INTRODUCTION

Anosognosia for hemiplegia (namely, the denial of contralesional motor deficits that may follow brain damage. Although this disturbance has been reported in the neurological literature since the beginning of the last century, only few longitudinal studies have addressed the issue of the anatomical substrate of the disorder. Here we present a comprehensive review of the literature on anosognosia for hemiplegia from 1938 to 2001, taking into account some of its clinical, epidemiological and anatomical aspects. In particular, an attempt has been made to identify the intra-hemispheric lesion locations most frequently associated to the denial behaviour.

Our review shows that anosognosia for hemiplegia most frequently occurs in association to unilateral right-sided or bilateral lesions of different brain areas (cortical and/or subcortical). It seems to be equally frequent when the damage is confined to frontal, parietal or temporal cortical structures, and may also emerge as a consequence of subcortical lesions. Interestingly, the probability of occurrence of anosognosia is highest when the lesion involves parietal and frontal structures in combination, if compared to other combinations of lesioned areas. This pattern of lesions suggests the existence of a complex cortico-subcortical circuit underlying awareness of motor acts that, if damaged, can give raise to the anosognosic symptoms.

Key words: anatomy, anosognosia, brain damage, denial, hemiplegia, neglect
frequently in association with lesions involving the infero-posterior parietal region and/or deep structures (thalamus and basal ganglia), although the composite contour maps of the lesions of the six patients presenting anosognosia for the motor impairment also showed some degree of frontal involvement. Similarly, Starkestein et al. (1993) found that patients with anosognosia had higher frequency of temporo-parietal, basal ganglia and thalamus lesions than patients without anosognosia. On the other hand, Small and Ellis (1996) and Ellis and Small (1997), by grouping patients according to the presence/absence of anosognosia and neglect, found that the majority (70%-79%) of anosognic patients had a lesion to the basal ganglia, whereas only 30% of the patients without anosognosia had a lesion involving this region. Therefore, although anosognosia for hemiplegia has been often considered a parietal lobe disturbance (Critchley, 1953) the results emerging from either group studies or single case report, when one considers them in isolation, do not seem to indicate the prevalence of a specific brain area involved in causing the denial behaviour.

In the present paper we reviewed an extensive literature on anosognosia for hemiplegia with the aim of defining some epidemiological and clinical aspects of the disorder. In particular, by analyzing a great number of cases where either a radiological report or a brain image study of the lesion was available, we tried to ascertain whether it was possible to identify a specific brain area responsible for the occurrence of anosognosia for hemiplegia.

**Method**

In the present paper we considered neurological/neuropsychological studies on brain-damaged patients where different aspects of anosognosia for hemiplegia were discussed. The database was selected using both PubMed Services and the references reported in the different papers we collected. Fifty-two studies from 1938 to 2001 that focused on the topic of our search were found. From this database we selected group studies and single case report according to the following criteria: Group studies were selected either when data relative to the prevalence of anosognosia (see below) were reported or when an anatomical report was available for each patient. Single case studies were selected only if the anatomical data were present. When available, we also considered the patient’s age and intellectual status, the presence/absence of neglect, the aetiology and the duration of illness. It must be acknowledged that a meta-analysis approach has the limitation that the sampling and the methods of definitions of the different disturbances can vary across studies. Therefore, we have to take into account the possibility that some negative cases were excluded as a result of tests that were not sensitive enough to detect one of the disorders at issue. This is crucial when one wants to select pure anosognic cases, dissociated from spatial neglect. In the present study we considered as pure anosognic cases only those patients where the absence of neglect was diagnosed after the execution of quantitative tests that evaluated different aspects of the spatial disorders. In those studies where neglect was considered to be absent, but no quantitative results were reported, data on neglect were indicated in the tables as ‘not available’ and the patients were not included in the ‘pure anosognic cases’.

**Prevalence of Anosognosia for Hemiplegia**

Anosognosia was usually evaluated using an interview that assesses the patient’s awareness of contralesional limb weakness. Although there can be differences in the procedure used in the different studies, we considered a patient to be anosognosic when an explicit verbal denial of the paresis was observed. In the more recent papers of our database, structured interviews and quantitative scores related to the severity of the denial behaviour are also available. For the prevalence of anosognosia we considered only those studies where the number of patients affected by complete contralesional hemiplegia was reported. We then divided those studies in two groups. The first group comprised those studies in which patients were selected independently of lesion side (i.e. the sample comprised both right and left brain-damaged patients and patients with bilateral lesions, see Table I). The second group was composed of those studies in which patients were selected for having a right hemisphere lesion (see Table II).

It is worth noting that papers in which the prevalence of anosognosia was given in relation to the whole sample of patients who entered the study, and not in relation to the number of patients showing the motor impairment, were not considered. Indeed, they could not provide any information about the real prevalence of the denial behaviour in those patients who were really affected by the symptom (contralesional hemiplegia) they denied.

**Anatomo-Clinical Correlations**

We considered only those studies (either group studies or single case study) where the lesion location was reported for each anosognic patient (23 studies). Data came from either autoptic examination or CT and MRI scans. Occasionally, either the scan films or the lesional maps were reproduced in the paper. The brain regions that were said to be affected are reported in the tables. Because for cortical lesions it was not possible to trace the localization at the level of single
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