OBSTRUCTIVE SLEEP APNEA

Osa, Obstructive Sleep Apnea Syndrome, Obstructive Sleep Apnea–Hypopnea Syndrome

Repetitive nocturnal complete collapses (apneas) or partial collapses (hypopneas) of the upper airway during sleep.

♀️ Diagnosis ♂♂ Male & Female

Related Diagnoses:
Polycystic ovary syndrome

ℹ️ About Obstructive sleep apnea

Obstructive sleep apnea (OSA) is the most common type of sleep apnea (complete collapses of the upper airway during sleep) and is caused by complete or partial obstructions of the upper airway (Pic. 1). The severity of OSA is measured by the number of occurrences of airway collapse per hour (the apnea-hypopnea index - AHI) (Pic. 2).

As the muscle tone of the body ordinarily relaxes during sleep, and the airway at the throat is composed of walls of soft tissue, which can collapse, it is not surprising that breathing can be obstructed during sleep. Although a minor degree of OSA is considered to be within the bounds of normal sleep, and many individuals experience episodes of OSA at some point in life, a small percentage of people have chronic, severe OSA.

Obstructive sleep apnea (OSA) has traditionally been seen as a male disease. However, the importance of OSA in women is increasingly being recognized, along with a number of significant gender-related differences in the symptoms, diagnosis, consequences, and treatment of OSA. Women tend to have less severe OSA than males, with a lower apnea-hypopnea index and shorter apneas and hypopneas (partial collapses of the upper airway). Prevalence rates are lower in women, and proportionally fewer women receive a correct diagnosis.

Individuals with OSA are rarely aware of difficulty breathing, even upon awakening. It is often recognized as a problem by others who observe the individual during episodes or is suspected because of its effects on the body. OSA is commonly accompanied with snoring. Some use the terms obstructive sleep apnea syndrome or obstructive sleep apnea–hypopnea syndrome to refer to OSA which is associated with symptoms during the daytime.

Many people experience episodes of OSA for only a short period. This can be the result of an upper respiratory infection that causes nasal congestion (a stuffy nose), along with swelling of the throat, or tonsillitis (an inflammation of the tonsils) that temporarily produces very enlarged tonsils. Temporary spells of OSA syndrome may also occur in individuals who are under the influence of a drug (such as alcohol) that may relax their body tone excessively and interfere with normal arousal from sleep mechanisms.

Most cases of OSA are believed to be caused by:

- old age (natural or premature)
- brain injury (temporary or permanent)
- decreased muscle tone - this can be caused by drugs or alcohol, or it can be caused by neurological problems or other disorders
- increased soft tissue around the airway (sometimes due to obesity), and
- structural features that give rise to a narrowed airway

In adults, most individuals with OSA syndrome are obese, however, obesity is not always present. Adults with normal body mass indices (BMIs) often have decreased muscle tone causing airway collapse and sleep apnea.
Polysomnography in diagnosing OSA characterizes the pauses in breathing. As in central apnea, pauses are followed by a relative decrease in blood oxygen (O2) and an increase in the blood carbon dioxide (CO2). Whereas in central sleep apnea the body’s motions of breathing stop, in OSA the chest not only continues to make the movements of inhalation, but the movements typically become even more pronounced. Monitors for airflow at the nose and mouth demonstrate that efforts to breathe are not only present but that they are often exaggerated. The chest muscles and diaphragm contract and the entire body may thrash and struggle.

Numerous treatment options are used in obstructive sleep apnea. Avoiding alcohol and smoking is recommended, as is avoiding medications that relax the central nervous system (for example, sedatives and muscle relaxants). Weight loss is recommended in those who are overweight. Continuous positive airway pressure (CPAP) and mandibular advancement devices are often used and found to be equally effective. Physical training, even without weight loss, improves sleep apnea. There is insufficient evidence to support widespread use of medications and in some cases the surgery can be used as a treatment.

**Associated diseases**

**Obesity**

Obstructive sleep apnea is associated with obesity. Although the exact pathway linking OSA and obesity remains somewhat unclear, it is recognized that obesity contributes to airway collapse during sleep by causing increased fat deposits around the upper airway, thus narrowing it and diminishing the activity of the muscles in that region. Conversely, sleep apnea may contribute to excess weight and obesity through sleep loss and daytime sleepiness as apneic individuals rouse often to resume breathing and reenable unobstructed air flow. Moreover, insufficient sleep has been associated with increased energy need and food intake.

**Complications**

Obstructive sleep apnoea (OSA) might lead to cardiovascular complications such as heart failure, left/right ventricular dysfunction, myocardial infarction, arrhythmias (irregular heartbeat), systemic and pulmonary hypertension (high pressure), that all increase morbidity (a diseased state) and mortality (a measure of the number of deaths in a given population).

Additionally, patients may have depression, physical and intellectual impairment, erectile dysfunction (the inability to develop or maintain an erection of the penis), and headache.

**Risk factors**

Individuals with decreased muscle tone (the continuous and passive partial contraction of the muscles) and increased soft tissue around the airway, and structural features that give rise to a narrowed airway are at high risk for OSA. Men, in which the anatomy is typified by increased mass in the torso and neck, are at increased risk of developing sleep apnea, especially through middle age and later.

Decreased muscle tone is also temporarily caused by chemical depressants (drug which slow down brain functioning); alcoholic drinks and sedative medications being the most common. The permanent premature muscular tonal loss in the upper airway may be precipitated by traumatic brain injury, neuromuscular disorders (medical conditions that impair the functioning of the muscles) or poor adherence to chemical and or speech therapy treatments.

Women suffer typically less frequently and to a lesser degree than do men, owing partially to physiology, but possibly also to differential levels of progesterone (sex hormone involved in the menstrual cycle, pregnancy, and embryogenesis). Prevalence in post-menopausal women approaches that of men in the same age range. Women are at greater risk for developing OSA during pregnancy.

OSA also appears to have a genetic component; those with a family history of it are more likely to develop it themselves. Lifestyle factors such as smoking may also increase the chances of developing OSA as the chemical irritants in smoke tend to inflame the soft tissue of the upper airway and promote fluid retention, both of which can result in narrowing of the upper airway.
Female fertility

Obstructive sleep apnea is associated with obesity. Fat tissue is an endocrine organ, which is able to produce estrogen. Every woman has androgen (primary male steroid hormone, that stimulates the development of male characteristics, e.g. testosterone) in her body, which is produced from estrogens during the process called aromatization. With high levels of estrogen as a source, there is also higher levels of androgen producing from fat tissue. High level of testosterone in female can lead to infertility due to lack of ovulation. Without ovulation, there is no egg released so it cannot be fertilized with sperm. Therefore pregnancy is not possible.

Also other hormones are increased in obese women such as leptin (a hormone made by adipose cells that helps to regulate energy balance by inhibiting hunger), the sex hormone-binding globulin (binds to the two sex hormones: androgen and estrogen) and insulin-like growth factor (proteins with high sequence similarity to insulin). All these increased hormones leads to disruption in gonadotropin secretion which is neccessary to proper ovulation and menstrual cycles.

Women may be at increased risk of OSA during pregnancy due to a number of factors. The growing uterus elevates the diaphragm (a thin sheet of muscle under the lungs), changing pulmonary mechanics. In addition, during pregnancy, neck circumference increases, nasal patency is reduced, and pharyngeal edema occurs.

Snoring during pregnancy appears to be a risk factor for both pregnancy-induced hypertension and intrauterine growth retardation.

Male fertility

Men with obstructive sleep apnea-hypopnea syndrome (OSAHS) show a high prevalence of erectile dysfunction (ED). The underlying mechanisms by which OSAHS and ED interact are still unknown.

Even with an erection problem, a man may still have sexual desire and be able to have an orgasm and to ejaculate. But without erection, it is not possible to transport the sperms from ejacuante into the uterus naturally.

Men diagnosed with OSA may manifest by decline in morning serum testosterone levels. A man with low levels of testosterone may lose his desire for sex. Testosterone is also necessary for sperm maturation. With low levels there are not enough sperms for conception.

Prevention

Avoiding alcohol and smoking is recommended, as is avoiding medications that relax the central nervous system (for example, sedatives and muscle relaxants). Weight loss is recommended in those who are overweight. Physical training, even without weight loss, improves sleep apnea.

Symptoms

- unexplained daytime sleepiness
- restless sleep
- loud snoring (with periods of silence followed by gasps)
- morning headaches
- insomnia (a sleep disorder where people have trouble sleeping)
- trouble concentrating
- mood changes such as irritability, anxiety and depression
- forgetfulness
- increased heart rate and/or blood pressure
- decreased sex drive
- unexplained weight gain
- increased urination and/or nocturia (the individual has to wake at night one or more times for urinate)
- frequent heartburn or gastroesophageal reflux disease (a long-term condition where stomach contents come back up into the esophagus) - heavy night sweats

### Therapies

#### Self therapy

The weight loss can ease the symptoms.

#### Conventional medicine

There are no sufficient studies, which can confirm the efficiency of medication for treatment of OSA. Other option to treat OSA is surgical therapy, with several different types of operation. An individual’s condition must be considered while the type of operation is choosing.

**Pharmacotherapy**

Evidence is insufficient to support the use of medications to treat obstructive sleep apnea. This includes the use of fluoxetine (an antidepressant), paroxetine (an antidepressant) and acetazolamide (a medication used to treat glaucoma, epilepsy, altitude sickness, periodic paralysis, and heart failure).

**Surgical therapy**

Surgical treatments to modify airway anatomy, known as sleep surgery, are varied and must be tailored to the specific airway obstruction needs of a patient. Surgery is not considered a frontline treatment for obstructive sleep apnea. For those obstructive sleep apnea sufferers unable or unwilling to comply with front line treatment, a properly selected surgical intervention will be the result of considering an individual’s specific anatomy and physiology, personal preference and disease severity.

There are a number of different operations that may be performed including:

- **Nasal surgery** (Pic. 3), including straightening of the nasal septum, in patients with nasal obstruction or congestion which reduces airway pressure and complicates OSA.
- **Tonsillectomy and/or adenoidectomy** in an attempt to increase the size of the airway.
- **Removal or reduction of parts of the soft palate** and some or all of the uvula, such as uvulopalatopharyngoplasty or laser-assisted uvulopalatoplasty.
- **Reduction of the tongue base**, either with laser excision or radiofrequency ablation.
- **Genioglossus advancement**, in which a small portion of the lower jaw that attaches to the tongue is moved forward, to pull the tongue away from the back of the airway.
- **Hyoid suspension** (Pic. 4), in which the hyoid bone in the neck, another attachment point for tongue muscles, is pulled forward in front of the larynx.
- **Maxillomandibular advancement**, which moves the upper (maxilla) and lower (mandible) jaws forward.

In the morbidly obese, a major loss of weight (such as what occurs after bariatric surgery) can sometimes cure the condition.

#### Other therapy

For treatment of obstructive sleep apnea is used Positive airway pressure (PAP) which a mode of respiratory ventilation. There are several types of PAP therapy, each works in different time of respiratory cycle. Another method is called radiofrequency ablation which uses radio wave energy. The success of these methods depends on severity of OSA in each patient and their preferences in which method they are willing to try.

**Continuous positive airway pressure (CPAP)**

Continuous positive airway pressure (Pic. 5) is a form of positive airway pressure ventilator, which applies mild air pressure on a continuous basis to keep the airways continuously open in people who are
able to breathe spontaneously on their own. It is an alternative to positive end-expiratory pressure (PEEP). Both modalities stent the lungs’ alveoli open and thus recruit more of the lung’s surface area for ventilation.

But while PEEP refers to devices that impose positive pressure only at the end of the exhalation, CPAP devices apply continuous positive airway pressure throughout the breathing cycle. Thus, the ventilator itself does not cycle during CPAP, no additional pressure above the level of CPAP is provided, and patients must initiate all of their breaths.

**Radiofrequency ablation**

Radiofrequency ablation (RFA) uses low frequency (300 kHz to 1 MHz) radio wave energy to target tissue, causing coagulative necrosis (a type of accidental cell death typically caused e.g. by infarction). RFA achieves its effects at 40 °C to 70 °C unlike other electrosurgical devices which require 400 °C to 600 °C for efficacy.

RFA is usually performed in an outpatient setting, using either local anesthetics or conscious sedation anesthesia, the procedure itself typically lasting under 3 minutes. The targeted tissue, such as tongue or palate, is usually approached through the mouth without the need for incisions, although occasionally the target is approached through the neck using assisted imaging.

Complications include ulceration, infection, nerve weakness or numbness and swelling. These complications occur in less than 1% of procedures.

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**Assisted reproduction**

If conservative medical treatments fail to achieve a pregnancy, the physician may suggest the patient to use the methods of assisted reproduction.

The women can be suggested to undergo in vitro fertilization (IVF). IVF and related ART techniques generally start with stimulating the ovaries to increase egg production. Most fertility medications are agents that stimulate the development of follicles in the ovary. Examples are gonadotropins and gonadotropin releasing hormone. After stimulation, the physician surgically extracts one or more eggs from the ovary, and unites them with sperm in a laboratory setting, with the intent of producing one or more embryos. Fertilization takes place outside the body, and the fertilized egg is reinserted into the woman’s reproductive tract, in a procedure called embryo transfer.

In case that after stimulation, there is no egg obtained or the embryos are bad and not possible to transfer, there is an option called egg donation.

Egg donation is the process by which a woman donates eggs (egg donor). First step is choosing the egg donor by a recipient from the profiles on or clinic databases (or, in countries where donors are required to remain anonymous, they are chosen by the recipient’s doctor based on recipient woman’s desired trait). For assisted reproduction purposes, egg donation typically involves IVF technology, with the eggs being fertilized in the laboratory; more rarely, unfertilized eggs may be frozen and stored for later use.

Erectile dysfunction which can be result of obstructive sleep apnea can be treated with methods of assisted reproduction. If there is a significant number of sperm and/or there is any other dysfunction, the retrieved sperm is placed inside woman’s uterus. This process is called intrauterine insemination (IUI).

If the number of sperm is not sufficient or the procedure is not successful, surgical methods of the sperm retrieval can be used (TESE, MESA, PESA).

A microsurgical epididymal sperm aspiration (MESA) is a surgical technique requires testis delivery through a 2-3 cm scrotal incision. The epididymal tunica is incised, and an enlarged tubule is selected. Then, the epididymal tubule is dissected and opened with sharp microsurgical scissors. The fluid that flows out of the tubule is aspirated with the aid of a silicone tube or a needle attached to a tuberculin syringe. The aspirate is flushed into a tube containing warm sperm medium and is transferred to the laboratory for examination. MESA can be repeated at a different site on the same epididymis (from the cauda to caput regions) and/or the contralateral epididymis until an adequate number of motile sperm
is retrieved.

Testicular sperm extraction (TESE) is the process of removing a small portion of tissue from the testicle under local anesthesia and extracting the few viable sperm cells.

The technical procedure for percutaneous epididymal sperm aspiration (PESA) involves the insertion of a needle attached to a syringe through the scrotal skin into the epididymis.

These techniques are used to collect the spermatozoa suitable for egg fertilization by intracytoplasmic sperm injection (ICSI). During ICSI just one sperm is injected directly into the egg cytoplasm using a micromanipulative apparatus that transforms imperfect hand movements into fine and precise movements of micromanipulation tools.

Find more about related issues

Diagnoses

Polycystic ovary syndrome
A condition in which a woman has an imbalance of female sex hormones. This may lead to changes in the menstrual cycle, cysts in the ovaries, trouble g
Learn more at: www.fertilitypedia.org/therapy/diag/polycystic-ovary-syndrome

Therapies

Egg donation
Process by which a woman donates eggs for purposes of assisted reproduction or biomedical research.
Learn more at: www.fertilitypedia.org/edu/therapies/egg-donation

ICSI
A micromanipulative fertilization technique in which a single sperm is injected directly into an egg.
Learn more at: www.fertilitypedia.org/edu/therapies/icsi

Sperm donation
The procedure in which a man (sperm donor) provides his sperm for fertility treatment.
Learn more at: www.fertilitypedia.org/edu/therapies/sperm-donation

Standard IVF
A process in which an egg is fertilised by sperm outside the body: in vitro. Own or donated gametes may be used.
Learn more at: www.fertilitypedia.org/edu/therapies/standard-ivf

Gallery
A CPAP machine, which uses continuous positive airway pressure throughout the breathing cycle to help lung’s alveoli remain open and thus recruit more of the lung’s surface area for ventilation.

Sources

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