Factors influencing employment after minor stroke and NSTEMI

Åse Hagen Morsund,* Hanne Ellekjær,† Arne Gramstad,‡
Magnus Tallaksen Reiestad,§ Rune Midgard,¶ Sigrid Botne Sando,#
Egil Jonsbu,$ and Halvor Næss,##

Aim: To study the effect of cognitive function, fatigue and emotional symptoms on employment after a minor ischemic stroke compared to non-ST-elevation myocardial infarction (NSTEMI).

Material and methods: We included 217 patients with minor ischemic stroke and 133 NSTEMI patients employed at baseline aged 18−70 years. Minor stroke was defined as modified Rankin scale (mRS) 0−2 at day seven or at discharge if before. Included NSTEMI patients had the same functional mRS. We applied a selection of cognitive tests and the patients completed questionnaires measuring symptoms of anxiety, depression and fatigue at follow up. Stroke patients were tested at three and 12 months and NSTEMI at 12 months.

Results: The patients still employed at 12 monthswere significantly younger than the unemployed patients and the NSTEMI patients employed were significantly older than the stroke patients (59 vs 55 years, $p < .001$). In total, 82 % of stroke patients and 90 % of the NSTEMI patients employed at baseline were still employed at 12 months ($p = 06$). Stroke patients at work after 12 months had higher education than unemployed patients. There were no difference between employed and unemployed patients in risk factors or location of cerebral ischemic lesions. Cognitive function did not change significantly in the stroke patients from three to 12 months. For stroke patients, we found a significant association between HADS-depression and unemployment at 12 months ($p = 04$), although this association was not present at three months. Lower age and higher educational level were associated with employment at 12 months for all patients.

Discussion and conclusion: Age and education are the main factors influencing the ability to stay in work after a minor stroke. Employed stroke patients were younger than the NSTEMI patients, but there was no difference in the frequencies in remaining employed. The employment rate at 12 months was high despite the relatively high prevalence of cognitive impairment in both groups.

Keywords: Minor stroke—Minor cognitive impairment after stroke—Poststroke fatigue—Poststroke anxiety and depression—Poststroke employment

From the *Department of Neurology, Møre and Romsdal Health Trust, Molde hospital, Molde and Department of Neuromedicine and Movement Science, Norwegian University of Science and Technology, Trondheim, Norway; †Department of Neuromedicine and Movement Science, Norwegian University of Science and Technology, Trondheim and Stroke Unit, Department of Internal Medicine, St Olavs hospital, University Hospital of Trondheim, Norway; ‡Department of Neurology, Haukeland University Hospital and Department of Biological and Medical Psychology, University of Bergen, Norway; §Department of psychiatry, Møre and Romsdal Health Trust, Molde hospital, Molde, Norway; ¶Clinical Trial Unit, Norwegian University of Science and Technology, Trondheim, Norway; #Department of Neuromedicine and Movement Science, Norwegian University of Science and Technology, Trondheim and Department of neurology, St Olavs hospital, University Hospital of Trondheim, Norway; $Department of Psychiatry, Møre og Romsdal Health Trust and Department of Mental Health, Norwegian University of Science and Technology, Trondheim, Norway; and ##Department of neurology, Haukeland University Hospital, Centre for age-related medicine, Stavanger University Hospital, Institute of Clinical Medicine, University of Bergen, Norway.

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Corresponding author. E-mail: ase.hagen.morsund@helse-mr.no.

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Introduction

Globally, cerebrovascular disease is the second most frequent cause of disability-adjusted life-years (DALYS)[1]. The range of disability is wide. In the Norwegian stroke registry 65.3% of the patients have a relatively mild impairment defined as NIHSS (National Institute of Health Stroke Scale) between 0−5 at admission[2]. Although a consensus on the definition of minor stroke is lacking, NIHSS $\leq$ 5 is used in other publications[3]. Low NIHSS scores are thought to represent a good outcome. However, the scale emphasizes sensorimotor symptoms and largely ignores other important aspects, such as cognitive symptoms, fatigue, anxiety and depression, which can cause serious disability and reduced quality of life in the patients. Even minor cognitive symptoms can cause employment difficulties after a stroke. Knowledge of factors influencing the ability to return to work after an ischemic stroke is clinically important. However, few studies focus on this topic[4]. A recent study of a stroke population aged 15−49 years showed that 37.6% of the patients were out of work 1 year poststroke[5]. The study showed an association between failure to return to work and large anterior strokes, strokes caused by large artery atherosclerosis, high-risk of cardio embolism, aphasia, limb paresis and visual deficit. The majority of patients in the study[5] had a low NIHSS score at discharge. In another study, the authors found that only 41 % had returned to work after 6 months despite relatively minor neurological and functional impairments, with median NIHSS 1 at discharge from the acute care unit[6]. Early cognitive deficit was the only significant predictor for the inability to return to work. In contrast, a study of spinal cord infarctions showed that all surviving patients younger than 60 years returned to work[7] even if mRS (modified Rankin Scale) was higher among the patients with spinal cord strokes than in a control group with cerebral infarctions. This difference may be due to cognitive deficits in the cerebral infarction patients[7]. Furthermore, pre-stroke employment resulted in better patient-reported outcome of depression, fatigue, cognitive symptoms and total burden of dysfunction after a minor stroke in one study[8]. The degree of physical disability, sociodemographic factors and psychiatric comorbidity might play an important role in the post-stroke employment. A population-based study from South London Stroke Register found that black ethnicity, women, older age, diabetes and dependence in the acute phase were independently associated with lower odds of return to work[9]. Another population-based study from New Zealand showed that psychiatric comorbidity measured at 28 days after a stroke was a strong independent predictor for not returning to work[10]. However, an association between depression and the ability to return to work was not confirmed in a more recent study[11]. In a publication addressing employment after acute myocardial infarction in a large patient cohort, only seven % of the patients employed at baseline were unemployed at 12 months[12]. This is a markedly lower prevalence compared to studies of stroke patients.

The aims of our study was to investigate employment in a patient population after a minor stroke compared to a control group of non-ST elevation myocardial infarction (NSTEMI) and assess predictors associated with the ability to return to work. We chose NSTEMI patients as the control group under the assumption that both patients had a vascular disease with a similar profile of risk factors.

Material and methods

We performed a 12 months follow-up of patients employed at baseline with ischemic stroke with a selection of cognitive tests and questionnaires measuring symptoms of anxiety, depression and fatigue. A control group of NSTEMI patients was included.

Regarding power we did a power calculation before study start indicating a need for 600 patients in each group. Due to practical reasons the final sample size was a lot lower, meaning that the study is probably too small to detect all of the relevant differences between groups.

Ischemic stroke patients: Ischemic stroke was defined in accordance with the Baltimore-Washington Cooperative Young Stroke Study Criteria[13] comprising neurological deficits lasting more than 24 h due to ischemic lesions, or transient ischemic attacks where CT or MRI showed infarctions related to the clinical findings.

Inclusion criteria

Ischemic stroke patients aged 18−70 years with minor stroke defined as mRS 0−2[14] at day 7 or at discharge if before. NSTEMI patients aged 18−70 years with mRS 0−2. Stroke and NSTEMI patients were included in the same time period.

Exclusion criteria

Patients with a major stroke defined as mRS > 2 at day 7 or at discharge if before, and patients with deterioration in mRS to more than 2 of any cause in the observational period. NSTEMI patients with mRS > 2 of any cause were excluded.

Recruitment

We recruited ischemic stroke patients consecutively from stroke units at Molde hospital, Haukeland University hospital and St Olav's hospital. Patients from other participating stroke units (Department of Neurology at St Olavs hospital, Kristiansund hospital, Volda hospital and Aalesund hospital) were included whenever practical, but not always consecutively. The recruitment period lasted for four years from 1 Jan 2013 until 31 Dec 2016. NSTEMI patients were recruited from Haukeland University Hospital, Ålesund, Molde and Kristiansund Hospitals in the same time period.

The stroke patients were assessed at three and 12 months and the NSTEMI patients at 12 months after initial inclusion.

Baseline investigation

Ischemic stroke patients underwent routine examination with NIHSS at admission[15], including risk factors (hypertension, diabetes mellitus, hypercholesterolemia, smoking, overweight defined as BMI ≥ 25), and brain imaging with CT and/or MRI. Patients were treated according to Norwegian guidelines for ischemic stroke[16].

Demographic data were collected at the time of initial admission.

Employment status

Employment status was further recorded at three and 12 months for the stroke patients and at 12 months for the NSTEMI patients. Employment include both part time and full-time employment. Patients on sick leave at baseline were defined as employed. Patients who retired after the vascular event are included in the analyses.

Assessment of cognitive and emotional function

We applied trail-making test A and B, Color-Word Interference test and Verbal Fluency (FAS) as tests of executive function[17]. The Color-Word interference test is divided in four items: Color naming, color reading, Inhibition and Inhibition/Switching, thus testing mental flexibility, mental speed and inhibition. These tests were drawn from the Delis-Kaplan Executive Function System (D-KEFS) which was developed to provide reliable measures for a range of executive functions[18].

Memory was tested with the CERAD ten-words learning task[19]. CERAD (Consortium to Establish a Registry for Alzheimer's Disease) is a standardized validated test battery for the assessment of Alzheimer disease[19] with normative data adjusted for age and education[20]. Scores falling below 1.5 SD of the mean were characterized as abnormal.

It is expceted that healthy adults achieve some low scores when a battery of neuropsychological tests are administered[21, 22]. In order to avoid potential misclassifications cognitive impairment was defined as iscores below 1.5 SD of ≥ 2 cognitive tests.

Ischemic stroke patients were screened by the Ullevaal aphasia screening test at three and 12 months[23]. The maximal total score is 52 points.

Questionnaires

The Hospital-Anxiety and Depression scale (HADS) was used to assess anxiety and depression[24]. A score ≥ 8 on the anxiety (HADS-A) or depression (HADS-D) items indicates possible presence of anxiety or depression disorders[25], a total score ≥ 15 indicates a mixture of anxiety and depression.

The Fatigue Severity Scale (FSS) was used to assess fatigue[26]. FSS is a nine-item questionnaire that assesses the effect of fatigue on daily living. Each item is a statement on fatigue that the subject rates from 1, completely disagree to 7, completely agree[27]. Fatigue was defined as FSS score ≥ 5[27].

Except for the baseline data, the analyses are done on patients employed at baseline to explore factors influencing employment after the vascular event.

Trained research nurses or the neurologist responsible for the study performed the cognitive testing.

Ethical approval: The ethics committee of Rogaland, Hordaland and Sogn and Fjordane (REC west) approved this study (REC number: 2012/1708).

Statistics

We used the Student's *t*-test to assess differences in mean values, and the Chi square test to assess differences in categorical variables. Univariate logistic regression was used to assess association between two variables. We used multivariate logistic regression to assess associations between more than two variables. The level of significance was set to p=.05. All significance testing was done as two-tailed tests. Stepwise backwards method to remove variables with high p-values was employed.

We used STATA 14 (Statacorp 4905 Lakeway Drive, College Station, Texas 77845 USA) for statistical analyses.

Results

A total 330 patients were included in the study. Of these 217 were ischemic stroke and 113 NSTEMI patients. Nineteen of the 217 ischemic stroke patients were lost to follow-up after 12 months (Table 1).

Ischemic stroke patients were younger than NSTEMI patients (p < 001) at baseline. The proportion of women was higher in the ischemic stroke group than in the NSTEMI group (p = 001). There was no significant difference in educational level between groups (p = 07) or between men and women in the stroke group. The prevalence of hypercholesterolemia (p = 04) and smoking (p = 001) were higher in NSTEMI than in ischemic stroke patients and the NSTEMI patients had higher BMI (p = 05) at baseline (Table 1).

In total 82 % of the stroke patients and 90 % of the NSTEMI patients were still employed at 12 months (p = 06).

Of the ischemic stroke patients, 92 % were employed at three months vs 82 % at 12 months (p.003). Ischemic

Table 1. *Characteristics of ischemic stroke and NSTEMI patients employed at baseline.*

	Ischemic stroke n 217 (%)	NSTEMI n 113 (%)	p value
Age (SD)	55 (10.2)	59 (6.2)	<.001
Females patients	67[31]	20[18]	.001
Education 1[a]	21[10]	14[12]	.07
Education 2	96 (45)	53 (47)	
Education 3	95 (45)	46 (41)	
Risk factors			
Hypertension	102 (48)	51 (45)	.6
Diabetes mellitus	24[11]	17[15]	.3
Atrial fibrillation	23[11]	9[8]	.4
Hypercholesterolemia[b]	92 (43)	62 (55)	.04
Smoking[c]	59[28]	52 (46)	.001
BMI mean (SD)	26.6 (4.1)	27.3 (3.2)	.05
Overweight (BMI≥25)	126 (59)	78 (69)	.08

[a]1 primary school, 2 high school, 3 bachelor/university
[b]Treatment with cholesterol lowering medication
[c]Current smoker or smoking within the last 12 months

stroke patients were younger than NSTEMI patients at 12 months (p < 001) (Table 1).

The screening for aphasia among stroke patients showed test scores of 51.7 at three months and 51.9 at 12 months (maximum total test score = 52) underlining that aphasia did not influence the results.

Ischemic stroke and NSTEMI patients employed at 12 months were younger and had a higher educational level than unemployed patients (Table 2).

Diabetes mellitus (OR .5, CI .2−1.3), atrial fibrillation (OR .6, CI .2−21.6) and hypercholesterolemia (OR .6, CI .3−1.3) were associated with unemployment in ischemic stroke patients (Table 2). Atrial fibrillation (OR .4, CI .1−2.0), smoking (OR .4, CI .1−1.4) and overweight (OR .4, CI .1−31.9) were associated with unemployment in the NSTEMI patients.

There was a trend towards more subcortical and infratentorial lesions (OR .8, CI .4−1.6 and OR .9, CI .4−2.1) in employed ischemic stroke patients as opposed to more cortical lesions (OR 3.0, CI .9−10.5) in unemployed patients. However, the difference did not reach significance.

Ischemic stroke: There were no significant differences in cognitive function between employed and unemployed patients at three months except for Color-Word Inhibition error with more errors in the unemployed group (Table 3). There were significant differences in Color-Word Inhibition error, total HADS and HADS-depression between unemployed and employed patients at 12 months with worse scores in the unemployed group (Table 3).

We performed calculations of the cognitive variables with the scaled scores Trail-making A and B, Verbal fluency and the Color-Word Interference tests with three different cut-offs (-.5, -1 and -1.5 SD). However, by narrowing the cut-off levels, no clear tendency appeared although we detected variation in significance both along the time scale and according to the chosen cut-off level as shown in Table 3.

The results of the cognitive tests done as continuous variables did not change the results listed in table three. A table of the results are available as additional material.

NSTEMI: There were no significant differences in cognitive function, HADS-A or HADS-D between employed and unemployed NSTEMI patients at 12 months. The number of NSTEMI patients who did not return to work after the NSTEMI was small (11 patients).

Lower age and higher education were associated with employment at 12 months both in ischemic stroke and NSTEMI patients (Table 4) . The regression model shows that a higher proportion of NSTEMI than ischemic stroke patients were employed at 12 months. Adjusting for sex, risk factors or cognitive impairment measured as impairment of two or more cognitive tests did not change the result.

There was no association between the total number of impaired cognitive tests and employment at 12 months in the two patient groups.

Discussion

High age and low education were associated with unemployment at 12 months follow-up for both stroke and NSTEMI patients employed at baseline (Table 4). Highly educated people may have a larger cognitive reserve which may explain the higher degree of employment, as also found by another study[28]. The age effect on employment at 12 months in patients employed at baseline was not explained by reduced cognitive function. The lack of difference in cognitive performance between employed and unemployed ischemic stroke patients at three and 12 month in our study also suggests that cognitive impairment is not the major cause of unemployment. This is in contrast to a study of mild to moderate stroke that found impaired global cognitive function as the only statistically significant independent predictor for return to work[29]. Another study found that patients that returned to work three months after a minor stroke had sigificantly

Table 2. *Unadjusted odds ratios for employment at 12 months according to sociodemographic factors and risk factors in ischemic stroke and NSTEMI patient and location of ischemic lesions in employed and unemployed stroke patients**. *Proportion of impaired cognitive tests.*

	Employed stroke 12 months n = 163 (%)	Unemployed 12 months n = 35 (%)	OR (95% CI)	p	NSTEMI employed at 12 months (%) n = 102	NSTEMI unemployed at 12 months (%)n = 12	OR (95%CI)	p
Age[a]	54	62	.9 (.8–9)	<.001	58	65	.8 (.6–9)	.002
Partner	129 (79)	27 (77)	1.1 (.5–2.7)	.8	88 (86)	9 (75)	2.1 (.5–8.7)	.3
Education 1[b]	15 (9)	9 (26)	ref		12 (12)	4 (33)	ref	
Education 2[b]	74 (46)	15 (44)	3.0 (1.1–8.0)	.03	48 (47)	4 (33)	4.0 (.9–18.4)	.08
Education 3[b]	73 (45)	10(29)	4.4 (1.5–12.6)	.006	42 (41)	4 (33)	3.5 (.8–16.1)	.1
Hypertension	81 (50)	18 (51)	.9 (.4–1.9)	.9	47 (46)	5 (42)	1.2 (.4–4.0)	.8
Diabetes mellitus	18 (11)	7 (20)	.5 (.2–1.3)	.1	15 (15)	2 (17)	.9 (.2–4.3)	.9
Atrial fibrillation	18 (11)	6 (17)	.6 (.2–21.6)	.3	7 (7)	2 (17)	.4 (.1–2.0)	.3
Hyper-cholesterolaemia[c]	73 (45)	20 (57)	.6 (.3–1.3)	.2	57 (56)	7 (58)	.9 (.3–3.0)	.9
Smoking[d]	47 (29)	9 (26)	1.2 (.5–2.7)	.7	45 (44)	8 (67)	.4 (.1–1.4)	.1
Overweight[e]	99 (61)	20 (57)	1.2 (.6–2.4)	.7	68 (67)	10 (83)	.4 (.1–31.9)	.2
Subcortical ischemic lesion	37 (23)	3 (9)	.8 (.4–1.6)	.6				
Cortical ischemic lesion	59 (36)	12 (35)	3.0 (.9-10.5)	.08				
Infratentorial ischemic lesion	32 (20)	8 (24)	.9 (.4–2.1)	.9				
	Number of impaired cognitive tests at 12 months*							
	158 stroke patients (%)				95 NSTEMI patients (%)			
0	77 (49)				49 (52)		P = 02[f]	

(*Continued*)

Table 2 (*Continued*)

	Employed stroke 12 months n = 163 (%)	Unemployed 12 months n = 35 (%)	OR (95% CI)	p	NSTEMI employed at 12 months (%) n = 102	NSTEMI unemployed at 12 months (%)n = 12	OR (95%CI)	p
1	23 (15)				25 (26)			
2	18 (11)				10 (7)			
3	8 (5)				5 (5)			
4	8 (5)				2 (2)			
5	6 (4)				3 (3)			
6	8 (5)				1 (1)			
7	4 (3)				0			
8	5 (3)				0			
9	1							

*Patients employed at baseline. [a]$p < .001$ between age difference of employed stroke and NSTEMI patients. [b]1 primary school, 2 high school, 3 bachelor/university. [c] Treatment with cholesterol lowering medication, [d] Current smoker or smoking within the last 12 months , [e] BMI ≥ 25.[f]p of 0 and 1 impaired cognitive test between stroke and NSTEMI.

Table 3. . *Comparison of cognitive test scores assessed at 3 months and 12 months in employed vs non-employed ischemic stroke patients at 12 months (scaled scores)**.

	Cognitive tests at 3 months associated with employment at 12 months (%)					Cognitive tests 12 months (%) associated with employment at 12 months				
			SD -1.5	SD -1	SD -.5			SD -1.5	SD -1	SD -.5
n	Employed 166	Non-employed 36	p	p	p	Employed 166	Non-employed 36	p	p	p
Trail-making A[a]	10 (6)	2 (6)	.9	.7	.9	6 (4)	1 (3)	.8	.6	.8
Trail-making B[a]	15 (9)	7 (19)	.07	.04	.05	14 (8)	6 (17)	.1	.04	.05
10-words test[b]	11 (7)	2 (6)	.8			7 (4)	1 (3)	.7		
10-words test delayed[bc]	20 (12)	8 (22)	.1			11 (7)	3 (8)	.8		
Verbal fluency (FAS)	18 (11)	8 (22)	.07	.04	.09	16 (10)	6 (17)	.2	.09	.2
Color-word interference tests										
Color naming[a]	43 (26)	9 (25)	.9	.4	.9	34 (21)	9 (25)	.6	.9	.9
Color reading[a]	30 (18)	6 (17)	.8	.3	.9	30 (18)	6 (17)	.9	.4	.9
Color-word inhibition[a]	26 (16)	6 (17)	.9	.7	.4	22 (13)	1 (3)	.07	.3	.7
Color-word inhibition/switching[a]	37 (22)	11 (31)	.3	.09	.8	33 (20)	5 (14)	.4	1.0	1.0
Namingerror[d]	12 (7)	3 (8)	.8			11 (7)	1 (3)	.4		
Readingerror[d]	30 (15)	2 (14)	.9			16 (10)	5 (14)	.5		
Inhibition error[a]	9 (5)	6 (17)	.02	.1	.2	5 (3)	5 (14)	.007	.2	.04
Inhibition/switching error [a]	7 (4)	3 (8)	.3	.3	.1	10 (6)	3 (8)	.6	.4	.4
Pooled data of cognitive tests			.2	.3	.5			.05	.2	.4
Impairment ≥ 2 cognitive tests	62 (40)	16 (44)	.6	.8	.3	57 (37)	11 (31)	.6	.6	.4
Questionnaires										
FSS[e]	44 (27)	6 (17)	.2			45 (28)	10 (31)	.7		
HADS[f]	21 (13)	5 (14)	.8			19 (12)	9 (27)	.02		
HADS-A[g]	32 (20)	7 (20)	.9			28 (18)	7 (21)	.6		
HADS-D[g]	11 (7)	3 (8)	.7			13 (8)	7 (19)	.04		

*Patients employed at baseline. [a]scaled score, [b]Adjusted for age and educational level,[c] tested with 5 min delay , [d] cumulative percentage, [e] Fatigue defined as FSS ≥ 5, [f] Anxiety and/or depression defined as HADS ≥ 15, [g] anxiety was defined as HADS-A ≥ 8, and [g]depression as HADS-D ≥ 8

Table 4. . *Odds ratio of being employed at 12 months according to event (stroke vs NSTEMI), educational level and cognition at 12 months in stroke and NSTEMI patients employed at baseline (n = 330).*

Employment at 12 months		
	OR (95% CI)	p
Age (baseline)	.8 (.8−9)	<.001
Sex (males)	1.2 (.5−2.8)	.7
Education 1[a]	Ref	
Education 2[a]	2.4 (.8−6.8)	.1
Education 3[a]	3.2 (1.0−10.2)	.05
Stroke vs NSTEMI patients	.3 (.1−7)	.01
Number of impaired cognitive tests[b]	1.1 (.9−1.5)	.4
HADS-D[c]	.6 (.2−2.0)	.4

Multivariat OR adjusted for [a]1 primary school, 2 high school, 3 bachelor/university, [b]distribution of impaired cognitive tests 0−10, [c]depression as HADS-D ≥ 8

Tests done at 12 months

more years of education and they had a significantly better cognitive performance[30].

Other factors than health related issues may determine whether our patients are able to return to their work. In Norway early retirement is an option, and some of our patients may have chosen this solution. A recent Finnish study also discussed this option[31].

More NSTEMI patients were employed at baseline even though they were older than the stroke patients. Stroke patients may have more cerebral ischemic lesions than NSTEMI patients before the index vascular event possibly explaining this age difference. Correcting for age, a higher proportion of NSTEMI patients were still employed at 12 months.

Cerebrovascular risk factors are associated with ischemic brain damage which may lead to cognitive impairment. In our study, diabetes mellitus, atrial fibrillation and hypercholesterolemia were associated with unemployment in ischemic stroke patients (Table 2). Lack of hypertension and diabetes and a non-smoker status before stroke was associated with a higher likelihood of return to work after cerebrovascular disease in another study[32].

For the NSTEMI patients, atrial fibrillation, smoking and overweight were associated with ending up unemployed in our study. However, the number of unemployed NSTEMI patients was small and the results must be interpreted with caution.

The prevalence of some of the risk factors was higher in the NSTEMI group compared to the stroke group. Nevertheless NSTEMI patients seem to stay longer in work than ischemic stroke patients which suggests that this difference does not influence the employment rate in our patients. This is in contrast to another study which found an association between risk factors and return to work after cerebrovascular disease[32]. Functional outcome (mRS and NIHSS) was not reported in that study. Cerebrovascular changes may be more prevalent in minor stroke patient than NSTEMI patients and may be more more important for employment than the prevalence number of risk factors according to our findings.

A study of spinal cord infarctions found that all surviving patients younger than 60 years with mRS ≥ 1 day 7 had been re-employed after discharge compared to 65% of patients younger than 60 years with cerebral infarctions and mRS ≥ 1 at day 7[7], which may illustrate that the cerebral lesions had an impact on the ability to stay in work even though the functional status as evaluated with mRS was similar. One study found that the participants thought that a stroke was more serious than a heart attack, which may influence the patients' expectation of function and the ability to stay in work after the illness[33].

The employment rate for ischemic stroke patients in our study was high even though the prevalence of cognitive impairment was high at 12 months. One explanation may be that our study have used cognitive tests that are too sensitive and demonstrate findings with little impact on employment. Our finding is in contrast to another study[6] where only 41 % of patients had returned to work after six months, even though the NIHSS at discharge was low (NIHSS 1 compared to 0.8 in our study).

An unpublished subgroup analysis of seven of our ischemic stroke patients showed that patients returning to work had less demanding tasks or less responsibility in their work than before the stroke[34]. This may also explain the high employment rate. The prevalence of unemployment in ischemic stroke patients in our study increased between three and 12 months. Some of the employed patients at three months may still have been on sick leave. At 12 months some of these patients may have converted to disability benefits due to a more clarified health status which may explain the increase in unemployment.

Prevalence of anxiety and depressive symptoms were higher in unemployed stroke patients at 12 months, but not at three months. This correlates with the findings in another study which found significant differences in depression in employed and unemployed patients[30]. Since the prevalence of cognitive impairment was unchanged from three to 12 months, the increasing prevalence of anxiety and depression may be the main cause for the increased unemployment rate. However, our study does not answer whether the depression causes the unemployment or if the unemployment causes the depression. Further studies are needed to clarify this interaction. A study from 2008 found that psychiatric comorbidity 28 days after a stroke was a predictor of not returning to work[35].

Strengths and weaknesses

The main strength of this study is a long follow-up time with repeated testing of the ischemic stroke patients and the case-control design. The sample size is also large. Nevertheless, the case-control method was a challenge because of difficulties recruiting control patients.

A weakness is that NSTEMI patients did not undergo a cerebral MRI.

According to the power analysis we did not reach the number of patients we wanted. A lower number of patients may influence the results of the analyses.

Conclusion

The current study found that the majority of patients employed at baseline retained their employment 12 months after an ischemic stroke. We found that the main factors influencing the ability to stay in work after a minor stroke are lower age, higher education and lack of affective symptoms e.g. anxiety and depression. Significantly more NSTEMI patients were employed after 12 months even though they had the same prevalence of cognitive impairment as the stroke group. The study suggests that to identify stroke patients with emotional symptoms is important since affective manifestations might contribute to employment.

Declaration of Competing Interest

None

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Informed consent

Written informed consent was obtained from the patients for their anonymized information to be published in this article.

Ethical approval

The ethics committee of Rogaland, Hordaland and Sogn and Fjordane (REC west) approved this study (REC number: 2012/1708).

Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Contributorship

HN is the main supervisor. He has been involved in protocol development, gaining ethical approval, data analysis and the first draft of the manuscript. HE is a co-supervisor and has been involved in protocol development and advice in the study period. AG is a neuropsychologist and has been involved in protocol development, especially the selection of cognitive tests and data analysis and interpretation. MTR is a neuropsychologist and has been involved in data analysis and interpretation. RM is a co-supervisor and has been involved in protocol development. SBS has been involved in the protocol development, especially the selection of cognitive tests. EJ has been involved in the protocol development with focus on anxiety and depression tests. All authors reviewed and edited the manuscript and approved the final version of the manuscript

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