Anna Szűcs M.D.

„Neurological aspects of some sleep disorders”

Ph.D. Theses

Consultant: Zoltán Nagy M.D. D.Sci.

Doctoral School, Semmelwis University

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OBJECTIVES

My aim is to present a neurological approach for some sleep disorders facilitating their specific interpretation and therapy.

1. Prospective follow up of sleep apnoea in haemorrhagic and ischaemic stroke- an analysis of causative relations
2. Sleep apnoea in myasthenia gravis – analysis of the factors influencing sleep disordered breathing
3. Insomnia ant fronto-basal tumour: causative relationship
4. Neuro-vascular compression of the lateral preoptic area underlying sleep related painful erection

METHODS

Examinations of sleep

Polysomnography: Th classical 'gold standard' of electrophysiologic sleep testing. I used it for the characterisation of the sleep of a patient with insomnia and one with sleep related painful erection. In the latter case, in order to detect and characterise erections during sleep, I supplemented it with a phallograph manufactured by our technician.

MESAM IV sleep apnoea screening monitor: The portable device registers capillary oxygen saturation, snoring sound, heart rate and body position. Data are elaborated by the MESAM IV software. It detects apnoeas with 92% sensitivity and 97% specificity. Its most reliable and biologically most important parameter is oxygen saturation. In my stroke examinations I utilised only parameters developed from the oxygen saturation, and it was the most important parameter in the myasthenic examination as well.

Microstructural sleep analysis: The traditional sleep scoring of Rechtschaffen and Kales does not look into the microstructural sleep parameters. These micro-awakenings and subtle fluctuations not resulting in phase shifts but indicating smaller changes in the level of vigilance give valuable data about sleep-stability. Microstructural parameters include K complexes and cyclic alternating pattern – CAP. I utilised both parameters to characterise the stability of the sleep of my insomnia patient.

NIH Stroke Scale

To characterise the level of disability in my stroke patients I applied the widely used stroke scale developed by the National Institute of Health in the United States.

Neuro-radiological methods

We applied them to depict stroke type and localisation as well as to examine the basal forebrain and the hypothalamus

Statistical analysis

I applied statistical methods in the prospective apnoea-study of acut ischaemic/haemorrhagic patiens' group (study l/a). As we had to take into account several interactions and probes (altogether 112 probes), we applied the Bonferoni method: we removed all factors with a significance level over 0,0005.

RESULTS

1. Sleep apnoea in acute stroke

l/a Three months follow up of sleep apnoea after acute ischaemic and haemorrhagic stroke

I performed sleep apnoea screening in 106 acute stroke patients within 6 days of stroke (test 1.). 51 patients with pathological sleep apnoea frequency were re-tested in 3 months (test 2). To characterise breathing during sleep I used oxygen desaturation index, the ratio of sleeping time spent below 90% oxygen saturation and minimal oxygen saturation value measured during sleep. I took known risk factors for stroke including history of loud snoring before stroke.

Ten patients (9%) of the initial acute stroke group died during the 3 months follow up period. 7 patients of them had an oxygen desaturation index over 20. Forty-four per cent of men and 25% of women reported loud snoring before stroke in the ischaemic group compared to 20% of men and no women in the haemorrhagic group. Risk profile of the ischaemic and haemorrhagic group was in other respects similar; only hypercholesterolaemia was significantly (P= 0,002) more frequent in the ischaemic group. 70% of the acute ischaemic – and 64% of the acute haemorrhagic stroke patients had a pathological oxygen desaturation index (>10).

Average NIH stroke scale of the ischaemic and haemorrhagic group improved similarly at three months control, however, sleep apnoea parameters' change differed in the two groups. Oxygen desaturation index of ischaemic stroke patients did not change compared to test 1; while it improved significantly in the haemorrhagic group (P=0,0002). Other sleep apnoea parameters showed a similar tendency. There was no correlation of the change in sleep apnoea parameters and NIH stroke scale in the ischaemic stroke group, but there was a tendency of correlation in the haemorrhagic group.

l/b Forty days follow up of sleep apnoea after acute brain haemorrhage

I performed sleep apnoea screening and random follow up during 40 days of 20 patients with acute brain haemorrhage. Results showed a tendency of improvement in sleep apnoea parameters, following the improvement of clinical disability status.

2. Sleep apnoea in myasthenia gravis

I performed sleep apnoea screening of 24 myasthenic patients and controls treated in neurological department. Most control subjects were adipose and hypertensive patients with a slight clinical possibility of sleep apnoea syndrome. Although the number of patients did not allow a statistical evaluation, the results showed the tendency that myasthenic male patients' sleep apnoea frequency surpassed that of controls. This tendency was the most marked in patients with bulbar muscle involvement. I did not find a similar tendency in the group of myasthenic women.

3. Organic insomnia: insomnia and fronto-basal tumour

The insomnia of the 53-year-old man developed three months before his visit. He told he had had practically no sleep since 4-5 weeks; he was depressed and irritated seeing no way out. His somatic status, laboratory data, X-ray of the chest, carotis sonography, ultrasound test of the abdomen were normal. There were sparse theta waves bifrontally on his EEG. Rorschach showed regression, slight organic signs , however, neuropsychological examination did not reveal any deficit. MRI of the brain revealed a left fronto-basal 3x3 cm lesion, probably a low grade astrocytoma or dysgenetic tumour.

Whole night polysomnigraphy showed an extremely superficial and fragmented night sleep with severely decreased amount of deep slow wave sleep and the practical lack of REM sleep. Microstructural analysis of sleep revealed surprisingly high amount of the different K complexes

- K complex alone
- K complex followed ba alpha activity (K-alpha)
- K complex followed by delta activity (K-delta)
- K complex followed by a sigma sleep spindle (K-sigma),

especially K-alpha complexes, making up 50% and 33% of all K complexes respectively; characterising the patients superficial sleep and invoking frequent awakenings. Reference value of the CAP rate in healthy middle aged man is 38,2-42,7%; in this case it was 70 and 63% respectively, showing severe instability of sleep.

4. Sleep related painful erection and neuro-vascular compression of the lateral preoptic area of the basal forebrain

The 65-year-old man's complaints began at age 55: he awoke several times during the night on painful erections. Later the frequency and severity of the painful awakenings gradually increased. Painful erection developed 3-5 times/night, the pain spread around on the perineal region, low back and thighs, it was hard to localise. His penis became senseless like wood. As he awoke, the erection disappeared. At the beginning the pain disappeared with the erection, later it persisted for hours. To avoid the torturing symptoms, he increased his sexual activity- in vain. It happened probably on account of the ill-localised pain that urosurgical interventions – transurethral prostatic resection and operation of an anal fissure – were performed two years after the beginning of his complaints.
His somatic status including neurological, urological and proctological examinations was normal. His mood was depressed, he was restless, he had suicid thoughts. Laboratory findings, thyreoid functions, serum prolactine were normal, MRI of the spine revealed no explaining abnormality.

Whole night polysomnography supplemented with phallography revealed fragmented night sleep with relatively few REM sleep. Erections developed l-7 minutes after REM sleep onsets, in the second half of the night, they lasted 3,8 and 5 minutes respectively. They were accompanied by an awakening reaction on EEG, then the patient awakened. out of REM sleep. We diagnosed sleep related painful erection.
Brain MRI revealed a neuro-vascular compression of the antero-lateral surface of the left hypothalamus.

CONCLUSIONS

Data of sleep physiology suggest that some sleep disorders may be associated to specific brain lesions and neurological diseases, they may be the symptoms of neurological conditions. I was looking for such examples.

In my stroke-apnoea study I found that there is a pathological sleep apnoea frequency in about 2/3 of acute stroke cases. I showed the most severe sleep apnoea in brainstem-cerebellar stroke. In a 3 months follow up of acute stroke patients it was shown that sleep apnoea improves together with other stroke symptoms in haemorrhagic stroke and remains permanent in ischaemic stroke. This result can be interpreted so that sleep apnoea is a stroke symptom of brain haemorrhage and it is a concomitant phenomenon in ischaemic strokes. If it is present in acute ischaemic stroke, it would probably necessitate a CPAP treatment. I have no case-number big enough to mark sleep apnoea syndrome as a risk factor for stroke, but taking into account also other publications in the literature on this issue, it seems to be a probable future conclusion of similar studies.

I found pathological sleep apnoea in 3/4 of treated male myasthenic patiens and in all patiens with involvement of the bulbar muscles, signaling no breathing problem during the day. I found no similar tendency in myasthenic female patients. The sexual difference needs confirmation and explanation. From the finding of pathological sleep apnoea in myasthenic male patients it can be concluded that myasthenic male patients should regularly be screened for sleep disordered breathing also in the lack of daytime breathing problems.

I described a clinical case - first time in the literature- where a basal forebrain tumour underlay severe insomnia. This observation seems to have theoretical and practical significance, suggesting that in cases of unexplained insomnia neurological background should also be considered.

Characterisation of sleep related erections on animal models in the literature led me to the conclusion that the parasomnia sleep related painful erection may be the result of a basal forebrain lesion, in my case - a neuro-vascular compression of the lateral praeoptic area.

SUMMARY

My aim is to examine the relation between some sleep disorders and neurological diseases; to analyse their mutual interactions in order to achieve new practical data for clinical use.

In the theoretical part I summarise some main points of sleep physiology concentrating on the associations of sleep regulation and neurological diseases.

In my examinations, besides clinical methods, the most important tools used are sleep analyses performed by polysomnography and MESAM IV as well as brain imaging methods. To assess clinical state of my stroke patients I utilised NIH Stroke Scale.

I found pathological sleep apnoea frequency in more than half of the patients in any type (bleeding/infarction) of acute stroke. In a prospective study, sleep apnoea parameters remain permanent during 3 months in the ischaemic group; on the other hand, sleep apnoea improves during follow up after brain haemorrhages. I showed pathological sleep apnoea frequency in myasthenia gravis among male patients without daytime respiration complaint.

I looked for the link between the mechanism of the sleep disorder and the underlying organic lesion in two cases. In this analyses I took into account the function of the affected structure in sleep regulation. I found a basal forebrain tumour, affecting sleep regulating centres underlying severe insomnia and I suggest a neuro-vascular compression of the lateral preoptic area of the hypothalamus being the reason of sleep related painful erection, a parasomnia of unknown origin.

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