Spatial Neglect

Spatial neglect is a common syndrome following stroke, most frequently of the right hemisphere. Up to two-thirds of acute right-hemisphere stroke patients demonstrate signs of contralesional neglect, failing to be aware of objects or people to their left in extrapersonal space. For example, when searching through a visual scene patients with left neglect tend to look at elements on the right only (Fig. 1). The syndrome may also involve ‘personal’ space, with patients neglecting their own contralesional body parts. Importantly, many patients are unaware they have these problems (anosognosia). Perhaps unsurprisingly, therefore, enduring neglect is a poor prognostic indicator for functional independence following stroke.

- When asked to report ten objects around the room neglect patients may predominantly choose items from the ipsilesional side of space.
- Tests of personal neglect include asking the patient to mime combing their hair, shaving or making-up their face. Right-hemisphere patients often fail to groom the left side of their face on such tasks, as well as in daily life.

Diagnosis

Severe neglect may often be diagnosed by simple observation, e.g., patients who turn their head and eyes to their extreme right and never spontaneously gaze to the left, even though leftward eye movements are intact on formal testing. In most cases, however, specific bedside assessments are required to identify neglect. Furthermore, it is important to quantify the severity of neglect in order to track patients’ progress in an acute stroke unit, or in response to rehabilitation. A number of simple and rapid tests have been developed for the assessment of neglect.

We recommend, where possible, using several of these tests when assessing neglect and also affected by constructional apraxia.

- Cancellation tasks (Fig. 2) involve patients searching for and marking with a pen target items on a sheet of paper. Right-hemisphere neglect patients often start on the right side of the page (whereas control subjects who read left-to-right usually start on the left), and omit targets on the left of the page. The most sensitive tests have a high density of targets as well as irrelevant distracter items. Cancellation tests are the single most sensitive bedside test and should wherever possible be included in any test battery.
- In line bisection tasks patients mark where they perceive to be the midpoint of a long (18-20 cm) horizontal line on a sheet of paper. Neglect patients, especially those with right posterior lesions, often deviate considerably to the right of the true midpoint.
- Object copying (Fig. 3) and drawing a clock face are commonly used but they are relatively insensitive when used alone, difficult to score in a graded manner and also affected by constructional apraxia.

Anatomy of neglect

Most neglect patients have suffered large right-hemisphere MCA strokes but the syndrome has been more specifically associated with damage to the following regions (Fig. 4):

- The right inferior parietal lobe (IPL) or nearby temporoparietal junction (TPJ), considered the ‘classical’ cortical sites.
- The right inferior frontal lobe, which tends to lead to more transient neglect.
- Subcortical ischaemic lesions in the territory of the right MCA involving the basal ganglia or thalamus, although this may be due to diaschisis or hypoperfusion in overlying parietal and frontal regions.
- Large posterior cerebral artery (PCA) territory strokes extending from occipital to medial temporal lobe. It remains to be determined whether neglect following such extensive PCA infarction is in fact due to parietal diaschisis, or is a separate disorder distinguished by unique underlying component deficits.

Cognitive deficits underlying neglect

Many different cognitive deficits, either in isolation or combination, are considered to contribute to the neglect syndrome. The following important spatially lateralised...
components (worse to the left in right-hemisphere patients) have been proposed to underlie neglect:

- A deficit in directing attention to the left – due either to a graded bias in directing attention rightwards, items on the right invariably ‘winning’ over objects to the left in the competition for attentional selection, or a difficulty in disengaging attention and shifting it leftwards.
- An impaired representation of space - which may occur in multiple frames of reference (e.g. retinotopic, head-centred, trunk-centred) or be specific to near or far space.
- A directional motor impairment, with patients experiencing difficulty in initiating or programming leftward movements.

In addition to these lateralised impairments (worse to the left following right-hemisphere stroke), it is increasingly becoming apparent that the neglect syndrome also consists of non-spatially lateralised deficits, involving both sides of space. Different patients may suffer different combinations of lateralised and non-lateralised impairments, depending upon the precise location and extent of their lesions. Furthermore, the severity of a patient’s neglect may be determined by the interaction between their lateralised and non-lateralised impairments, which could help to explain why some patients recover poorly. Non-spatially lateralised components of neglect include:

- Impairments in sustained attention.
- A bias to local features in the visual scene.
- A deficit in spatial working memory.
- Prolonged time-course of visual processing.

Treatment and Rehabilitation

Initial attempts to rehabilitate neglect encouraged patients to direct their gaze towards contralesional space. But although these approaches showed some success in reducing neglect within a particular task (e.g. in reading, by cueing patients to find a red line marked on the left margin), patients typically demonstrated little generalisation of their improved scanning behaviour to tasks outside of the training environment. Unfortunately, many neglect patients are often unaware of their deficit and in complex real-world environments, cues to remind them to look left (e.g. red lines) are not readily available.

Recently researchers have attempted to develop techniques that produce an automatic change in behaviour, without relying on patients adopting a new control strategy to look leftwards. The most promising of these approaches involves prism adaptation, using lenses that induce a rightward horizontal displacement of patients’ visual fields. Recent studies have suggested that the after-effects of simple prism adaptation treatment may result in a long lasting amelioration of neglect that generalises across a wide range of deficits. Further work is required to understand the mechanisms underlying such improvement, and to establish the extent of its effectiveness. Other research is being directed towards drug treatments for specific cognitive deficits underlying the neglect syndrome.

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References