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Short report

Sleep and dreaming disturbances in closed head injury patients

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SUMMARY Single night sleep recordings in closed head injury patients 6 to 59 months after injury revealed less stage 1 and a greater number of awakenings compared to age matched controls. Neither the time spent in REM sleep nor the Wechsler Memory Quotient were related to complaints of decreased or absent dreaming following injury. The proportion of REM and number of awakenings, however, showed a moderate relationship to certain behavioural problems.

Disturbances in dreaming, as well as abnormal sleep patterns, have been documented in patients with functional and organic behavioural disturbances.[1 2] Patients with closed head injury frequently have a high incidence of behavioural disturbance.[3-5] While sleep disturbances have been recognised in children and adults with head injuries,[6] most studies have been concerned with predicting outcome of prolonged coma.[7] A recent study, however, related sleep abnormalities to cognitive functioning in patients with acute closed head injuries;[2] they showed abnormal sleep patterns during the first six months after injury and a positive correlation existed between percent of REM sleep and cognitive functioning. Do patients continue to show sleep abnormalities more than six months after injury? Is percent REM related to subjective complaints of dreaming disturbance or cognitive or emotional functioning after closed head injury? A group of such patients who complained of disturbance of dreaming or sleep or both were studied with sleep EEG recordings, and their neuropsychological and psychosocial behaviours were documented.

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Method

The subjects were ten patients (8 males, 2 females) with a history of a closed head injury and ten aged matched controls (all males). The patients ages ranged from 18 to 37 years with a mean age of 26·4 years (SD = 6·13). Time since injury varied from 6 to 59 months. Patients varied in their medications because of individual clinical needs; however, none were on drugs known to substantially alter sleep patterns. All patients, except one, had been rendered comatose for at least 24 hours, and most were in coma for no less than 3 days. The Glasgow Outcome Ratings indicated that three patients were severely impaired, four moderately impaired, and three were mildly impaired. Controls were between the ages of 21 to 28 years with a mean age of 24·6 years (SD = 6·13). They were volunteers in good health, not receiving medication, with no history of head trauma, or sleep disturbances.

Neuropsychological and psychosocial measures Each closed head injury patient was given the Wechsler Adult Intelligence Scale, the Wechsler Memory Scale, the Trails Test (Part B), and the Katz-R Adjustment Scale (which is filled out by a relative). Patients were typically tested during the same month of their EEG recordings, but the interval between time of testing and sleep EEG was as long as 4 months in three patients.

Sleep EEG recordings and measures Subjects were studied in a single overnight recording session which included monitoring the electroencephalogram (EEG) from a C_3 and C_4 placement, electrooculogram (EOG), electromyogram (EMG) from the submental muscles, and electrocardiogram (EKG, V_5 placement). Subjects were awakened after approximately 6-7 hours of sleep. Sleep EEG variables were scored according to standard criteria.[8] REM latency was measured as the number of minutes from sleep onset to the beginning of REM activity. All patients were asked if they noticed a decrement in dreaming since their head injury prior to their sleep EEG.

Results

Patients after closed head injuries and age-matched controls differed in two important areas. The patients had less stage 1 sleep and a greater number of awakenings during the night's sleep. All other measures were similar in the two groups (tables 1 and 2).

Table 1 *Percentage of sleep stages in 10 closed head injury patients and ten age matched controls*

	Closed head injury		*Controls*		*t*
	Mean	*SD*	*Mean*	*SD*	
Stage 1	3·6	2·2	6·8	2·5	3·04*
Stage 2	53·4	13·4	60·1	12·2	1·17
Stage 3	8·2	8·2	4·7	5·0	1·15
Stage 4	4·2	6·3	1·6	4·7	1·04
REM	23·5	5·7	22·3	6·1	0·45
Wake	6·6	5·2	4·4	4·3	1·03

*Significant at $p < 0·05$ level.

Table 2 *Comparison of closed head injury patients and controls on selected sleep variables*

	Closed head injury		*Controls*		*t*
	Mean	*SD*	*Mean*	*SD*	
Number of awakenings after sleep onset	8·6	5·8	3·2	3·3	2·56*
Mean length of awakenings (min)	10·0	21·2	4·1	3·1	1·87
Sleep efficiency index†	88·5	5·8	92·5	5·3	1·49
REM latency	95·3	51·1	112·7	47·6	0·79
% REM 1st 3rd of night	9·9	7·3	6·8	5·3	1·09
2nd-3rd	25·0	8·5	21·0	11·0	0·78
3rd-3rd	34·7	10·6	37·9	12·7	0·61

*Significant at $p < 0·05$ level.
†Sleep efficiency index is defined as the number of epochs of sleep divided by the total recorded time. This is the percent of time spent actually sleeping.

Percent REM was not related to the patients' complaints of decreased or absent dreaming. One patient, who had no memory of dreams whatsoever, showed normal percent REM sleep. Another showed an unusual increase in REM sleep, while a third had an abnormal decrease in percent REM sleep. Complaints of dreaming were also not related to memory function. Patients who adamantly stated decreased or no dreaming had essentially the same mean Wechsler Memory Quotients (88) as patients who reported no change in their dreaming state (93). Neither percent REM nor latency to REM statistically correlated with Wechsler Full Scale IQ ($r = -0·19$; $r = -0·45$), Memory Quotient ($r = 0·06$; $r = 0·06$), or speed of performance on the Trails Test (Part B) ($r = -0·27$; $r = 0·00$). This is an interesting finding since percent REM and latency to REM were reported to correlate with cognitive functioning during the acute phase of recovery from closed head injury.[2] Correlations between other stages of sleep and neuropsychological test scores resulted in only a modest positive correlation between stage 1 and time to complete the Trails Test (Part B) ($r = 0·60$; $p = <0·05$).

Percent REM, stage 3 and 4 sleep, and stage 1 sleep, as well as the number of awakenings, were correlated to social adjustment ratings made by relatives on the Katz-R Adjustment Scale. This scale provides for 13 dimensions relevant to social functioning. Of the 52 correlations calculated, only 1 reached statistical significance. Belligerence and the percent of state 3 and 4 sleep were related ($r = 0·71$; $p = <0·05$). Given the large number of correlations, it is possible that this may not be a reliable finding. However, two correlations were observed that appeared clinically relevant. The first was the negative correlation between percent REM and hyperactivity ratings ($r = -0·50$; $p = <0·13$). Second, the number of awakenings during the night's sleep showed a positive relationship with ratings of general psychopathology ($r = -0·57$; $p = <0·10$).

Discussion

During wakefulness, many of the closed head injury patients were observed to yawn frequently. One even fell asleep during group psychotherapy when not actively engaged. Reduced stage 1 sleep may reflect problems in sustaining arousal level. When environmental influences are reduced, patients after closed head injuries may not have sufficient internal regulation of arousal and attentional mechanisms to adequately process information. Given the brain structures assumed to be at high risk in such head injuries, namely prefrontal and anterior temporal regions, there is one model of attention[9] that would predict such problems in these patients. Also, the finding that speed of performance on the Trails Test was correlated with stage 1 sleep is in support of this notion.

While the patients had two to three times more awakenings during the course of the night compared to controls, they were not awake for significantly longer time periods. This may reflect problems in neural disinhibition, where the sleep and wake cycle can be easily disrupted by internal or external stimuli or both. The fact that the number of awakenings seem to be clinically related to general level of psychopathological symptoms deserves further investigation.

Failure to find substantial abnormalities of REM sleep, compared to controls, in a single night's sleep recording argues against reduction of dreaming in this group of patients. Yet complaints of decreased dreaming are, in our experience, common in this clinical population. It may be that during the acute phase following head injury, dreaming is in fact impaired and is paralleled by disturbances in REM sleep. As the patient recovers and REM approaches normality, residual problems in neuropsychological functioning may result in misperceptions of decreased dreaming. Another possibility, of course, is that dream disturbances do occur several months after closed head injury, but present sleep measures do not reveal them.

Finally, the present study suggests that certain behavioural problems following closed head injury may have physiological correlates. Further exploration of this may prove fruitful in managing these patients.

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