

## Vertebral Level of the Celiac Ganglion and Its Clinical Implications

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### Abstract

**Background:** Celiac ganglia play a major role in pain management of chronic pancreatitis and pancreatic cancer. Celiac ganglia/plexus block is used in the management of chronic upper abdominal pain. Inconsistent result of the block may be due to the variation in the vertebral level of the celiac ganglion. The study was conducted with aim of finding the vertebral level of the ganglion in order to establish a predictable pattern for the neurolysis of celiac ganglion and plexus.

**Methods:** Twenty formalin embalmed adult, seventeen male and three female, cadavers were dissected through a midline abdominal incision.

**Results:** Thirty four out of forty ganglia (82.5%) were at the level of L1 and six ganglia (17.5%) were at the T12 vertebra.

**Conclusions:** Most commonly celiac ganglion lie at the level of L1 and its position varies from T12 to L1.

**Keywords:** Celiac ganglion; Celiac artery; Superior mesenteric artery; Thoracic vertebra.

### Introduction

Celiac ganglia are the two largest prevertebral ganglia located in the upper abdomen as part of the autonomic nervous system that is functionally responsible for innervating the digestive tract and abdominal visceral tissue. The ganglia serve as integrative centers for coordinating intestinal motility as well as secretion and absorption throughout the digestive tract.<sup>8</sup>

Anatomic variation of celiac ganglion and celiac plexus has been a subject interest among Anatomists, as is evident from the literature that the variation is not only from case to case but also, from the right side to left side in the same person. The celiac ganglia are variable in number, size, and location. The ganglia are located in the retroperitoneal fat anterolateral to the aorta and posterior to the stomach and pancreas.<sup>3</sup> They lie in the antecrural space anterior to the diaphragmatic crura, which separate them from the retrocrural splanchnic nerves and the vertebral bodies.<sup>4</sup> The location of the celiac ganglia is usually described in relation to surrounding structures, and also show variation in, relations and vertebral level.

### Materials And Methods

Twenty formalin embalmed adult cadavers,

seventeen male and three female, were dissected for this study. In all cadavers dissection was performed through a midline incision.

Abdominal organs such as liver, stomach, spleen, pancreas, duodenum, small intestine and large intestine were removed with the preservation of diaphragm, posterior abdominal wall and aorta with its branches. Peritoneum on the anterior surface of the ganglion was removed.

Great care was taken to not to disturb the ganglion from underlying fascia and thus to preserve the true relationship with the vertebral column. Origin of celiac artery and superior mesenteric artery noted to assign the vertebral level of the ganglion on right and left side.

Ganglion related to celiac artery (Fig.1) were assigned the vertebral level of T12<sup>14,16</sup> and the ganglion related to superior mesenteric artery were assigned the vertebral level of L1.<sup>9,15</sup>

## Results

**Table 1:** Vertebral level of the ganglion.

Sex	Right ganglion	Left ganglion
Male	T12	T12
Male	T12	T12
Male	L1	L1
Male	L1	L1
Male	L1	L1
Male	L1	L1
Male	T12	L1
Female	T12	L1
Male	L1	L1
Male	L1	L1
Male	L1	L1
Male	L1	L1
Male	L1	L1
Male	L1	L1
Male	L1	L1
Male	L1	L1
Male	L1	L1
Female	L1	L1
Female	L1	L1
Male	L1	L1
Male	L1	L1

**Table 2:** Vertebral level of Celiac ganglion.

Vertebral level	Right side	Left side
T12	4	2
L1	16	18
Total	20	20



**Fig. 1:** Right and left celiac ganglion.

**Table 3:** Comparative studies of vertebral level of celiac ganglion.

Author	Sample size	Vertebral level of ganglion	Reference
Ward EM, et al.	20 cadavers	Middle of L2 (second lumbar vertebra) to Intervertebral disc between T12 and L1	19
Filshie J, et al.	12 patients	L1	2
Paz Z, Rosen A	46 dissections	L1	10
Zhang XM, et al.	65 cadavers	T11 (eleventh thoracic vertebra) to L1	20
Tae In Ha, et al.	57 patients	T12 to L1	17
Wanna Sirojanakul et al.	83 cadavers	middle third of T12 to lower third of L1 vertebra	18
Pereira et al.	108 patients	T11 to L1	11
In this study	20 cadavers	T12 to L1	

## Discussion

Celiac ganglia are nerve bundles located in the upper abdomen as part of the autonomic nervous system that is functionally responsible for innervating the digestive tract and abdominal visceral tissue. The collection of nerve cell bodies of postganglionic sympathetic nerves forms the celiac ganglion.<sup>19</sup> The ganglia serve as integrative centres for coordinating intestinal motility as well as secretion and absorption throughout the digestive tract. The current belief is that celiac ganglia are their own level of regulation, distinct from both the central nervous system as well as the intrinsic control in digestive viscera. For this reason, the ganglia have

earned the name 'little brain'. People with chronic pancreatitis or malignancies in the upper abdominal region often suffer from unmanageable abdominal pain due to constant stimulation of celiac plexus nociceptive fibres. In these cases, celiac plexus block is a therapeutic procedure which helps with decreasing the pain sensation.<sup>8</sup> Celiac plexus block/neurolysis may be performed from either a posterior or anterior approach.

Posterior approaches are more commonly performed to decrease the incidence of neurologic complications resulting from either needle passage or inadvertent retrocrural spread of neurolytic with the anterior approach. The classic needle entry site is five to seven cm from the midline at the level of the L1 vertebral body, with the right-sided entry point often slightly more lateral than the left. The needles may contact the lateral aspect of L1 vertebral body, in which case they may be slightly withdrawn and laterally redirected to walk along the bone. The tips should ultimately be positioned lateral to the L1 vertebral body. The clinician is guided by x-ray, ultrasound, CT scan, once the celiac ganglion is accessed, pain killer is injected.<sup>3</sup> Therefore, knowing about the vertebral level of celiac ganglion is of importance for the clinician to achieve good result. The vertebral level of the celiac ganglion varies from T12 to L2<sup>[1]</sup>, T11 to L1<sup>[12,21]</sup>, middle of the L2 vertebra to intervertebral disc between T12 and L1<sup>[19]</sup>, middle third of T12 to L1<sup>[20]</sup> (Table III), T12 to L2<sup>[5]</sup> and L1.<sup>[2,10,11,13,17,18]</sup> In this study of twenty cadaveric dissection, 82.5% ganglia were at the level of L1 vertebra and 17.5% at the level of T12 vertebra (Table I and Table II), and these observations are similar to the findings the authors who reported ganglia lying at level of T12 to L1.<sup>[6,7,18,21]</sup>

The inconsistent result of celiac ganglion block may be due to the underappreciated anatomical variations of the ganglion. As the variation in the vertebral level is not only from case to case but also from right to left side.<sup>19</sup> The variation in the vertebral level of ganglion emphasises its clinical importance in outcome of celiac plexus block used for relieving chronic pain of upper abdominal organ pathologies.

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**Conflict of Interest:** None

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