

Occurrence of Stellate Ganglion: A Fetal Study

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Keywords

Stellate block, cervical, ganglion, Fetus, vertebrae.

Abstract

Introduction : The stellate ganglion also called as cervicothoracic ganglion, which is collection of sympathetic nerves. The ganglion lies anterior to the neck of the 1st rib. The dimensions of ganglion is about 2.5 cm in its length x 1 cm in width x 0.5 cm about thickness. It might reach to anterior part of horizontal process of C7 vertebrae. The longus colli muscle is located anterolaterally, scalene muscle lies medial to the stellate ganglion. A suprapleural membrane structurally separates the ganglion from the caudal side of the cervical pleura. The trachea, oesophagus as well as the vertebral column lies medial to stellate ganglion.

Aim : To identify stellate ganglion, its position in relation to the vertebrae. To note the size of stellate ganglion and its histology.

Materials and method: The present work was carried on 50 aborted formalin preserved human fetus specimens ranged from 11th -28th week of gestation in Department of Anatomy, GMCH, Chandigarh received in regard to autopsy. The fetuses were grouped into four age groups on the basis of gestation. Group A (11-15 weeks), Group B (15+ _20 weeks), Group C (20+ _25 weeks) and Group D (25 weeks onwards). The stellate ganglion was observed and its position, size was noted.

Result: Among 50 fetuses, the stellate ganglion also called as cervicothoracic ganglion were present in every age group from 11 weeks to 28 weeks of gestational age. The stellate ganglion was accounted for 64% in the fetus cervical sympathetic chains. The position of stellate ganglion at the level of C7-T1 was most common and constant.

Conclusion: The Stellate ganglia aggregation produce a complete sympathectomy to structures of head & neck region. The detailed knowledge of occurrence of stellate ganglion, its position in different gestational age groups of fetus would be guide for embryologist, anatomist, surgeons.

1. Introduction

The cervical part of sympathetic chain is a part of peripheral autonomic nervous system that lies in pre-vertebral fascia between carotid sheath in front and pre-vertebral muscles behind. It has 3 ganglia: superior cervical ganglion which is formed by C1 to C4 cervical ganglion, the middle ganglion by coalescence of 5th & 6th cervical

ganglion, Inferior ganglion is formed by fusion of lower two cervical & sometimes with T1 nerve to form cervico-thoracic or stellate ganglion.¹

The stellate ganglion gives grey rami communicantes to C7 & C8 cervical nerves of brachial plexus, cardiac branches and branches to blood vessels close to it and sometimes branch to vagus nerve.² A

stellate ganglion when formed by coalescence of inferior cervical and first thoracic sympathetic ganglion is found in 80% of the population. The ganglion which is seen as an oval-shaped structure lies in relation to anterior part of neck of 1st rib.³

The cervicothoracic ganglion, it is group with sympathetic nerves, lies in relation to anterior part of the neck of first rib. It might reach anterior to horizontal process of the C7 vertebra. It measured 2.5 cm in its length x 1 cm in width x 0.5 cm in its thickness. As referred, it appears star-shaped and elongated ("stellate"-star-shaped). However, the size & shape of the stellate ganglia might show variability in the different population. The longus colli muscle is present anterolateral & scalene muscles lie medial to the stellate ganglion. The Sibson's fascia separates stellate ganglion from caudal part of cervical pleura. The trachea, oesophagus & vertebral column lies medial to the ganglion. In regard to the relevant vasculature, the vertebral vessels are anterolateral in location to stellate ganglion. A carotid artery is located ventral to the ganglion. The superior intercostal artery lies laterally & the costocervical trunk which is branch of the subclavian artery branches out near the inferior end of stellate ganglion.⁴

Some of studies reported considerable variation in the stellate ganglion in different populations. In 80% of the population, there was the fusion of inferior cervical & T1 ganglion. In the remaining cases, fusion of the inferior cervical & T1 was not in the familiar manner. The ICG or stellate ganglion, which would be present in front of C7 vertebrae at its transverse process.⁵

Since, the sympathetic flow to the structures in the head & neck, synapses at the sympathetic ganglia, or at stellate ganglia, may pass through it to the cranial sympathetic ganglia. The stellate ganglion block gives a more complete sympathetic denervation in region of head & neck. The Scalene muscles, brachial plexus which is situated laterally, contributes the spread of local anesthetic to the brachial plexus, producing somatic block other than the sympathetic block.^{6,7,8}

The stellate ganglia blockade is remarkably performed procedure in relief to pain. If it is performed correctly with care, it could provide a very good therapeutic, prognostic and diagnostic values.

2. Materials And Method

The present work was done on 50 aborted formalin preserved Human fetus specimens which ranged from 11th -28th week of gestation in Department of Anatomy, GMCH, Chandigarh. These fetuses received were obtained for purpose of routine autopsy and evaluation. The consent form to do additional research was taken from parents at the time of receiving fetus. The ethical clearance was taken for the study. The gestational age and crown rump length of fetus was noted. The fetuses were grouped on the basis of their gestational age. The macerated fetuses and fetuses with any malformation were excluded from the study. A straight anterior midline vertical incision from symphysis menti to pubic symphysis was made and transverse incisions extending from right to left shoulders were made to reflect the skin. Anterior midline structures in neck and thorax were removed with care to approach to the sympathetic chain and stellate ganglion was observed. The mean length of stellate

ganglion and its position in relation to vertebrae was noted in different age groups.

size of ganglion. The fetuses were grouped on the basis of gestational age as shown in Table 1.

3. Observations

The sympathetic chain was present bilaterally in all fetuses with variation in position and

Table no 1: Gestational age group distribution.

| Groups | Gestational age (weeks) | Number of cases | Total number |
|--------|-------------------------|-----------------|--------------|
| A | 11+_15 | 12 | 24 |
| B | 15+_20 | 13 | 26 |
| C | 20+_25 | 14 | 28 |
| D | 25 onwards | 11 | 22 |
| | | 50 | 100 |

Fig 1. Showing stellate ganglion (anterior midline structures removed)

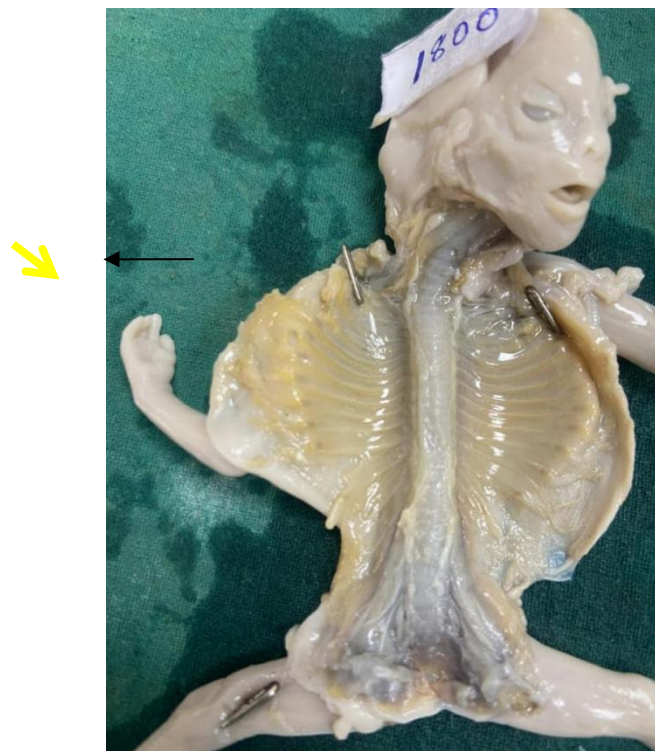


Table no 2: Size of stellate ganglion

| | |
|----------------|-------|
| Mean length | 0.7cm |
| Mean thickness | 0.3cm |

The mean length of stellate ganglion was found to be 0.3cm. found to be 0.7cm and mean thickness was

Table no 3: Occurrence of stellate ganglion

| Group | No. of cases | Stellate ganglion (%age) |
|-------|--------------|--------------------------|
| A | 12 | 5 (41.6%) |
| B | 13 | 10 (76.9%) |
| C | 14 | 10 (71.4%) |
| D | 11 | 7 (63.6%) |

The stellate ganglion was present in 5 cases out of 12 in gestational age of 11-15 weeks. Among 13 cases ,In age group B the stellate ganglion was seen in 10 cases (76.9%).In group C It was present in 10 cases out of 14 cases .However in group D in 7(63.6%)

fetuses there was seen presence of stellate ganglion. The cervicothoracic ganglion/stellate ganglion were present in every age group and accounted for 64% of the ganglia in the fetus cervical sympathetic chains.

Table no 4: Location of stellate ganglion

| Position | Group A | Group B | Group C | Group D |
|-----------|---------|---------|---------|---------|
| At C6-C7 | 2 | 1 | 3 | - |
| At C7- T1 | 2 | 3 | 5 | 6 |
| At C6C7T1 | 1 | 3 | 2 | 1 |
| At C7T1T2 | - | 1 | - | - |
| At C7 | - | 2 | - | - |

The stellate or cervicothoracic ganglion was found in almost all age groups.The stellate ganglion was seen in 32 cases (64%). Its position was at C7T1 in 16 cases , at the level of C6C7T1 in 7cases..In group A in 2 cases it was at the level of C6C7,2 at level of C7T1.In

group B in I case it was at C6C7 ,at C7T1 and C6C7T1 in 3 cases each.In group C most of cases in 5 fetuses it was seen at C7T1.In group D in 6 cases it was found at the level of C7T1.

Histology

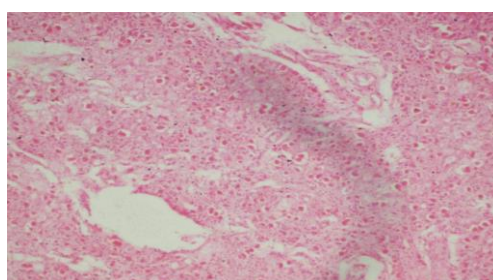


Fig. 2: Histology of stellate ganglion

In fetus stellate ganglion, the mature adult like neurons with perinuclear halo space surrounded by sheath cells were clearly seen. Numerous fibres and nuclei of fibrocytes were seen among the neurons.

4. Discussion

The cervical part of sympathetic chain is blocked at the cervicothoracic ganglion or stellate ganglion. The stellate block which is a medical aid given into the nerves that helps to improve the pain in the regions of head, neck, arm & upper chest. It helps to increase the circulation and the supply of blood to the upper arm.⁹ However, to minimize the risk to the vertebral artery injury, stellate blocks are performed at the level of C6 vertebrae.¹⁰ For the disorders of upper limb, injection volumes of about 10-20 ml have been utilised during reference based method to ensure spread to C7- T1.¹¹

De gama also dissected 40 fetus specimens ranged 16-30 weeks of gestational age. He noted superior cervical ganglion was present in almost all of cases, the middle ganglion found in 79% cases, inferior cervical ganglion in 45% cases.¹² The stellate ganglion was present in 48% cases while in present study stellate ganglion was present in 64% cases.

Hemanth Kommuru investigated 31 south Indian cadavers. They found that the inferior cervical ganglion united with T1 to form stellate ganglion and it extended to T1 and T2. Out of 25 dissections he observed inferior ganglion was independent in 5 cases, fused with first and second thoracic in 3 cases. Of 31 dissections stellate ganglion was present in 19 cases and fused with T1, T2 in one case and independent in 11 cases.¹³ However, in present fetus study the position of stellate ganglion extends from C6 to T2. The most

common and constant position was seen at the level of C7T1.

The stellate ganglia which measured about 2.5cm x 1cm x 0.5cm and it extends ventral to the transverse process of C7 vertebrae. A stellate ganglion gives sympathetic fibres to ventral rami of C7, C8 & T1. The offshoot of viscera gives contribution to cardiac plexus in thoracic region. It gives branches to the brachial plexus³. In present fetal study the stellate ganglion measures about 0.7cm x 0.3cm. The occurrence or failure regarding cervical block was dependent on the anatomy of cervical sympathetic chain and on needle placement for delivery of anaesthetic. So this study will add to the existing literature and will be guide for the vertebral position and size of the stellate ganglion in early developmental stage. From the histology one could easily identify the stellate ganglion, with adult like mature neurons having neuronal space surrounding it with numerous fibres and fibrocytes.

5. Conclusion

The cervical sympathetic /stellate ganglia block is common performed operation to relieve upper limb and head neck structures. If it is performed right, this could provide great curative, predictive and diagnostic values. The stellate ganglion block also produce a total sympathectomy to structures of the head & neck region. So, the detailed knowledge of occurrence of stellate ganglion, its position in different gestational age groups of fetus would be guide for embryologist, anatomist, surgeons.

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