

Key Points

1. Compression of the brainstem, cerebellum, cranial nerves, and upper spinal cord are common in Chiari, syringomyelia, and basilar invagination (BI)
2. Respiratory control center and key nerve pathways are in these areas
3. Study examined the sleep of 32 people with Chiari, syringomyelia and/or BI and compared them to a control group
4. The study group had a much higher incidence of snoring and sleep disturbances
5. 59% of the study group demonstrated sleep apnea vs only 12% for the control group
6. The study group also had a higher rate of central sleep apnea
7. 88% of subjects with BI had sleep apnea and tended to have more severe cases

Definitions

apnea - temporary stop in breathing

basilar invagination - condition, sometimes associated with Chiari, where the C2 vertebra is displaced upward, potentially compressing the brainstem

central sleep apnea - sleep apnea due to a delay in the nerve signal from the brain to breathe

cerebellar tonsils - portion of the cerebellum located at the bottom, so named because of their shape

Chiari malformation - condition where the cerebellar tonsils are displaced out of the skull area into the spinal area, causing compression of brain tissue and disruption of CSF flow

control group - in an experiment, a group of subjects which is used as a basis for comparison

cranial nerves - 12 pairs of

It Can Be Hard To Get A Good Night's Sleep With Chiari

In today's hectic world, there are many reasons one might not get a good night's sleep; and now, according to researchers from the Sleep Institute in Sao Paulo, Brazil, Chiari, syringomyelia and basilar invagination can be added to the list.

Chiari has previously been linked with respiratory problems, and published case studies have indicated a potential link between Chiari and sleep apnea, so Dr. Botelho and his colleagues decided to scientifically study the incidence of sleep problems among people with what they term Craniovertebral Junction Malformations (CVJMs). They published their results in the December, 2003 issue of the Journal of Neurosurgery.

Sleep apnea is a disorder where a person actually stops breathing for more than ten seconds at a time during sleep and must wake up to breathe again. A person is considered to have sleep apnea disorder when he or she suffers more than 5 such incidents per hour during the night. Some sufferers endure hundreds of such episodes each night and as might be expected are pretty tired during the day.

There are two main types of sleep apnea, obstructive and central. Obstructive apnea is when breathing is disrupted by something blocking the throat - usually a narrowing of the windpipe. Central apnea is when there is a delay in the nerve signals from the brain which control breathing. Of the two, central apnea is considered to be more serious.

For the study, Dr. Botelho's team identified 32 people with symptomatic CVJM, verified by MRI, who had not yet undergone surgery. As a basis for comparison, the team also recruited 16 healthy subjects - with no neurological disorders - as a control group. All participants answered survey questions about sleep disorders and how tired they were during the day. In addition, the subject's sleep was physiologically monitored all night long at the researchers sleep lab, a process called whole-night polysomnography. The whole-night sleep study evaluated the following:

1. The number of obstructive apnea episodes - no air flow combined with chest/abdomen movements for more than 10 seconds
2. The number of central apnea episodes - no air flow combined with chest/abdomen movements for more than 10 seconds *after* air is supplied to the upper airways (through the nose, for example)
3. The number of hypopneic episodes - reduction in air flow of more than 50% with chest/abdomen movements for less than 10 seconds
4. The amount of oxygen in the blood

To analyze the data, the team divided the CVJM subjects into three groups: those with Chiari, those Chiari and syringomyelia, and those with basilar invagination. In addition they created an Apnea Index which was the number of apnea/hypopnea episodes per hour and established that an index of more than 5 constituted sleep apnea disorder.

While the survey/questionnaire results were unremarkable, the results of the sleep study were dramatic (see Figure 1). Fifty-nine percent of the CVJM subjects exhibited sleep apnea (more than 5 episodes per hour), while only 12% of the control group did. It should be noted that even the control group number is high; the general incidence of sleep apnea is around 2%, but the researchers attribute the high number to not screening for sleep disorders.

Looking at the CVJM subgroups is also revealing, with the basilar invagination group faring the worst, followed by those with Chiari only, then those with Chiari and syringomyelia. Among the basilar invagination group, 88% experienced sleep apnea disorder with an average index score of 23. Twenty three episodes per hour for eight hours of sleep means they were waking up more than 150 times during any given night. The average index score for the Chiari group was 16 which still translates to more than 100 episodes per night.

The basilar invagination group fared the worst when it came to central versus obstructive episodes as well. In the BI group, an average of 35% of the episodes were the more serious central type, versus only 4% for the control group. Here the group with Chiari and syringomyelia did a little worse than the Chiari only group with 18% of their apnea episodes being central, versus 12% for the Chiari group.

The researchers admit they don't know exactly why people with CVJMs experience such dramatic sleep problems, but they do suggest three possible reasons:

1. Direct compression of the brain stem which houses the control center for automatic breathing
2. Compression of cranial nerves which originate in the brain itself
3. Altered nerve pathways due to a syrinx.

Certainly, compression of the brain stem is a plausible explanation as to why the BI group has the most

nerves that start in the brain itself versus the spinal cord

hypopnea - slow or shallow breathing

obstructive sleep apnea - sleep apnea due to an obstruction in the throat

polysomnography - studying physical measures - such as breathing - during sleep in a controlled environment

sleep apnea - disruption of breathing during sleep which lasts longer than 10 seconds

syringomyelia - neurological condition where a fluid filled cyst forms in the spinal cord

syrix - fluid filled cyst in the spinal cord

problems, as basilar invagination involves the bony part of a vertebra being displaced upwards, often into the brainstem.

Whatever the underlying mechanism is, clearly trouble sleeping can be added to the laundry list of symptoms people with CVJMs must often endure.

Figure 1
Incidence of Sleep Apnea By Group

Group	Average Apnea Index	% With Apnea Syndrome
C	16	60
C&S	8	44
BI	23	88
Control	3	12

- C = Chiari; C&S = Chiari and syringomyelia; BI = basilar invagination
- Apnea Index is the number of apnea/hypopnea events per hour
- Apnea syndrome is defined as an apnea index > 5

Source

Botelho RV et al. [A Prospective Controlled Study of Sleep Respiratory Events In Patients With Craniovertebral Junction Malformation](#). Journal of Neurosurgery. 2003 Dec; 99(6) 1004-9

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