

## Kyphosis and lordosis

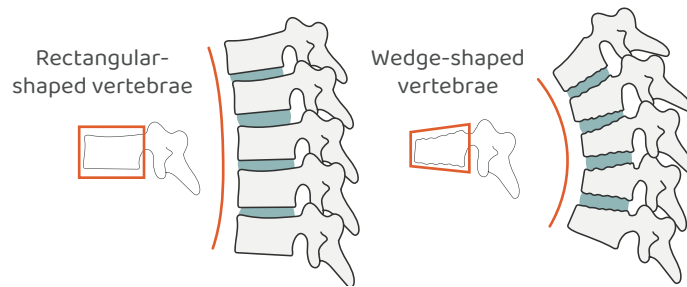
### Hyper- and hypokyphosis

Kyphosis is an outward curvature of the spine, rounding away from the center of the body. This curvature is visible only in the sagittal plane. When upright, a typical spine has slight kyphosis in the thoracic and sacral regions. When the amount of kyphosis is atypical, the term kyphosis is assigned either the prefix “hyper,” meaning above typical, or “hypo,” meaning below typical.

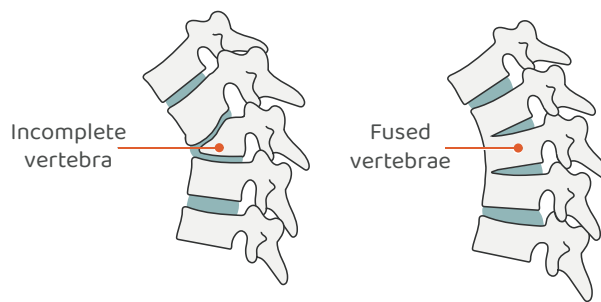
- Hyperkyphosis indicates excessive rounding of the spine, typically in the thoracic region.
- Hypokyphosis indicates a loss of kyphosis and the presentation of an abnormally straight or flat spine.

**Hyperkyphosis** is classified based on its cause. Classifications include:

- **Postural kyphosis**, which is not a spine condition, but rather a posture that causes the appearance of hyperkyphosis. It is caused by a person slouching or not sitting or standing up straight. This is the most common cause of “non-structural” hyperkyphosis, the term used for hyperkyphosis that is not associated with a structural abnormality of the spine.
- **Scheuermann’s kyphosis**, which is a spine condition where at least three consecutive vertebrae grow in a wedge shape instead of a rectangular shape (Figure A1.1). This is also referred to as juvenile osteochondrosis of the spine.
- **Congenital kyphosis**, which is a spine condition where the vertebrae of a fetus does not form properly during pregnancy, which may lead to hyperkyphosis. Examples include atypical shapes or incomplete vertebrae and fused vertebrae (Figure A2.2).



**Figure A1.1** Typical spine (left) compared to Scheuermann's kyphosis (right).



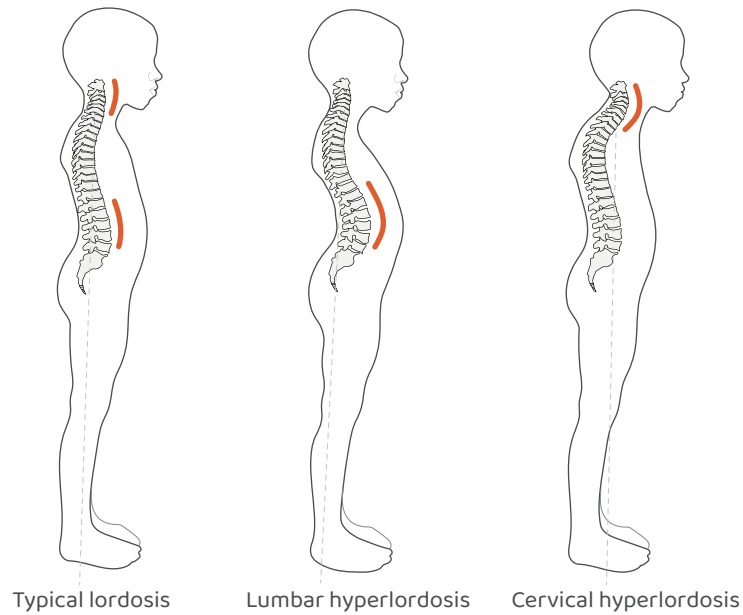
**Figure A1.2** Congenital kyphosis.

**Hypokyphosis** means there is a loss of kyphosis or flattening of the spine. Hypokyphosis is often associated with idiopathic scoliosis. It is believed that one of the main causes of idiopathic scoliosis is asymmetric growth of the spine; the front of the spine grows faster than the back of the spine. When this asymmetric growth occurs, it commonly results also in hypokyphosis.

## Hyper- and hypolordosis

Lordosis is an inward curvature of the spine, arching toward the center of the body. This curvature is visible only in the sagittal plane. When upright, a typical spine has lordosis in the cervical and lumbar regions. In the same manner as kyphosis, when the amount of lordosis is atypical, the prefixes “hyper” or “hypo” are used.

- Hyperlordosis indicates excessive arching of the spine, typically in the lumbar region, but this can also develop in the cervical region (Figure A1.3). Having excessive arching in the lumbar region is sometimes described as a “swayback.”
- Hypolordosis indicates an abnormally straight or flat spine, typically in the lumbar region.



**Figure A1.3** Typical spinal lordosis (left) compared to hyperlordosis in the lumbar (middle) and cervical (right) regions.

Hyperlordosis has many possible causes. Two common causes are:

- **Weak abdominal muscles:** The muscles that surround the stomach and lower back are essential for spine support. When these muscles are weak, individuals may be more prone to hyperlordosis. This is normal in younger children until they develop core strength.
- **Trauma:** Injuries to the spine can weaken it and lead to hyperlordosis.

Hypolordosis is mainly caused by **congenital vertebral abnormalities**—that is, individuals may be born with vertebrae that did not develop properly. This can prevent the front of the spine from growing at the same rate as the back of the spine, which can lead to hypolordosis as the spine begins to arch.

## APPENDIX 2

### “Other” scoliosis

“Other” types of scoliosis exist that do not fit into the four established types (idiopathic, congenital, neuromuscular, and syndromic). “Other” includes scoliosis associated with neural axis abnormalities, which are atypical structures within the central nervous system (brain and spinal cord) that can impact the growth of the spine. These include:

- Syrxinx
- Chiari malformation type I
- Tethered cord syndrome

See Table A2.1.

**Table A2.1** Neural axis abnormalities associated with scoliosis

NEURAL AXIS ABNORMALITY	DEFINITION
<b>Syrinx</b>	A fluid-filled area that forms in the spinal cord, caused by a condition termed syringomyelia, which is an atypical widening of the central canal in the spinal cord
<b>Chiari malformation type I</b>	A condition in which brain tissue extends into the spinal canal through the opening in the base of the skull
<b>Tethered cord syndrome</b>	A neurologic condition where connective tissue is attached to the spinal cord which “tethers” it, usually to the bottom of the spine, and inhibits the movement of the spinal cord within the spine.