Reviewer's Comment concerning "Sleep apnea and cervical spine pathology" (10.1007/s00586-013-3046-4 by Adam Khan, Khoi D. Than, Kevin S. Chen, Anthony C. Wang, Frank La Marca, Paul Park)

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The authors address an interesting topic. More and more obstructive sleep apnea syndrome (OSAS) is recognized and treatment installed. OSAS is a disabling entity, since it affects daily activities and quality of life. OSAS is very frequently associated with obesity [1]. As the authors stated the cause is multifactorial and included among others tobacco smoking, black race, and low socioeconomic status. OSAS is also associated with substantially increased medical costs [2].

(Spinal) surgeons will be encountered more and more with this disease. The perioperative care is more intensive than in case of patient without OSAS. Due to OSAS, the patients are more prone to have postoperative complications even warranting referral to an intensive care unit [3]. In our hospital, patients with known OSAS are already prophylactically referred to ICU after surgery.

For spinal surgery, the subject is interesting from a different point of view. Although a correlation with OSAS and altered dimensions in the upper pharyngeal space during sleep was known, a relationship between disorders of the cervical spine and OSAS appeared logical. In this narrative review, the authors tried to summarize the findings from articles in the literature.

The discrepancy between the number of articles written about OSAS in this period (many thousands) and the retrieved articles (177) and from which eventually 17 were included in the study was striking. This could be due to either an absence of relationship or unfamiliarity with it. From this point of view, this review is interesting.

Only two studies were included. One study included 91 patients with diagnosed OSAS [4]. The controls were not known with OSAS. The authors found more fusions in the OSAS than in the control group. The conclusion seemed to be straightforward, but the mean age of the OSAS patients was approximately 49 years and that of the controls 30 years. Only because of the difference in age, the prevalence of fusion will be lower in the control group than in the OSAS group. Furthermore, a correction for BMI was not performed. Neither was the difference in gender between the groups (OSAS 82.4 % males versus 28.6 % males in the control group) corrected for. Finally, but also very important, the OSAS patients were tested for OSAS whereas the controls were not. It can be possible that controls with subclinical OSAS were included. These facts should have been reported, and the conclusion been made that this study did not proof a correlation between cervical spine pathology and OSAS.

The other study [5] was from the same group as the former. It seemed very apparent that a large part (males) of the study was also included in the former study. In this review, it is not clear whether for doubling in two studies was corrected. The conclusion of the study [5] was that a fusion of the upper cervical vertebral bodies 2 and 3 seemed to be correlated with a different craniofacial profile in patients with OSAS. Controls without OSAS with the same cervical anomaly were not included (Spinal surgeons are often encountered with this anomaly). Again a correlation between OSAS and cervical spine was not apparent. Therefore, a relationship between OSAS and cervical spine pathology was not proven as the authors correctly stated, but in my opinion not even suggested.

They also included some case reports. If only compression of the airway was the explanation, the relation with sleep is difficult to understand unless it is related to

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the position of the body during sleep. One might assume that during prone position (airway away from compressing moment), the patient has less or no complaints whereas in supine position these were maximal. The included case reports should in my opinion be summarized as compressive causes, and not specified in osteochondromas, osteophytes etc. The mechanism will be the same. However, correction for other causes has not been done. For example, one of the cases [6] had at presentation also difficulty with swallowing. At examination, a swelling was seen in the pharynx. In this case, everybody would accept the relation with OSAS.

The relationship with rheumatoid arthritis (RA) seemed to be more convincing. However, in the study by Shoda [7], controls without OSAS were not included. This was important, since another study did not show a statistically significant real difference between patients RA and OSAS [8]. If a relation existed, Shoda stated clearly that the diagnosed sleep apnea might be due to mechanical compression related to RA or due to compression of brainstem or caudal cranial nerves [7]. Unfortunately, I was unable to locate the cited article by Shimizu in Pubmed, probably, because it was an abstract.

The relationship with anterior cervical spine surgery was confirmed in one prospective series of four patients. As the authors correctly stated, it seemed to be plausible to relate it to anterior cervical spine surgery with distortion of the nervous innervations of the pharyngeal and laryngeal structures analogous to dysphagia and/or hoarseness.

In conclusion, scientific evidence that spinal abnormalities contribute to OSAS is still lacking. It seemed to be obvious for various compressive moments like tumors etc. A mechanism similar to the dysphagia or hoarseness may cause OSAS after anterior spinal surgery. However, due to the unawareness of the spinal surgeons of its existence the prevalence of OSAS may be under reported. As pointed out

OSAS has major impact on the patient, but also on the costs of health care. This review will certainly increase awareness among spinal surgeons, for which the authors should be commended.

Conflict of interest None.

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