

The Cervical Sympathetic Chain in Fetuses at Different Gestational Age.

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Abstract

Introduction: The cervical part of sympathetic chain (CSC) is a part of the peripheral autonomic nervous system. It continues below with the thoracic part of sympathetic chain. It has three ganglia-superior, middle and inferior.

Material & method: The material for the present study included 50 spontaneously aborted fetuses. The cervical part of sympathetic chain was exposed bilaterally and location, length, number and position of ganglia was noted.

Observations: The specimens were divided into four groups (A=11-15 weeks, B=15+ _20 weeks, C=20+ _25 weeks, Group D=25 weeks onwards). **Morphology:** The number of cervical ganglia varied from 1-3; Three ganglia was noticed in 54% cases, two ganglia in 42 % cases. In only 4% cases only one ganglia was seen. The presence of cervico-thoracic ganglion was noted in 66% fetal specimens. The length was measured and compared with other authors.

1. Introduction:

The sympathetic trunks, ganglionated nerve trunks seen bilaterally, they extend through entire length of the vertebral column. In neck region trunk bears 3 ganglia, 11-12 in thoracic, 4 or 5 in the lumbar region and 4 or 5 in pelvis¹. The cervical sympathetic chain lies in the pre-vertebral fascia present between the carotid sheath in front and pre-vertebral muscles behind it. The cervical part continues below with the thoracic sympathetic trunk, and above it extends in skull as an internal carotid nerve. There are three ganglia on cervical sympathetic trunk. Superior cervical ganglion (SCG) is formed by the union of upper 1-4 cervical segments, it supplies vasoconstrictor as well as pseudo-motor nerves to the head and neck region, dilator pupillae and smooth muscles in the eyelids and orbitalis². Middle cervical ganglion it may be absent sometimes where it is replaced by minute ganglion and represents a coalescence of the ganglion of 5 & 6th cervical segments and gives grey rami communicantes to C5 and C6 cervical nerves of the brachial plexus, thyroid and cardiac branches. Inferior cervical ganglion formed by the fusion of lower two cervical and sometimes 1st thoracic segmental ganglion, also

participates and forms a cervico-thoracic (CTG) or stellate ganglia (SG). Additionally, 2nd, 3rd and even 4th thoracic ganglion may participate in its formation. It gives grey rami communicantes to C7 and C8 cervical nerves of the brachial plexus, cardiac branches, and branches to the nearby blood vessels and sometimes branch to the vagus nerve as well³. The sympathetic trunk is blocked at the level of cervicothoracic ganglion⁴. The stellate ganglion is fusion of the inferior cervical sympathetic ganglion with the first thoracic ganglion and is present in 80% of the population⁵. It is located at the level of C7, anterior to its transverse process and superior to the neck of the first rib. The sympathetic chain runs downward on head of ribs and leaves the thorax on the side of the body of the 12th thoracic vertebra behind the medial arcuate ligament. The thoracic part of the sympathetic chain has rami communicantes, postganglionic fibers to the heart, aorta, lungs and oesophagus⁶. The primordia of sympathetic trunk is noted at 5 mm stage of embryo, with small group of cells in the thoracolumbar region. The cells move towards the cervical region cranially and to the sacral region caudally during 9 mm stage. The ganglia get differentiated along with the intervening cord at 20-

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22mm stage with prominent white and grey ramus comminantes⁷.The cervical sympathetic trunk reaches the level of C3 at 9 mm stage and is present in the entire neck at 11 mm stage⁸.

The topography of the cervical part of sympathetic chain is clinically important to avoid injury to CSC during surgical treatment related to cervical spine. Also the number and location of CSG should be ascertained in fetus to know if there was any shift in adult anatomy. Due to paucity of literature regarding foetal studies in India, few authors had reported on development of sympathetic chain. Hence the present study was an attempt to trace the morphology & histogenesis of cervical sympathetic chain at different stages of gestational age.

2. Materials and Methods:

The present study included 50 spontaneously aborted fetuses (n=50 chains bilaterally) received for routine autopsy in department of Anatomy, Government medical college and hospital, Chandigarh. Prior to autopsy, the consent was taken from the parent/s to perform autopsy and to conduct additional research

from academic viewpoint. The congenitally malformed fetuses were excluded from the study. The gestational age (GA) and crown-rump length of fetuses were recorded. The fetuses were divided into four gestational age groups: Group A (11-15 weeks), Group B (15 +-20 weeks), Group C (20+-25 weeks) and Group D (25+ onwards). The neck of fetus was fully extended and anterior midline incision from symphysis menti to sternum and lateral incision along the neck was given to expose the cervical chain ,its location was observed with respect to adjoining structures.The length of each chain was measured from the upper end of the SCG(superior cervical ganglion) till the lower end of the ICG(inferior cervical ganglion) (sometimes till the CTG, depending upon its presence) with the help of digital vernier caliper.The positions and number of the ganglia were noted.

3. Observation:

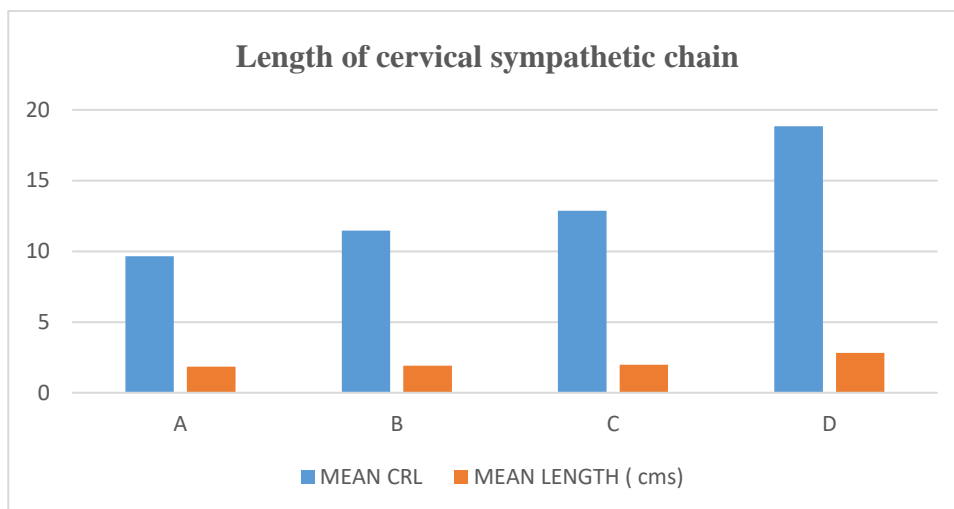
The chains were present bilaterally all fetuses with no variations in the location and number of ganglia on either side (Table 1).

Table 1: Group of distribution of fetuses

Groups	Gestation age(weeks)	No. of specimens	No. of fetal CST
A	11-15	12	24
B	15 ⁺ - 20	13	26
C	20 ⁺ -25	14	28
D	26-till birth	11	22
Total		50	100

Total of 50 fetus specimens (100 chains bilaterally) were taken from different age groups and cervical sympathetic chain was observed bilaterally.

Figure 1: Showing the mean length of cervical part of sympathetic chain and CRL.



The mean Crown rump length (CRL) was found to be 9.65cm in group A, followed by 11.46cm in group B, 12.87cm in group C whereas 18.84cm in group D. The mean length of cervical part of sympathetic chain (CST) was 1.85cm in fetuses of 11-15 weeks of gestational age. There was slight increase in the length of chain i.e. from Group A to Group B. The maximum length was found in group D which was 2.81cm. Therefore, it was noted that length of cervical sympathetic chain was directly proportional to gestational age of the fetus as shown in figure 1.

The length of CST was directly proportional to the gestational age. However, there was significant increase in length from 20th to 26th weeks as compared to the earlier age groups (fig1). This shows the growth of fetus was more pronounced during second trimester.

Next, the number of the cervical sympathetic ganglia was observed and noted in all age groups.

Table 2: Prevalence of number of CSG in different age groups

Groups	Number of Cases	Number of cases with respect to the presence of ganglion in cervical sympathetic chains			
		3- ganglia	2- ganglia	1- ganglia	Stellate ganglion
A	12	4(33.3%)	6(50%)	2(16.6%)	5(41.66%)
B	13	9(69%)	4(30.7%)	-	9(69.23%)
C	14	9(64.2%)	5(35.71%)	-	12(85.71%)
D	11	5(45.45%)	6(54.54%)	-	7(63.63%)
Total		27	21	2	33

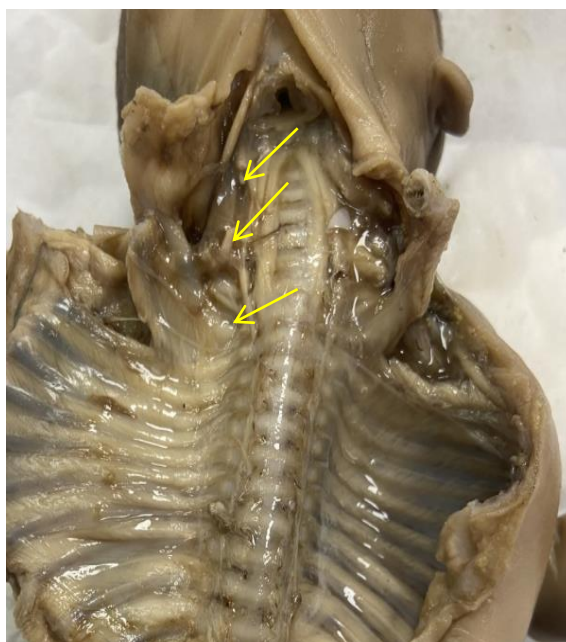
In study conducted on 50 fetus specimens, three ganglion was seen in 27 cases (54%), two in 21 cases (42%), one in 2 fetus specimens (4%). The stellate ganglion was seen in 33 fetus specimens (66%) in

almost all age groups. In group A, there were 3 ganglia in four cases, 3 ganglia in Group B out of 9 cases, followed by 9 cases in group C and 5 cases in group D. Two ganglia were seen in 6 cases in group A, 4

cases in group B, 5 in group C and 6 cases in group

D. Two fetus specimen had only one ganglion.

Figure 2: Fetus with Superior, middle and inferior cervical ganglion.



4. Discussion

The number of cervical ganglia were observed and collected in different age groups. The presence of cervical ganglion in cadaver and fetus study showed variation.

Sobinciski⁹ who reported the presence of three ganglia in his research on 6-11 week old fetuses. However, our study favoured it with presence of 3 ganglia in 11-28 week fetuses. Whereas, In adult cadavers it ranged from 2-3 in number¹⁰.

The mean length of cervical sympathetic chain in fetuses from 11-15 weeks was 1.77cm according to study conducted by Gest⁶. It was in accordance to our study which reported length of cervical chain in 11-15 weeks was about 1.85cm. However, In cadaver study done by Manuel¹¹ the mean length was noted as 7.68cm.

The human sympathetic chain consists of ganglia and interganglionic cord of the chain. The study conducted by Erdinc on 30 fresh embalmed adult cadavers and found the level of intermediate ganglion of CST. The SCG (superior cervical ganglion) had the most constant position at the level of C4 in all dissections. The position of intermediate ganglion was at the level of C5 in 26% cases, C6 in 33%, C7 in 13% cases.

Intermediate ganglion was not seen in 26% cases¹². According to study done by Tubbs it was reported that the superior cervical ganglion was the largest, rests posterior to the internal carotid artery and lies anterior to the second and third cervical vertebrae¹³. De Gama dissected 40 Fetus specimens of 16-30 weeks gestational age. He noted that SCG (superior cervical ganglion) was present in all cases, MCG (middle cervical ganglion) in 79% cases, ICG (inferior cervical ganglion) in 45% cases. The stellate ganglion was seen in 48% cases which was same as of our study¹⁴.

In present study done on 25 fetuses (50 chains) from 11th to 28 weeks of gestational age, the presence of superior cervical ganglion was seen in almost all of the cases (100%). The position of superior cervical ganglion was mostly at the level of C1-C2. The middle cervical ganglion position was variable at level of C3, between C3-C4, at C4, C5. The inferior ganglion was mostly at the level of C7. The stellate or cervicothoracic ganglion was seen in all age groups.

5. Conclusion

The morphological changes of cervical part of sympathetic chain study will add to the existing knowledge and form the basis for understanding structural changes. It will provide foetal database

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regarding differentiation, maturation and growth of the cervical chain to the embryologist as well as to the anatomist and regarding cervical spine and stellate block for the surgeons during various surgical procedures.

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