Facilitatory effect of neglect rehabilitation on the recovery of left hemiplegic stroke patients: a cross-over study

Abstract  A study of the effect of specific training for visual neglect on the recovery of motor and functional impairment in stroke patients is reported. Two groups of right hemisphere stroke patients with hemispatial neglect and one group without neglect were assessed by means of three functional and neurological scales (Rivermead Mobility Index, Barthel Index, Canadian Neurological Scale). Three evaluations were made at 0, 2 and 4 months from the beginning of physical rehabilitation. During the first 2 months of physical rehabilitation one of the two groups of neglect patients was randomly assigned to specific training for neglect, and the second group to a general cognitive intervention; during the final 2 months of rehabilitation the types of training were switched in the two groups. The non-neglect patients improved steadily during physical rehabilitation. In contrast, the functional recovery of the two neglect groups was time-locked to the period of the specific training for neglect. At the time of admission, the two neglect groups performed at the same level; after 2 months of rehabilitation, the group with neglect training showed higher functional recovery than the group with only general cognitive intervention. When the latter group received neglect training, there was no longer any difference between the two neglect groups. This pattern was present for both of the functional scales used but not for the neurological scale. Motor and functional recovery of stroke patients with neglect seems to be significantly improved by the simultaneous presence of a treatment specifically focused on neglect.

Key words Hemi-neglect · Functional recovery · Rehabilitation

Introduction

Recent evidence [32] indicates that primary neurological impairment may be aggravated by the simultaneous presence of attentional disorders in the contralateral part of space, such as unilateral neglect. This is characterized by the patient’s failure to orientate, respond to or report stimuli appearing on the side contralateral to the cerebral lesion [28]. (While often associated with primary sensory deficits, neglect is a central independent disorder as demonstrated by neglect patients with no field defects and by hemianopic patients without neglect [28].) Since neglect is considerably more frequent among patients with right hemispheric lesions, it is not surprising that the incidence of these disorders is asymmetrically distributed in acute strokes. Contrary to the commonly held belief that there is no asymmetry in the incidence of functional impairments in left and right stroke patients [1], recent studies suggest reconsidering the role of the side of the lesion in the outcome and in recovery from stroke. Thus, in a large unselected population of brain-damaged patients, both sensory and motor impairments are more frequent in right-sided than left-sided lesions [29]. The authors sug-
gest that the presence of neglect may be responsible for the more severe left-sided symptomatology.

The recovery of sensory and motor deficits following unilateral hemispheric lesions also shows considerable asymmetry, with a slower and more incomplete functional improvement following right-sided lesions [19]. Compared with patients with left stroke, longer length of stay in a rehabilitation centre [13, 14], greater assistance in daily living [7, 9, 20], and less improvement of motor deficits [7] are typical manifestations of the more severe and long-lasting impairments in unilateral right hemispheric strokes. Although for methodological reasons it may be difficult to compare longitudinal studies, the smaller amount of improvement in motor recovery observed in right-sided lesions has often been associated with neglect, hemisomatognosia and visuospatial disorders [11, 18, 19, 21].

The effectiveness of cognitive rehabilitation of neurological disease has been recently reviewed [27]; in spite of frequent methodological weaknesses, some studies have documented the positive effects of specific cognitive training on the reduction of neglect [3, 8, 10, 26, 35, 36]. Therefore, because of the described symptomatic and functional correlation association, it seemed important to test systematically whether training specifically developed to improve neglect might facilitate the neurological and functional outcome produced by standard physiotherapeutic techniques.

Subjects and methods

Fifty-nine right-handed, right brain-damaged stroke patients participated in the study. All patients had suffered a single stroke from 2 to 6 months before. The experimental group did not include patients over 78 years of age, with multiple lesions, neoplastic or haemorrhagic aetiology, or with other chronic CNS pathologies (Parkinson’s disease, dementia, multiple sclerosis, polyneuropathy).

Patients were selected and assigned to the different experimental groups so as to reduce all possible sources of bias; they were selected from those patients consecutively admitted over almost 3 years to a single large ward (100 beds). Bed numbers were assigned by the Hospital Administration on the basis of reservation priority. This number (either odd or even) was used to assign blindly the patients to one of the experimental groups (see below).

The ward physicians, including the researchers, did not intervene at this point.

All patients were given a neglect screening battery ([37], see below) as part of a standard clinical evaluation. This was carried out by a neuropsychologist who did not participate in the research and was not informed of the specific goals of the study; the screening was carried out after bed assignment. Therefore, assignment to either immediate or delayed treatment was independent from the screening results. In turn, group assignment could not influence reading test during screening for neglect since the neuropsychologist did not know that the number of the bed was being used to separate patients into different experimental groups.

Based on the results of this screening, 23 patients (9 males and 14 females) were included in the neglect group (N+) and 36 (15 males and 21 females) in the non-neglect group (N–). Patients with odd numbers (n = 12) received the training for neglect immediately (N+I), and patients having even numbers (n=11) after 2 months (delayed training; N+D). Informed consent was obtained from all patients.

Mean age was 61.5 years (SD 13.32) in the N– group, 68.0 (SD 7.19) in N+I and 70.0 (SD 5.46) in N+D [F(2, 56) = 2.32, n.s.]; average time from onset of disease was 47.11 days (SD 31.65) in N–, 64.33 days (SD 40.5) in N+I and 63.36 days (SD 37.25) in N+D [F(2, 56) = 1.48, n.s.].

Instruments

Functional and neurological scales

Both functional disabilities and neurological impairments were assessed by means of three widely used scales:

Rivermead Mobility Index. This scale (derived from the Rivermead Motor Assessment) [4] detects the ability of a patient to perform 15 common daily movements: turning over in bed, lying to sitting, sitting balance, sitting to standing, standing unsupported, transfer, walking inside, stairs, walking outside (even ground), walking inside with no aid, picking up something from the floor, walking outside on uneven ground, bathing, up and down four steps, running. A score of 1 is given for each correct response and 0 for each wrong one. Thus, the scale ranges from a score of 0 (totally unable) to 15. The scale proved to be valid and reliable for evaluating mobility after stroke and head injury [4], and it has been recently used in a randomized crossover trial in stroke rehabilitation [34].

Barthel Index. Activities of daily living status were monitored using the Barthel Index [22], a ten-item scale that measures the functional abilities of patients, such as eating, dressing, grooming, walking, and bowel and bladder functions. This scale gives a score between 0 and 100. The top score implies functional independence, not necessarily normality. It is widely used with stroke patients [33] and has proven to be of functional prognostic value in previous stroke outcome studies [16, 17].

Canadian Neurological Scale. We used the revised version [6] of the scale [5] to measure the severity of the stroke. The eight-item scale measures level of consciousness, orientation, speech, facial weakness and motor function, for a maximum score of 11.5 in normal patients. A separate section is used for patients with comprehension deficits. It has undergone extensive validation and reliability tests [6].

Evaluation of hemi-spatial neglect

All patients were administered a battery for hemi-spatial neglect [37]. This included the Letter Cancellation Test [10], the Barrage Test [2], the Wundt-Jasrow Area Illusion Test [23] and the Sentence Reading Test [25].

In the first two tests, the number of items (either lines or letters) correctly crossed is measured. In order to express the degree of

1 This test uses a version of this well-known optical illusion modified to favour the detection of spatial asymmetries. Two fans of the same shape and surface are presented; however, due to the spatial arrangement of the display one of the two figures appears longer (over 99% of judgements in control subjects). Forty stimuli are given with ten different sizes, ranging from 5.7° to 57° of visual angle in ten equally spaced steps. Each stimulus size is presented in four different ways: fans pointing either to the left or to the right, with convexity oriented upward or downward. For each stimulus the patient is requested to say or to indicate by pointing whether the top or the bottom fan was longer. The responses are classified as “expected” (in agreement with the known illusory effect) or “unexpected” (in the direction opposite to the illusion). For more details see [23].