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Research Article

Functional Capacity of Upper Limb after Stroke

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ABSTRACT

Objective: Functional capacities of stroke appear to be less compared those of the lower limb. We carried out a cross-sectional, prospective study for assess functional capacities of paretic upper limb after stroke.

Methodology: Patients with Confirmed stroke, beyond 3 months, were included. Functional abilities assessed by the maximum number of index finger taps per minute (taping test), time to put in and take out 25 pegs (nine hole peg test) and the Franchay Arm Test. We retained a significant difference of 27 seconds (nine hole peg test), 28 shots (Taping test) between paretic and healthy side.

Results: 40 patients were included, with a mean age of 54 years. Sex ratio was 0.7. The grips, franchay arm test, taping test, nine hole peg test were normal in 60%, 55.5%, 20%, 25% respectively. Functional prognosis factors are ischemic stroke (p=0.003-0.02), weakness (p=0.000) and neglect (p=0.000).

Discussion and conclusion: Functional activities of the upper limb, after stroke are more pejorative on those requiring manual dexterity (nine hole peg test and taping test). Decreasing functional capacities of upper limb in stroke patients, beyond 6 months of evolution can be explain by worsening spasticity, discontinous rehabilitation and insufficiency of social and professional integration.

Keywords: Prognosis; Upper limb; Functional activities; Quantitative and qualitative analysis

INTRODUCTION

Strokes are a public health problem and represent 2/3 of hospitalizations of the neurology department, Fann teaching hospital and 40% of consultations at Physical Medicine and Rehabilitation, department, Fann, teaching hospital, Dakar, Senegal [1].

Overall disability, linked to vascular hemiplegia, affects around 50% of patients [2]. Handicap's depended to deficit topography, cerebral lesions topography, but also to age and underlying defects. Recovery of the lower limb are less difficult than upper limb, because to preferential localization of ischemia stroke, on the superficial sylvian territory (70%), a greater frequency of orthopedic complications in upper limbs, which dominated by pain (between 5% and 84%) and distribution of spasticity on extensors, which favorable for verticalization and locomotion [3]. A study conducted at the Department of Physical Medicine and Rehabilitation, Fann, teaching hospital revealed that 91% of stroke patients walk [3]. Recovery of the upper limb remains very limited with persistent griping disorders in around 80% of cases [3]. Isn't studied in Senegal. Thus, we carried out this study. Objective was to assess functional capacities of upper limb in patients with vascular hemiplegic, followed more 3 months.

METHODOLOGY

We carried out a transversal and prospective study, at Physical Médicine and rehabi-litation department, of Fann teaching hospital, Dakar Senegal between 01st March and 01st september 2021. Stroke patients confirmed by brain imaging, evoluting for more than 3 months, without pre-existing disablities at upper limb, severe memory and attention, comprehension and visual impairment were included. Sociodemogra-phic characteristics, stroke data, neurological and orthopedic impairments were collected. Memory was assessed by the Modified Senegal test,

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hemnegligence by the Modified Albert test. To assess Gripping, we asked patients to successively perform the gestures of "grabbing and releasing a ball"; pick up a money piece on table; grab a pen placed on the table with two fingers; hold a sheet. The Franchay Arm Test, was used to assess the ability of patients to stabilize a ruler while the other hand draws a line; pick up and drop a pen cap; drink a glass of water, open and close a clothespin and comb hair. Finally, we evaluated the manual dexterity by a variant of the nine hole peg test with 25 stems to put in the corresponding holes, each composed of a circular part and a lateral protuberance, requiring a perfect orientation of stems (Figure 1) and the tapping test with a device allowing to count the taping of the index finger in one minute (Figure 2). For each of these tests, a significant difference was retained. It corresponded to difference of means between non paretic dominant and minor side. Quantitative and qualitative analysis data was performed by SPSS version 18 software. Bivariate analysis was performed to determine prognosis factors. Significance level was defined by $p<0.05$.

Figure 1: Nine Hole Peg test with 25 stems.

Figure 2: Tapping test.

RESULTS

We included 40 patients with a mean age of 54 ± 14 years with extremes of 27 years and 82 years. The mean age was 54.3 years ± 14 for women and 53.6 years ± 15 for men. The most represented age group was 56-65 years. The sex ratio (M/F) was 0.7. Married (70%), divorced (12.5%) and widowers (12.5%) were predominant. High blood pressure (80%), dyslipidemia (25%), oral contraception (39.1%) and diabetes (22.5%) were the main cardiovascular risk factors. Ischaemic stroke, (90%) was largely predominant. The average duration of the stroke was 8 months with extremes of 3 months and 42 months. Fifty-five percent (55%) of patients had course duration of 3-6 months, 35% between 7-12 months and 10% beyond 12 months. Weakness was more severe in the hand (55%), forearm (47.5%), arm (42.5%), shoulder (47.5%). It was associated with neglect (40%), memory impairment (30%), pain in the shoulder (65%) and hand (22.5%). Sixty percent (60%) of patients normally per-formed global, bi-digital, tri-digital grips. Picking up a money piece was impossible in 40% of patients, holding a sheet (34%), grabbing a pen (30%). Hand-mouth, hand-neck, hand-belt, hand-pocket gestures were possible and normal in 61.9% of cases. The franchay arm Test was normal in 55% of patients. The most difficult activities are opening and closing a clothespin, which was not possible in 45% of patients; combing their hair (32.5%). The tapping test was normal in 20% of patients (118-145 taping per minute) (Table 1). It was abnormal in 45% of cases and impossible (35%). The nine hole peg test was normal in 25% of cases, impossible (47%), and abnormal (28%). The functional activities of upper limb, after stroke, were possible and normal in 17.9 to 64.3% of

Table 1: Functional capacity of paretic upper limb after stroke.

Possible functional capacity of paretic upper limb		Age (years)					p
		27-35	36-45	46-55	56-65	65	
	Overall	50%	71.4%	80%	53.8%	66.7%	0.890
	Pick money piece	33.3%	57 .1%	80%	53.8%	66.7%	0.457
	Two fingers	50%	71.4%	80%	53.8%	66.7%	0.730
Grip	Three fingers	33.3%	71.4%	80%	46.2%	66.7%	0.520
	Hand-pocked	66.7%	71.4%	80%	61.5%	66.7%	0.892
	Hand-belt	50%	71.4%	60%	53.8%	66.7%	0.723
Other movement	Hand-mouth	66.7%	71.4%	80%	61.5%	66.7%	0.198
	Hand -neck	33.3%	71.4%	60%	38.5%	66.7%	0.081
	Stabilize a ruler. while drawing a line	50%	57.1%	80%	61.5%	66.7%	0.646
	Grasp a cylinder	50%	57.1%	80%	61.5%	55.6%	0.686
	Pick up a glass. half full of water	50%	57.1%	80%	38.5%	66.7%	0.573
	Remove and replace a sprung clothes peg	33.3%	57.1%	60%	30.8%	66.7%	0.566
Frenchay arm test	Comb hair	33.3%	57.1%	60%	38.5%	66.7%	0.722
Nine hole peg test	Put and remove 25 metals stems	0	0	60%	30.8%	33.3%	0.122
Taping test	Taping with index	0	42.9%	40%	7.7%	22.2%	0.582

Table 2: Functional capacity of paretic upper limb, and duration of stroke.

Possible functional abilities of the paretic upper limb		Duration of evolution (months)			p
		03-Jun	07-Dec	>12	
	Global	72%	50%	50%	0.531
	Pick up a coin	68.20%	42.90%	50%	0.452
	Two-fingers	77.70%	50%	50%	0.419
Grip	Three fingers	68.70%	42.90%	50%	0.532
	Hand-pocket	77.30%	57.10%	50%	0.587
	Hand-belt	72.70%	42.90%	50%	0.587
other movement	Hand-mouth	72.70%	64.30%	50%	0.587
	Hand-neck	63.60%	35.70%	50%	0.587
	Draw a line	68.20%	57.1		0.74
	Cylinder grip and release	63.60%	57.10%	50%	0.74
	Drink a glass of water	59.10%	50%	50%	0.74
	Open and close pliers	54.50%	35.70%	50%	0.74
Frenchay Arm Test	Comb the hair	59.10%	35.70%	50%	0.74
Nine Hole Peg Test	Put pegs in holes	22.70%	28.60%	25%	0.713
Taping test	Regular tapping with the index finger	27.30%	14.30%	0	0.64

Table 3: Functional capacity of paretic upper limb and nature of stroke.

Functional capacity of paretic upper limb after stroke		Nature of stroke		p
		Ischemia	hemorrage	
	Overall Stabilize a ruler. while drawing	58.30%	100%	0.615
	Kip money piece	58.30%	33.30%	0.009
	Two-fingers	58.30%	100%	0.615
Grip	Three-fingers	55.60%	66.70%	0.454
	hand-pocked	63.90%	100%	0.71
	hand-belt	63.90%	33.30%	0.002
Autres gestes	hand-mouth	63.90%	100%	0.71
	hand-neck	55.60%	33.30%	0.057
	Stabilize a ruler. while drawing	58.30%	100%	0.615
	Grasp a cylinder	55.60%	100%	0.564
	Pick up a glass. half full of water	50%	100%	0.457
	Remove and replace a sprung clothes peg	50%	33.30%	0.003
Frenchay arm test	Comb hair	52.80%	33.30%	0.026
Nine hole peg test	Put and remove 25 metals stems	25%	0	0.403
Taping test	Taping with index	19.40%	33.30%	0.541

the painful patients, whatever the activity considered, against 16.7 to 75% for the non-painful. Pain was not a determinant functional prognosis factor of paretic upper limb, after stroke. Tables 1 and 2 respectively show functional capacities of patients according to age and length of stroke. Functional prognosis factors of upper limb in vascular hemiplegic are ischaemic stroke (Table 3), hemnegligence (p=0.000), proximal upper limb weakness (p=0.000) (Table 2).

DISCUSSION

Stroke in Africa more frequently affects younger, with an average age around 50 years [4-6]. Sex predominancy is variable in the African literature [5-8]. In our study, women were more represented. Female predominancy, can be explain by frequency of cardiovascular risk factors in women. In Senegal, obesity of married women is a sign of marital well-being. Added to this, gradual increase of contraception among Senegalese women, as observed in our study, probably related to an improvement in mother and child health [9]. Oral contraception interested 39.1% of women. Despite the variety of strokes, ischemic stroke is most common [3,10]. In our study, 92.5% of patients had benefited from rehabilitation. This rate is higher than that found by Diouf, et al. [5] in 2006. A better knowledge of place of rehabilitation in stroke in Senegal can explain this. Study setting (Department of Physical Medicine) could partly explain this rate of rehabilitation. In our study, stroke was responsible for weakness at hand (55%), forearm (47.5%), shoulder (47.5%) arm (42.5%). Seventeen percent (17%) of stroke patients had no motor deficit. Vascular hemiplegia is often associated with various challenges related to complications or lesion topography. Shoulder pain is the main complication found in 65% of patients. This rate is higher than that found in

the literature [6,10]. In our study, negligect was found in 40% of patients. This confirm results of Olga boukrina found, that 50% of patients with right cerebral stroke, experience spatial neglect [11]. In our study, grips were more severe on holds requiring precision such as picking up a money piece, grabbing a pen, and holding a sheet. Our stroke patients were unable to hold a sheet in 32.5% of cases, pick up a pen (30%) and pick up a coin (40%). These difficulties would be causes in part by deficit in upper limb over the muscles of the hand (55%), an organ characterized functionally by a great mobility of gestures. Some daily activities require a combination of approach and grip gestures. They are well understood by the franchay arm test. We have found that the most difficult activity of the franchay arm test in people with vascular hemiplegia is 'opening and closing a clothespin. Gesture, which involves two fingers, requires precision and bi-digital coordination. Like the Franchay Arm test, the finger taping test requires some motor skills and coordination between flexion and extension of the index finger on the one hand, and precision in order to tap the counter arm. In our study, the tapping test was normal only in 1/5 of the cases. In our study, we used a version of nine hole peg test, assessed manual dexterity. We found difficults in stroke patients to doing this. It was impossible to perform in 47% of patients and normal in 28% of cases. Functional prognosis factors of stroke are known [12]. In this study authors found that fucntional prognosis of upper limb after stroke are age, sex, lesion site, initial motor impairment, motor-evoked potentials and somatosensory-evoked potentials, and most significant prognosis factor is initial measure of upper limb impairment [12]. In our study, age is not a determining prognosis factor of functional capacities of the upper limb (p= 0.08-0.8), but decreasing motor fonction of upper limb found beyond 6 months of evolution. Rehabilitation stroke can take several months. In developping country like Sénegal, long rehabilitation in stroke patients is ofen stoped , because socio-economic problems, which contribited to decline autonomy, through worsening of spasticity and fatigabilty. So in those countries, self-rehabilitation should be seen as an alternative. In our study, functional capacities of upper limb, in patients stroke, are more negative, in the event of severe deficit, predominantly in the foream, arm and shoulder. This suggests a modification of the strategies, for actions which require precision and dexterity, involving 'shoulder, arm and forearm. Based on these findings, it seems that abnormalities in gestural precision and coordination in vascular hemiplegic patients are largely due to the severe deficit of the forearm, arm and shoulder. Hemiplegic shoulder pain (HSP) impedes functional motor recovery of the affected limbs and negatively affects quality of life and daily activities. [13]. In our study, pain was not a functional progno-sis of upper limb, after stroke. Functional activities of the upper limb were possible in 17.9% to 64.3% of painful patients, against 16.7% to 75% for non-painful patients. Spatial neglect is an independent and a significant predictor of upper limb outcome [14,15]. Our study confirms those assessments.

CONCLUSION

Functional activities of upper limb, after stroke, assessed qualitatively and quantitatively, show, difficults in those requiring precision and manual coordination. They are not exclusively consequences of motor deficit at hand, but of the shoulder, arm, and forearm. Some of these functional activities, such as picking up a money piece on the table (p=0.009), opening and closing clothespin (p=0.02), combing hair (p=0.003), are strongly dependent to stroke. Functional prognosis factors of upper limb capacities, after stroke, are neglect, ischemia stroke and proximal upper limb weakness.

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