



# Congenital Scoliosis with Bilateral Foramen Transversarium in the Fifth Lumbar Vertebra

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## What is known on this subject?

In typical human anatomy, the cervical vertebrae differ from the thoracic and lumbar vertebrae in the presence of a pair of foramen transversarium (FT).

## What this case report adds?

To date, there has been no reported lumbar FT in a case diagnosed with congenital scoliosis. In particular, when using pedicle or lateral mass screws for the cervical spine, the FT and the possibly accompanying vascular structures may be at risk. It should be noted that this situation may also occur in congenital scoliosis in the trajectory of the transpedicular pedicle screws. In any case of suspected congenital scoliosis in which surgical intervention is planned, a sensitive evaluation with computed tomography angiography is recommended to rule out any unexpected anatomic variations.

## ABSTRACT

The foramen transversarium (FT) is frequently mentioned in the cervical spine, and the possibility of injury to the vertebral artery and vein passing through this structure is noted, particularly during surgical procedures. In this report, we present an atypically located FT at the level of the L5 vertebra, which was identified during the pre-operative three-dimensional computed tomography (CT) evaluation of a patient with congenital scoliosis in our clinic. A 33-year-old female patient with congenital scoliosis was admitted to our clinic because of cosmetic deformities and spinal pain. CT showed multiple bone formation abnormalities in the thoracic region and surprisingly, bilateral FT at the level of the L5 vertebra in the lumbar region of the spine with no accompanying vascular structures on digital CT angiography. The literature defining lumbar FT is sparse. We believe that knowledge of this rare variant can add to the relevant literature and that it is important to consider this variant in radiological imaging and surgical procedures in this region.

**Keywords:** Anatomical variation, congenital scoliosis, lumbar foramen transversarium, neurosurgery

## Introduction

Congenital scoliosis occurs worldwide with a frequency of 0.5-1/1000 births, and 50% of cases require treatment. Congenital scoliosis is a three-dimensional (3D) deformity of the

spine characterized by different formation and segmentation abnormalities. Surgical need depends on the type of anomaly, its location, and the general growth potential of the individual (1).

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The literature frequently mentions the foramen transversarium (FT) and its variations in the cervical spine and refers to the possibility of injury to the vertebral artery and vein passing through this structure, especially during surgical procedures (2,3).

The cervical vertebrae differ from the thoracic and lumbar vertebrae in the presence of a pair of FTs. However, there are a few reports in the literature in which FT appears as an anatomical variation in the lumbar region homologous to the foramen processus transversi of the cervical vertebrae (4). While recognition of lumbar FT can be ignored in cases that do not require invasive procedures, it is essential to consider such anatomic differences in cases where surgical treatment is planned.

### Case Report

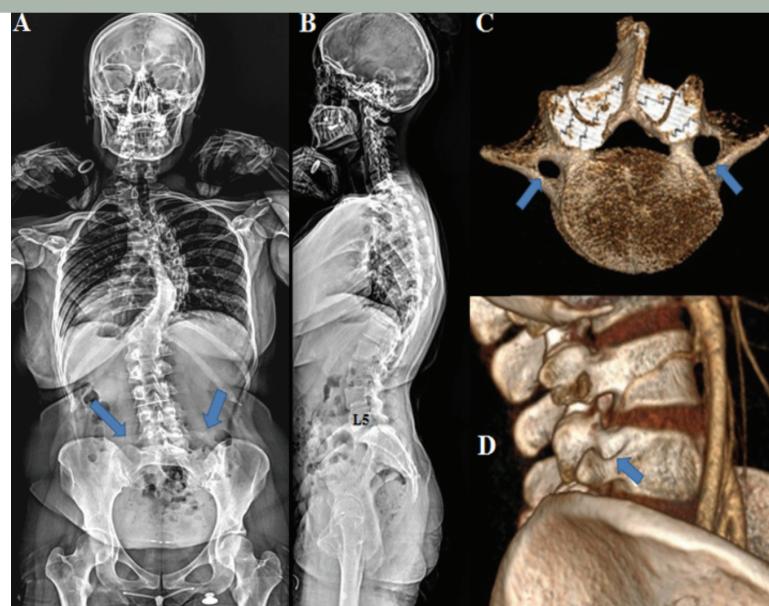
We present the anatomical alteration of the FT of the L5 vertebra found during the pre-operative examination of a 33-year-old female patient with congenital scoliosis who presented to our clinic. She was admitted for pain and cosmetic deformities with a Cobb curvature of 71 degrees in the main thoracic region and 47 degrees in the thoracolumbar region. The patient's spine has the following congenital anomalies: T2 non-segmented hemivertebra, T2 butterfly

vertebra, T7 butterfly vertebra, T8-9 right semi-segmented accessory hemivertebra, T9-10 right semi-segmented accessory hemivertebra, T11-12 fusion, and T11-12 left non-segmented hemivertebra. We observed 13 ribs on the left side and 12 on the right side. Cervical, thoracic, and lumbar spinal magnetic resonance imaging scans did not reveal any intraspinal pathology, and there were no abnormalities at the craniocervical junction. Posterior instrumented fusion surgery with multiple osteotomies is recommended. The surgical fusion level planning did not cover the L5 lumbar vertebra.

The radiology department was contacted after a routine preoperative 3D computed tomography (CT) scan revealed several cervical and thoracic bone abnormalities as well as a bilateral FT in the L5 vertebra. CT angiography was recommended by the relevant department. On detailed examination of the butterfly-shaped lumbar L5 vertebra, bilateral, well-formed FTs were detected. The FTs were wider on the left and connected the corpus and pedicle to the two transverse processes. As depicted in Figure 1, no vascular structures were found in the foramen.

### Discussion

In typical human anatomy, the vertebral artery, vein, and accompanying sympathetic plexus pass through the FT,



**Figure 1.** Radiological examinations of a 33-year-old female patient who presented to our clinic for surgical treatment. Preoperative radiological examination revealed a transverse foramen anomaly in the L5 vertebra (arrows). The spinal deformity is shown in (A) as an AP radiograph of the entire spine and in (B) as a lateral radiograph. In the (C) 3D reconstruction view, bilateral transverse foramina can be seen, which is wider on the left side. In (D), the 3D volume rendering view in the lateral plane shows that the vascular structure does not pass through the transverse foramen

AP: Anterior posterior, 3D: Three-dimensional

which is normally located in the processus transversus of all cervical vertebrae. While the vertebral artery ascends through the FT of the sixth cervical vertebra, only the vertebral vein(s) are located in the seventh cervical foramen. The 6<sup>th</sup> cervical vertebra is the most common entry point of the vertebral artery to the FT, but some studies have reported that the C4, C5, and C7 cervical vertebrae can also be the entry point of the vertebral artery (5,6). In the present case, no vascular structures were observed in the FT of L5 on CT angiography imaging and 3D volume rendering reformats.

FT can be encountered in the lumbar region, especially in L1 and L5 (7). Beers et al. (4) reported four cases with a diagnosis of possible spinal stenosis or disk herniation in routine computed tomography of the lower lumbar spine. The authors stated that these foramina probably developed when the costotransverse elements between the mammillary and accessory processes failed to unite at the site of the anastomotic vessels during the embryological period (4). To date, there have been no reports of lumbar FT in a case diagnosed with congenital scoliosis.

Especially when using pedicle or lateral mass screws for the cervical spine, the FT and the possibly accompanying vascular

structures may be at risk (8). It should be noted that this situation may also occur in congenital scoliosis in the trajectory of the transpedicular pedicle screws. In any case of suspected congenital scoliosis in which surgical intervention is planned, a sensitive evaluation with CT angiography is recommended to rule out any unexpected anatomic variations.

### Ethics

**Informed Consent:** Obtained.

**Peer-review:** Externally and internally peer-reviewed.

### Authorship Contributions

Surgical and Medical Practices: K.A., A.V.Ö., Concept: K.A., M.B.B., Design: K.A., M.B.B., Data Collection or Processing: A.K.G., Analysis or Interpretation: Y.Ö., K.A., M.B.B., Literature Search: Y.Ö., K.A., Writing: Y.Ö., K.A.

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