We prospectively studied the prognostic significance of conjugate eye deviation in 80 patients with acute stroke and compared the 3-month mortality and disability of these patients to those of the Tilburg epidemiological study of stroke. Mortality of patients with conjugate eye deviation was higher (41%) than for the general stroke population (34%), but this difference was not statistically significant ($p < 0.179$). Looking at mortality and disability together, we found the outcome of patients with conjugate eye deviation to be significantly worse ($p < 0.001$). Deviation of the eyes occurred more frequently to the right (65%) than to the left (35%). In the patient group with eye deviation to the left, mortality was significantly higher (64%, $p < 0.001$) than in the group with eye deviation to the right (25%); only two patients of the former group (n=28) could return home. Compared to the Tilburg epidemiological study of stroke, the group with eye deviation to the left did significantly worse, both for mortality alone ($p < 0.001$) and for mortality and disability together ($p < 0.001$). The group with eye deviation to the right did significantly worse only for mortality and disability together ($p < 0.01$). Our results indicate that conjugate eye deviation is a prognostic factor for poor short-term mortality and disability in stroke patients, especially when the eyes are deviated to the left. (Stroke 1991;22:200–202)

During the acute phase of a stroke, some features have predictive value for outcome.1 It has been well established that advanced age and impaired consciousness are adverse factors for short-term survival and recovery in stroke patients.2-4 There also has been speculation about the prognostic significance of conjugate eye deviation,2,5 a well-known sign seen frequently in stroke patients.5,6

We performed a prospective study of 80 patients with conjugate eye deviation caused by stroke to evaluate the influence of this sign on short-term mortality and disability.

Subjects and Methods

During a 2-year period, all patients admitted to the St. Elisabeth and Maria hospitals in Tilburg with conjugate eye deviation caused by stroke were included in this study. Conjugate eye deviation was defined as any sustained deviation of the eyes in the horizontal plane, equal for both eyes and consistent to one side.

On admission, a standard neurological examination was performed, which was repeated once a week until discharge or death of the patient, and again 3 months after onset. The diagnosis of stroke was based on clinical criteria and, if possible, confirmed by computerized tomography (CT) or autopsy. Stroke was defined as rapidly developing clinical signs of focal disturbance of cerebral function, lasting more than 24 hours or leading to death, with no apparent cause other than a vascular origin. The CT scan was done after 7–10 days and, if necessary for clinical reasons, also in the acute phase. The lesions detected by CT were quantified by measuring their volume on seven standardized slices.

We compared 3-month case fatality and disability to those of the Tilburg Epidemiological Study of Stroke (TESS), which had been performed in the same hospitals a few years earlier.7,8 The latter study included 526 cases of acute stroke diagnosed according to the clinical criteria for stroke mentioned earlier. The $\chi^2$ test or Student's $t$ test was applied for statistical analysis. Because three comparisons were made, a level of statistical significance of 0.01 was chosen (Bonferroni correction).

Results

The ages and sex of the 80 patients with conjugate eye deviation did not differ significantly from those of the TESS population (Table 1). Computerized tomography was performed in 63 patients and autopsy
Unspecified stroke
Study of Stroke.
jugate eye deviation to the right (mean, 120 volume units; range, 7-269; n=41). The ratio of the mean volume of the lesions of the whole group was 3:2
(p<0.01, x^2) compared to the laterality in the TESS study, in which a slight predominance for left-sided hemispheric stroke was found (right to left, 54:46, n=436). In our study, the patient group with conjugate eye deviation to the left showed a significantly worse prognosis compared to the group with deviation to the right, both for mortality (p<0.001, x^2) and for mortality and disability (p<0.01, x^2). Only two patients of this group could return home (Table 4). In comparing the TESS population with only the patient group having conjugate eye deviation to the left, the differences were statistically significant for mortality (p<0.001, x^2) and for mortality and disability (p<0.01, x^2). For the group with eye deviation to the right, only mortality and disability rates together were significantly worse than for the TESS population (p<0.01, x^2).

**Discussion**

This study indicates that conjugate eye deviation is an adverse prognostic factor for short-term mortality and disability in patients with acute stroke. For mortality alone, the difference between the whole group with eye deviation and the general stroke population of the TESS study was not statistically significant. However, in this respect, it must be noted that the mortality rate of TESS is high compared with other stroke survival studies. Another factor that could have negatively influenced the result is the unknown number of patients with conjugate eye deviation included in the TESS study. A few earlier studies have reported the unfavorable prognostic significance of this sign. De Renzi et al found that patients with conjugate eye deviation could return home as slightly disabled or fully independent.

Conjugate eye deviation to the right occurred more frequently than to the left – 65% versus 35%, respectively. The dominance of conjugate eye deviation to the right caused by right-sided hemispheric stroke (n=48) was statistically significant (p<0.01, x^2) compared to the laterality in the TESS study, in which a slight predominance for left-sided hemispheric stroke was found (right to left, 54:46, n=436). In our study, the patient group with conjugate eye deviation to the left showed a significantly worse prognosis compared to the group with deviation to the right, both for mortality (p<0.001, x^2) and for mortality and disability (p<0.01, x^2). Only two patients of this group could return home (Table 4). In comparing the TESS population with only the patient group having conjugate eye deviation to the left, the differences were statistically significant for mortality (p<0.001, x^2) and for mortality and disability (p<0.001, x^2). For the group with eye deviation to the right, only mortality and disability rates together were significantly worse than for the TESS population (p<0.01, x^2).

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44% of the stroke patients with conjugate eye deviation died during hospitalization compared to 12% of the patients without eye deviation.

Moreover, our study demonstrates a significant difference regarding outcome between patients with conjugate eye deviation directed to the right and patients with eye deviation to the left; the latter group showed a poorer prognosis in terms of mortality. Although it is known that conjugate eye deviation occurs more frequently in patients with right-sided brain damage,\textsuperscript{5,6,10} which is confirmed by our findings, this asymmetry for prognostic significance has not been reported earlier.

What determines the negative influence of conjugate eye deviation on mortality and disability? Age did not play an important role in our study, but we can propose a number of other possible contributing factors. It has been mentioned that conjugate eye deviation is almost invariably associated with impairment of consciousness,\textsuperscript{11} which is an established adverse factor for prognosis. However, in our study, the majority of the patients ($n=54$) had a normal or only slightly depressed coma score, varying from 13 to 15 according to the Glasgow Coma Scale (adjusted for aphasia). Most patients did have a severe neurological deficit, with a high occurrence of motor dysfunction of the limbs ($n=80$) and hemianopia ($n=58$). Limb weakness is a possible determinant for mortality and disability,\textsuperscript{2-4} and the adverse effect of conjugate eye deviation combined with hemianopia has been described previously.\textsuperscript{12}

The severe neurological impairment found in patients with conjugate eye deviation may reflect a larger size of the responsible lesions, which logically has an influence on prognosis. Corresponding to earlier studies,\textsuperscript{5,6} the hemispheric lesions in our patients with conjugate eye deviation were indeed predominantly extensive, involving most or all of the territory fed by the middle cerebral artery. In addition, the lesions in the group with conjugate eye deviation to the left were significantly larger compared to the group with deviation to the right, which can explain the poorer prognosis of this group. Finally, the type of lesion responsible for conjugate eye deviation may play a role. In our series, an intracerebral hemorrhage was more frequently the cause of this sign, although not significantly ($p<0.06$, $\chi^2$). Others have also reported a relation between intracerebral hemorrhage and conjugate eye deviation,\textsuperscript{6,13} and fatality and disability rates for intracerebral hemorrhages have been shown to be higher than those for infarctions.\textsuperscript{9}

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References

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