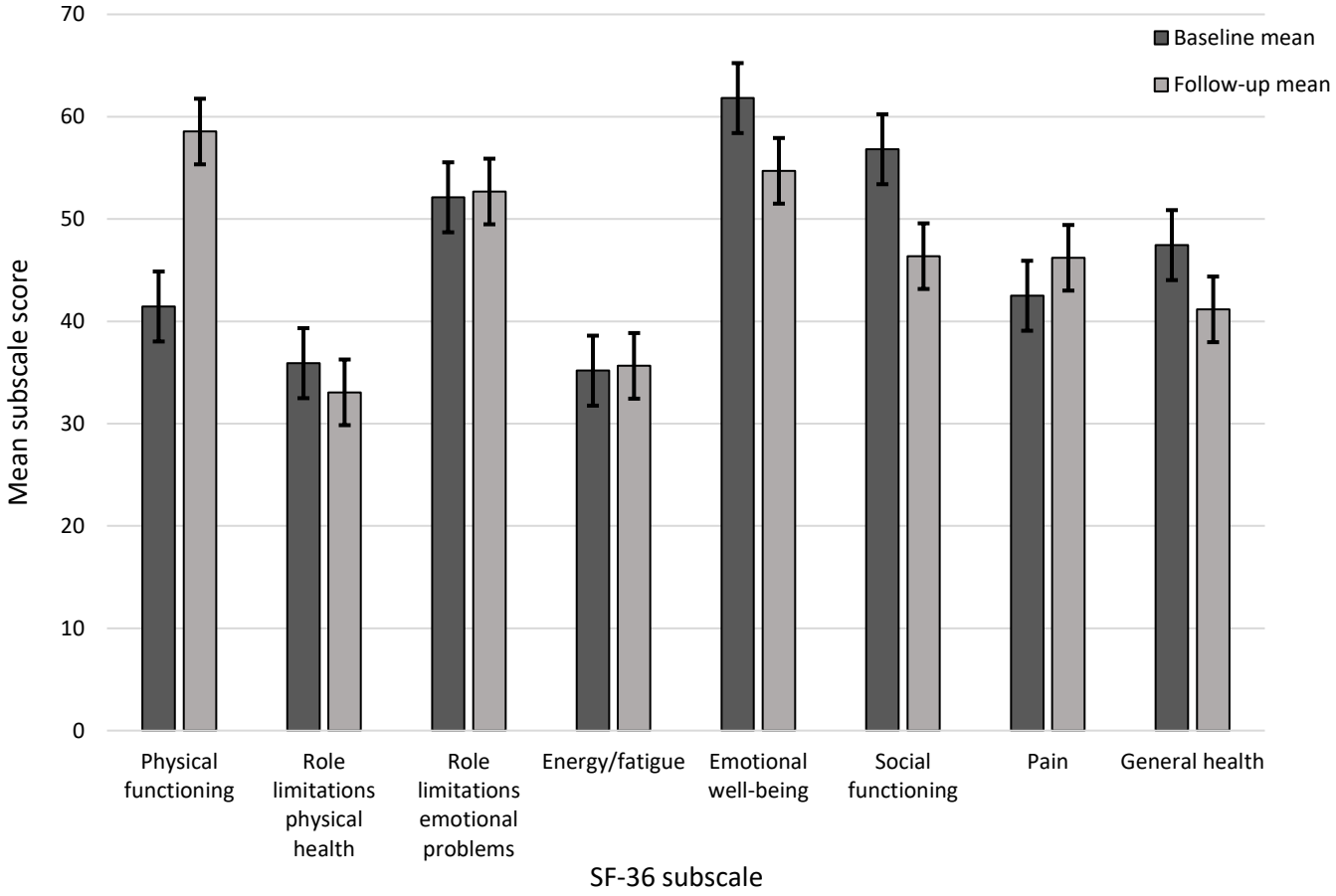

Figure 1. Mean subscale scores of short from health survey at baseline and 2-month follow-up.

Discussion

This paper describes the demographic and clinical characteristics of a prospective sample of 56 patients with functional stroke symptoms, with a two-month follow-up. There was a higher proportion of females, consistent with epidemiological research {2}. Presenting neurological symptoms were heterogeneous. Amongst patients who agreed to follow-up, 82% had ongoing symptoms but only 46% had been offered or were receiving any treatment. In line with our predictions, almost 40% patients reached the cut-off indicating a probable diagnosis of anxiety and approximately half reached this level for depression. Levels of anxiety were correlated with illness beliefs and adjustment; in particular, all-or-nothing and resting behaviours, embarrassment avoidance, symptom focussing and resting behaviours. Anxiety cases reported greater symptom focussing and embarrassment avoidance than non-cases. Depression scores correlated with embarrassment avoidance, as found previously in patients with chronic fatigue {30}. Patients with functional stroke symptoms reported only moderate understanding and little sense of control over symptoms. Consistent with our hypotheses, self-report measures were mostly stable at follow-up, with only physical functioning improving significantly.

Clinical profile

Almost all patients had unilateral symptoms and, most frequently limb weakness. Sixteen (28.6%) were judged to have functional symptoms in addition to a vascular stroke or migraine. There were inconsistencies between diagnoses at admission, consensus diagnoses gained from discussion/clinical notes and diagnoses at discharge. This suggests real uncertainties in making a firm diagnosis in the acute stroke setting. Nevertheless, there is a need for clear, detailed medical notes; accurate diagnoses are consequential for ongoing care, as discharge summaries are used by GPs and other health care professionals to guide long term treatment. A third of participants had current or past psychiatric diagnoses. Formal psychiatric comorbidity was therefore not a reliable indicator of functional symptoms {2, 16}. Just over three quarters (78.6%) had cardiovascular risk factors and approximately a fifth reported recent surgery, illness or injury supports. Notably, two thirds of patients did not give a past history of unexplained or functional symptoms, suggesting that for most, this was the first time they had experienced them. These findings are similar to acute functional motor disorder {12} and suggest that relevant physical health related factors are pertinent in shaping patients' symptoms as well as medical responses to such symptoms. A history of psychological trauma was only identified in two patients, though it is unlikely this would have been explored in consultations with stroke clinicians.

Investigations

89% received a CT-head scan and 79% underwent a MRI. High figures for imaging utilisation may reflect changes to UK stroke care targets aiming to increase the proportion of suspected stroke patients receiving brain imaging within 12 hours of an emergency admission {41}. Previous estimates from the US {42} have reported between 92-95% patients with a final diagnosis of stroke after emergency admission received CT imaging while MRI usage ranged from 55-79% across states, placing our findings at the higher end of imaging utilisation and indicating patients with functional symptoms contribute a substantial cost to stroke services.

Perceptions and impact of symptoms

Functional stroke symptoms were associated with a high level of self-reported symptoms in general with associated high levels of concern about their severity and consequences. Similar to Binzer (1997) {22} patients reported relatively low levels of personal control over symptoms.

The range of symptom attributions made by participants reflected the three dimensions proposed by Robbins and Kirmayer (1991): psychological, somatic and normalising. As such, patients demonstrated a reasonably flexible approach which should give confidence to clinicians working with such patients {23}. Symptom attributions remained varied at 2-month follow-up, with physical attributions, overwork and stress being the most frequent again.

The stability of most of the self-report measures (over this relatively short period) likely corresponds to the fact that the majority (82%) of patients experienced ongoing symptoms, though most said their overall condition had improved. Although physical functioning improved significantly, scores remained rather low compared to general population samples {39}.

Implications

Our findings go some way in explaining how patients without stroke end up in the stroke pathway. Having not had similar experiences before and with an awareness of cardiovascular risk factors, the patients may be more likely to engage in symptom focussing and perceive symptoms as a sinister health event, leading them to present to emergency services. Once in the stroke system, it is the burden of the stroke clinician to provide evidence against a stroke amidst uncertainties. This may sustain anxiety and promote dysfunctional behavioural responses.

Despite the persistence of symptoms, less than half of patients were offered treatment or support. This highlights the need for a clearer care pathway for this patient group. The average annual GP attendance rate for our sample was already greater than the national average which has been estimated at 3.8 consultations per year {44}. Offering an intervention for ongoing neurological symptoms could lead to healthcare savings in the long term.

Strengths and limitations

This paper built on previous retrospective research {5} by collecting a prospective sample. There was some attrition, which could have biased our results and certainly limited the power of our analyses. Self-report measures may result in an underestimate of psychological distress since patients with functional symptoms may have a lower recognition of anxiety symptoms {45}. Unfortunately, we were unable to recruit a vascular stroke control group. This n would have allowed us to comment on the specificity of the characteristics found within our cohort. Future research may seek to recruit a larger sample, with a suitable control group, and address attrition, enabling the use of more powerful statistical analyses to predict outcomes and identify important clinical sub-groups. Positioning researchers in emergency departments may be one way of increasing sample size. Furthermore, exploring differences between patients discharged from emergency departments versus inpatient admissions may give insight to how functional symptoms are identified in stroke settings. Research using a structured clinical interview would add robust diagnoses to our findings on psychological distress. Finally, expert consensus on the diagnosis of migraine and its implications in stroke settings would be valuable.

We acknowledge that while brain imaging is a sensitive tool for identifying vascular stroke, it is possible for some to go undetected. However, the experienced, specialist stroke clinicians providing diagnosis, and the tendency to err on the side of caution suggests that few cases would be missed. Conversely, functional symptoms are often very underreported, especially in conventional stroke services. Symptoms like dissociation are unlikely to be spontaneously reported by patients and physicians in these environments are unlikely to directly ask about them. False negative functional diagnoses probably affected our sample and is a general concern.

Conclusion

Patients with functional stroke report broadly similar responses to symptoms as patients with functional motor symptoms in outpatient settings. Patients report high levels of psychological distress, especially anxiety, sustained at 2-month follow-up. Patients receive intense medical investigations, but the recording of functional diagnoses was inconsistent – a finding reflected in patients' own understanding. Despite most followed-up responders experiencing ongoing symptoms, less than half were offered an intervention. There is a need for clearer guidance on communicating functional diagnoses and support with these symptoms in acute stroke settings.

Declaration of interests

The authors have no competing interests.

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Appendix A. Table of consensus, initial admission and discharge summary diagnoses groups with original diagnoses verbatim from clinical notes.

Consensus diagnosis	Admission diagnosis group	Verbatim Initial diagnosis	Discharge diagnosis group	Verbatim discharge summary diagnoses
Functional	Possible stroke	Possible small somatosensory stroke	No dx stated	None given
Functional	Possible stroke	Possible ischemic stroke	No dx stated	No diagnosis
Functional	Stroke	Clinical R MCA infarct	Negative dx	No acute infarction
Functional	Stroke	R MCA	Negative dx	Non-stroke possibility functional
Functional	Stroke/TIA, migraine or functional	?New vascular event ?non-organic element -/+ migraine	Negative dx	Headache and paraesthesia L leg -> No organic cause found
Functional	Possible stroke	?Pontine infarct	Functional dx or label	Functional Motor Disorder
Functional	Possible stroke	Differential dx stroke	Functional dx or label	Functional Neurological symptom disorder with mixed symptoms
Functional	Possible stroke	Subacute left MCA infarct, differential dx peripheral neuropathy	Functional dx or label	Functional with possible brachial plexus injury
Overlay	Possible stroke	? RPOCS, L MCA infarct	Functional dx or label	FNS w/dizziness and speech disturbance
Functional	TIA	A & E: TIA (suspected diagnosis)	Functional dx or label	From A&E: TIA, From clinic: functional
Functional	Functional symptoms	Functional neurological symptoms	Functional dx or label	Functional Neurological disorder
Functional	Functional symptoms	Functional neurological symptoms	Functional dx or label	Functional Neurological Symptoms
Functional	Stroke or functional	?Stroke vs ?Mimic	Functional dx or label	Panic attack and Functional neurological disorder
Functional	Leg weakness	Leg weakness	Functional dx or label	Functional Neurological Syndrome
Functional	Stroke	Acute right MCA syndrome	Functional dx or label	Functional disorder
Functional	Functional symptoms	FND	Functional dx or label	FND
Functional	Stroke	L ACA infarct	Functional dx or label	FND
Functional	Seizure	Seizures	Functional dx or label	FND, Functional weakness, non-epileptic seizures
Functional	Functional symptoms	Functional limb weakness	Functional dx or label	Functional limb weakness
Functional	Functional symptoms	Not organic symptoms	Functional dx or label	Functional stroke
Functional	Stroke	Right lacunar stroke	Functional dx or label	Functional presentation
Functional	Other physical condition with functional	Vasovagal episode with likely functional overlay	Functional dx or label	FND

Functional	Stroke	Clinical R MCA infarct	Functional dx or label	Functional Neurological disorder
Functional	Migraine and functional sx	Migraine w/functional overlay or hemiplegic migraine	Functional dx or label	Functional Neurological disorder
Functional	Functional symptoms	Anxiety related transient symptoms and peripheral neuropathy	Functional dx or label	Functional Disorder/Neurological symptoms-peripheral neuropathy
Functional	Functional symptoms	FNS	Functional dx or label	Functional disorder
Functional	Functional symptoms	Functional syndrome	Functional dx or label	Functional Neurological disorder
Functional	Stroke or functional	?subacute stroke, ?functional element	Functional dx or label	Functional weakness
Functional	Migraine or stroke	?Stroke vs migraine	Functional dx or label	?FND
Overlay	Stroke or functional	Functional neurological weakness vs stroke w/overlay	Stroke	Acute infarct left corona radiata
Overlay	Stroke	Haemorrhagic transformation or extension of infarct	Stroke	Local extension of left sided ischemia stroke
Overlay	Possible stroke	Possible new ischemic event	Stroke	Clinical small brainstem stroke
Overlay	Stroke	L MCA infarct	Stroke	Stroke
Functional	Possible stroke	Subacute right MCA & PCA stroke or congestive heart failure	Stroke	Stroke suspected stroke unspecified
Overlay	Stroke	Right deep ICH	Stroke	Right midbrain haemorrhage
Overlay	Functional symptoms	Variable neurological symptoms/functional overlay	Functional overlay	Functional Overlay
Functional	Possible stroke	?Stroke	Functional overlay	Functional overlay
Functional	Other physical condition with functional	?Functional overlay or drug induced side effects	Functional overlay	Epilepsy drug side effect, seizures, ?functional overlay
Overlay	Stroke/TIA, migraine or functional	Migrainous with possible small event or possible functional overlay	Migraine with functional sx	Migraine with functional overlay
Overlay	Stroke	Stroke (suspected stroke)	Migraine with functional sx	Migraine and Functional components
Overlay	Stroke/TIA, migraine or functional	Migraine/ functional neurological symptoms/ demyelinating disease/ TIA	Migraine with functional sx	Migraine with functional overlay
Functional	Migraine and functional sx	Complex migraine ?Functional	Migraine with functional sx	Migraine ?Functional
Functional	Stroke or functional	Acute stroke vs FNS	Migraine with functional sx	FNS in context of migraine symptoms
Overlay	TIA	?High risk TIA	Migraine	Migraine

Overlay	Migraine or stroke	Migraine and stroke	Migraine	Migraine
Functional	Functional symptoms	Functional neurological disorder	Migraine	Migraine
Functional	Stroke or functional	?lacunar stroke vs functional	Migraine	Migraine
Overlay	Stroke	Posterior circulation stroke	Stroke with functional sx	Posterior circulation stroke with some functional overlay
Overlay	Migraine or stroke	Migrainous or cerebella infarct	Stroke with functional sx	Stroke w/functional overlay
Overlay	Functional symptoms	Possible functional stroke	Stroke with functional sx	Right thalamic/ post limb internal capsule infarct with functional overlay
Functional	Stroke	Small left hemisphere infarct	Anxiety exacerbated physical pathology	Decompensation related to anxiety
Overlay	TIA	Recurrent TIA/Capsular warning syndrome	TIA	?TIA
Functional	Stroke or functional	?Decompensation ?functional overlay	Stress exacerbated physical pathology	Exacerbation of lacunar stroke symptoms in context of probable stress
Functional	Possible stroke	?Dissection ?Demyelination	Stress exacerbated physical pathology	Migraine flare up by stress symptoms
Functional	Stroke	Right lacunar syndrome	Transient neurological sx	Transient neurological symptoms
Functional	Stroke	Stroke (suspected stroke)	Other stroke mimic dx with functional sx	Bell's Palsy and Functional Left Hemiparesis

Appendix B. Questionnaire subscale totals at follow-up for participants identified with only functional symptoms versus functional 'overlay'.

		Functional only (n=24)		Functional 'Overlay' (n=7)	
Questionnaire	Sub-scale (each score out of 100)	Mean	SD	Mean	SD
Short-form Health Survey	Physical functioning	58.13	32.36	60.0	15.55
	Role limitations due to physical health	36.46	43.60	21.43	42.86
	Role limitations due to emotional problems	55.56	43.59	26.73	46.00
	Energy/fatigue	38.96	26.95	24.29	13.05
	Emotional well-being	51.83	32.68	64.57	25.45
	Social functioning	45.31	35.51	50.0	34.61
	Pain	45.73	37.49	47.86	25.14
	General health	39.79	22.43	46.68	25.23
Hospital Anxiety and Depression Scale	HADS Anxiety total	9.54	6.65	8.29	6.78
	HADS Depression total	7.25	5.38	5.57	4.72
Cognitive Behavioural Responses Questionnaire	Fear avoidance total	5.75	2.82	5.0	3.46
	Damage beliefs total	6.71	2.35	6.29	2.87
	Embarrassment avoidance total	5.29	4.81	2.0	3.70
	Symptom focusing total	7.33	3.61	7.57	4.12
	All or nothing behaviour total	7.58	4.20	7.14	3.39
	Resting behaviour total	5.29	3.51	4.86	3.76
Work and Social Adjustment Scale	Work impaired	5.33	3.13	3.33	3.72
	Home management impaired	4.50	2.89	4.17	2.56
	Social leisure impaired total	4.32	3.08	3.14	3.08
	Private leisure impaired total	2.83	2.90	3.86	2.61
	Relationships impaired total	2.92	3.27	2.83	3.49
	WSAS total	19.79	12.94	15.86	10.24
Brief Illness Perception Questionnaire	Consequences	6.25	2.89	5.86	4.26
	Timeline	5.39	3.03	4.67	.52
	Personal control	6.92	3.32	6.14	2.73
	Treatment control	4.22	3.52	5.14	4.34
	Identity	6.63	2.67	5.86	2.41
	Concern	6.13	3.50	7.43	3.26
	Understanding	5.83	3.34	4.0	4.29
	Emotional response	6.38	3.33	7.0	3.56

Appendix C. Presenting symptoms of participants with isolated functional symptoms and functional 'overlay'.

	Isolated functional symptoms (n=40)		Functional 'overlay' (n=16)	
Symptom	N	%	N	%
Laterality				
Unilateral	36	90	14	87.5
Bilateral	4	4.5	2	2.3
Pain				
Headache/migraine	14	35	9	56.3
Pain in limbs or body	11	12.2	2	2.29
Systemic / autonomic				
Dizziness	5	12.5	4	25
LOC[†] syncope	4	10	1	1.1
Feeling slow/tired	4	10	1	43.8
Panic	3	7.5	1	6.25
Nausea	3	7.5	0	-
Vomiting	2	5	0	-
Seizure	1	2.5	0	-
Speech/ swallow				
Dysarthria/ Slurred speech	14	35	3	18.8
Aphasia	6	15	4	25
Stuttering	5	12.5	0	-
Swallow symptoms	2	5	0	-
Motor				
Lower limb weakness	34	85	11	68.8
Upper limb weakness	27	67.5	14	87.5
Facial droop/ weakness	10	25	3	18.8
Limb ataxia	5	12.5	2	12.5
Tremor/ shaking	5	12.5	1	6.25
Hand weakness	3	7.5	0	-
Gait	4	10	0	-
Onset				

Confusion/ disorientation	5	12.5	1	6.3
Onset on waking	5	12.5	0	-
Noticed by someone else	2	5	1	8
Dissociation	1	2.5	0	-
Sensory				
Upper limb sensory change	15	37.5	7	43.8
Lower limb sensory change	15	37.5	4	25
Facial numbness	8	20	4	25
Visual				
Visual loss	9	22.5	6	37.5
Diplopia	2	5	0	-
Nystagmus	1	2.5	0	-
Ptosis	1	2.5	0	-
Other				
Inconsistent/ intermittent	7	17.5	4	25
Photophobia	1	2.5	0	-
Twitching	1	2.5	0	-
Phonophobia	1	2.5	0	-
Vertigo	1	2.5	0	-
Erratic behaviour	0	-	1	6.3
Shortness of breath	0	-	1	6.3

Appendix D. Participants report of treatment and investigations offered at 2-month follow-up.

Diagnosis	Ongoing symptoms	Treatments offered							
		Tailored functional symptom treatment	Physiotherapy/ rehabilitation from stroke ward	Speech therapy	Referred to mental health service	Unspecified medication change	Other organic investigation	TMS	No treatment offered
Functional symptoms only (n=25)	20	2	5	2	2	6	4	1	12
Functional symptoms overlaying a stroke (n=6)	5	0	2	0	1	0	3	0	1
Functional symptoms overlaying other condition (n=3)	3	1	1	0	0	0	1	0	1