

# Hiccup

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A **hiccup** (**HIK*<sup>ⓘ</sup>*; also spelled **hiccough**) is an involuntary contraction (myoclonic jerk) of the diaphragm that may repeat several times per minute. In medicine, it is known as **synchronous diaphragmatic flutter** (SDF), or **singultus**, Latin for the act of catching one's breath while sobbing.<sup>[1]</sup> The hiccup is an involuntary action involving a reflex arc.<sup>[1]</sup> Once triggered, the reflex causes a strong contraction of the diaphragm followed about 0.25 seconds later by closure of the vocal cords, which results in the classic "hic" sound.

Hiccups may occur individually, or they may occur in bouts. The rhythm of the hiccup, or the time between hiccups, tends to be relatively constant.

A bout of hiccups, in general, resolves itself without intervention, although many home remedies are often used to attempt to shorten the duration.<sup>[2]</sup> Medical treatment is occasionally necessary in cases of chronic hiccups.

## Signs and symptoms

- A single or a series of breathing diaphragm spasms, of variable spacing and duration.
- A brief (less than one half second), unexpected, shoulder, abdomen, throat, or full body tremor.
- Hiccups may present as an audible chirp, squeak, "hupp", or if controlled, a quick inhaling gasp, sigh, or sniff.
- Hiccups may present as brief but distracting or painful, frequent or occasional interruptions in normal breathing, with sudden momentary pain of the throat, chest, and/or abdomen.

## Causes

- Coughing
- Swallowing air excessively<sup>[3]</sup>
- Rapid eating<sup>[4]</sup>
- Intense emotions such as fear, anxiety, excitement, joy, or euphoria
- Carbonated beverages, alcohol, dry breads, and some spicy foods<sup>[5]</sup>
- Opiate drug use<sup>[6]</sup>
- Laughing<sup>[7]</sup>

Hiccups may be triggered by a number of common human conditions. In rare cases, they can be a sign of serious medical problems.

## Pre-phrenic nucleus irritation of medulla

Clinical case reports mention that lesions of the medulla that involve the area slightly ventral and lateral to nucleus and tractus solitarius cause hiccups. One (of several) explanations for this finding is that such a lesion “irritates” descending information from nucleus solitarius to the phrenic nucleus. The phrenic nucleus consists of a functionally related group of cell bodies in the ventral horn from C3-C5. Axons arising from the phrenic nucleus comprise the phrenic nerve, which innervates the diaphragm. The hiccups result from spasmodic lowering of the diaphragm that causes a short, sharp inspiratory cough. Brain stem lesions involving the area ventral and lateral to nucleus and tractus solitarius result in hiccup.<sup>[8]</sup>

- Coughing
- Kidney failure<sup>[9]</sup>

## CNS disorders

- Stroke<sup>[9]</sup>
- Multiple sclerosis<sup>[10]</sup>
- Meningitis<sup>[9]</sup>

## Nerve damage

- Gastroesophageal reflux<sup>[11]</sup>

## Phylogenetic hypothesis

An international respiratory research group composed of members from Canada, France and Japan proposed that the hiccup is an **evolutionary remnant of earlier amphibian respiration**.<sup>[12]</sup> Amphibians such as tadpoles gulp air and water across their gills via a rather simple motor reflex akin to mammalian hiccuping. The motor pathways that enable hiccuping form early during fetal development, before the motor pathways that enable normal lung ventilation form. Thus, according to recapitulation theory the hiccup is evolutionarily antecedent to modern lung respiration.

Additionally, this group (C. Stauss et al.) points out that hiccups and amphibian gulping are inhibited by elevated CO<sub>2</sub> and may be stopped by GABAB receptor agonists, illustrating a possible shared physiology and evolutionary heritage. **These proposals may explain why premature infants spend 2.5% of their time hiccuping, possibly gulping like amphibians, as their lungs are not yet fully formed.**<sup>[13]</sup>

Fetal intrauterine hiccups are of two types. The physiological type occurs prior to twenty-eight weeks after conception and tend to last five to ten minutes. These hiccups are part of fetal development and are associated with the myelination of the phrenic nerve, which primarily controls the thoracic diaphragm.

The phylogeny hypothesis explains how the hiccup reflex might have evolved, and if there is not an explanation it may explain hiccups as an evolutionary remnant, held-over from our amphibious ancestors.<sup>[14]</sup> This hypothesis has been questioned because of the existence of the afferent loop of the reflex, the fact that it does not explain the reason for glottic closure, and because the very short contraction of the hiccup is unlikely to have a significant strengthening effect on the slow-twitch muscles of respiration.

## **Clearance of air from stomach**

A more recent explanation by Howes in 2012 suggests that hiccups may have evolved along with other reflexes developed in mammals that allow them to coordinate suckling milk and breathing.<sup>[14]</sup> Hiccups are only found in mammals, and are most common in infants, becoming rarer as mammals age. This may suggest that they evolved to allow air trapped in the stomach of suckling infants to escape, allowing more milk to be ingested. The hypothesis suggests that the air bubble in the stomach stimulates the sensory limb of the reflex at receptors in the stomach, esophagus and along the diaphragm. This triggers the hiccup, which creates suction in the chest, pulling air from the stomach up and out through the mouth, effectively burping the animal. This theory is supported by the strong tendency for infants to get hiccups, the component of the reflex that suppresses peristalsis in the esophagus, and the existence of hiccups only in milk-drinking mammals.

## **Treatment**

Hiccups are normally treated at home through self-care. Hiccups are treated medically only in severe and persistent (termed "intractable") cases.

Numerous medical remedies exist but no particular treatment is known to be especially effective.<sup>[15]</sup> Many drugs have been used, such as baclofen, chlorpromazine, metoclopramide, gabapentin, and various proton-pump inhibitors. Hiccups that are secondary to some other cause like gastroesophageal reflux disease or esophageal webs are dealt with by treating the underlying disorder. The phrenic nerve can be blocked temporarily with injection of 0.5% procaine, or permanently with bilateral phrenicotomy or other forms of surgical destruction. Even this rather drastic treatment does not cure some cases, however.

An anecdotal medical approach is to install lidocaine liniment 3% or gel 2% into the ear canal. Somehow this creates a vagus nerve-triggering reflex through its extensions to the external ear and tympanus (ear drum). The effect can be immediate, and also have lasting effect after the lidocaine effect expires after about two hours.<sup>[16]</sup>

Haloperidol (Haldol, an anti-psychotic and sedative), metoclopramide (Reglan, a gastrointestinal stimulant), and chlorpromazine (Thorazine, an anti-psychotic with strong sedative effects) are used in cases of intractable hiccups. Effective treatment with sedatives often requires a dose that renders the person either unconscious or highly lethargic. Hence, medicating with sedatives is only appropriate short-term, as the affected individual cannot continue with normal life activities while under their effect.

Persistent digital rectal massage has also been proven effective in terminating intractable hiccups.<sup>[17]</sup>

The administration of intranasal vinegar was found to ease the chronic and severe hiccups of a three-year-old Japanese girl. Vinegar may stimulate the dorsal wall of the nasopharynx, where the pharyngeal branch of the glossopharyngeal nerve (the afferent of the hiccup reflex arc) is located.<sup>[18]</sup>

Bryan R. Payne, a neurosurgeon at the Louisiana State University Health Sciences Center in New Orleans, has had some success with an experimental procedure in which a vagus nerve stimulator is implanted in the upper chest of patients with an intractable case of hiccups. "It sends rhythmic bursts of electricity to the brain by way of the vagus nerve, which passes through the neck. The Food and Drug Administration approved the vagus nerve stimulator in 1997 as a way to control seizures in some patients with epilepsy."<sup>[19]</sup>

Lockhart stated that hiccups can sometimes be cured by pinching the skin that covers the surface of the deltoid muscles, which is supplied by the axillary nerve which shares the c5 nerve root with the phrenic nerve.<sup>[20]</sup>

## Self-care and folk remedies

There are many superstitious and folk remedies for hiccups, including headstanding, drinking a glass of water upside-down, being frightened by someone, breathing into a bag, and eating a large spoonful of peanut butter. Placing sugar on or under the tongue has also been used.<sup>[21][22]</sup>

A simple treatment involves increasing the partial pressure of CO<sub>2</sub> and inhibiting diaphragm activity by holding one's breath or rebreathing into a paper bag.<sup>[citation needed]</sup> Vagus nerve stimulation can improve hiccups, done at home by irritating the pharynx through swallowing dry bread or crushed ice, or by applying traction to the tongue, or by stimulating the gag reflex.<sup>[citation needed]</sup>

In Plato's *Symposium*, Aristophanes has a case of the hiccups and is advised by Eryximachus, a physician, to cure them by holding his breath, or, failing that, by gargling or provoking sneezing. This ancient recommendation can be compared with the vagus nerve stimulation techniques mentioned previously.

## Society and culture

American Charles Osborne had hiccups for 68 years, from 1922 to February 1990,<sup>[23]</sup> and was entered in the *Guinness World Records* as the man with the longest attack of hiccups, an estimated 430 million hiccups.<sup>[24]</sup> In 2007, Florida teenager Jennifer Mee gained media fame for hiccuping around 50 times per minute for more than five weeks.<sup>[25][26]</sup> Christopher Sands, a Briton, hiccupped an estimated 10 million times in a 27-month period from February 2007, to May 2009. His condition, which meant that he could hardly eat or sleep, was eventually discovered to be caused by a tumor on his brain stem

pushing on nerves causing him to hiccup every two seconds, 12 hours a day. His hiccups stopped in 2009 following surgery.<sup>[27]</sup>

In Slavic, Baltic and Hungarian folklore, it is said that hiccups occur when the person experiencing them is being talked about by someone not present. In Indian, Nepalese, and Arabic folklore, they are similarly said to occur when the person experiencing them is being thought of by somebody close.<sup>[*citation needed*]</sup>