

# A Two Trunked Brachial Plexus: A Case Report

RAJAN KUMAR SINGLA, RAVI KANT SHARMA, BHAGYA SHREE

## ABSTRACT

The brachial plexus is a major and a complicated plexus at the root of the neck. It is formed by the ventral primary rami of the C<sub>5</sub>, C<sub>6</sub>, C<sub>7</sub>, C<sub>8</sub> and the T<sub>1</sub> spinal nerves. During the routine under graduate dissection of the right upper limb of an adult female cadaver, a variant pattern of a two trunked brachial plexus was encountered. The upper trunk was formed by the fusion of the C<sub>5</sub> and the C<sub>6</sub> roots. The C<sub>7</sub> root, instead of continuing as the middle trunk, joined with the roots of C<sub>8</sub> and T<sub>1</sub> to form the lower trunk.

## INTRODUCTION

The brachial plexus is formed by the ventral primary rami of the C<sub>5</sub>, C<sub>6</sub>, C<sub>7</sub>, C<sub>8</sub> and the T<sub>1</sub> spinal nerves. The upper trunk of the plexus is formed by the union of the C<sub>5</sub> and the C<sub>6</sub> roots; the middle trunk is the continuation of the C<sub>7</sub> root and the lower trunk is formed by the union of the C<sub>8</sub> and the T<sub>1</sub> roots. Each trunk divides into the ventral and dorsal divisions. The ventral divisions of the upper and the middle trunk join to form the lateral cord; the ventral division of the lower trunk continues as the medial cord and the posterior divisions of all the three trunks join to form the posterior cord of the brachial plexus [1].

The brachial plexus may be damaged in open, closed or obstetrical injuries, it may be pressed upon by the cervical rib or it may be involved in a tumour [2]. The knowledge on its variations is important for explaining incomprehensible clinical signs [3]. Apart from the clinicians, these variations are also of interest to the radiologists, anaesthesiologists, neurosurgeons, neurologists, vascular surgeons and the orthopaedic surgeons [4]. One such case which had two trunks of the brachial plexus (with absence of the middle trunk) on the right upper limb of a female cadaver, was encountered in our department, which has been reported here.

## CASE REPORT

During a routine under graduate dissection of the upper limb of an adult female cadaver in the Department of Anatomy, Govt. Medical College, Amritsar (Punjab), India, the following variant of the brachial plexus was encountered.

On the right side, there were two trunks instead of the usual three. The upper trunk was formed by the fusion of the C<sub>5</sub> and the C<sub>6</sub> roots. The C<sub>7</sub> root, instead of continuing as the middle trunk, joined with the roots of C<sub>8</sub> and T<sub>1</sub> to form a single trunk (which has been termed as the lower trunk in this case). The lateral cord was formed as a continuation of the anterior division of the upper trunk (C<sub>5</sub>, C<sub>6</sub>). The medial cord was formed as a continuation of the

On the left side, the usual pattern of the brachial plexus was seen. The knowledge on such variations are of interest to anatomists, clinicians, anesthesiologists and especially, to surgeons. These are of immense importance during surgical explorations of the axilla and the arm region and also during nerve blocks. It also helps the clinicians in getting a proper understanding of some previously unexplained clinical symptoms. Further, the ontogeny and the phylogeny of this entity have been discussed in detail.

**Key Words:** Brachial plexus, Roots, Trunks, Cords

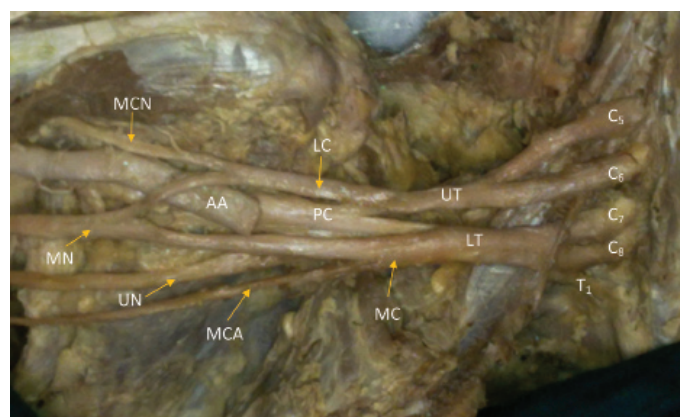
anterior division of the lower trunk (C<sub>7</sub>, C<sub>8</sub>, T<sub>1</sub>). Thus, the fibres of C<sub>7</sub> were going into the medial cord instead of the usual lateral cord. The root value for the lateral cord was C<sub>5,6</sub> instead of the usual C<sub>5-7</sub> and that of the medial cord was C<sub>7,8, T1</sub> instead of the usual C<sub>8</sub>, T<sub>1</sub>. The posterior cord was formed by the fusion of the posterior divisions of the upper (C<sub>5,6</sub>) and lower (C<sub>7,8, T1</sub>) trunks. The further branchings of the three cords were normal [Table/Fig-1].

On the left limb, the usual pattern of the brachial plexus was seen.

## DISCUSSION

The common variations in the formation of the brachial plexus i.e. the prefixed and postfixed plexuses, have been well documented [5].

Formation of the lower trunk of the brachial plexus by the C<sub>7</sub>, C<sub>8</sub> and T<sub>1</sub> roots is very rare. Only Nayak et al., [6] had earlier encountered an absence of the middle trunk, with the C<sub>7</sub> root joining C<sub>5</sub> and C<sub>6</sub>



**[Table/Fig-1]:** Showing a two trunked brachial plexus. AA: Axillary artery; C<sub>5</sub>, T<sub>1</sub>: Roots of brachial plexus; MC: Medial cord  
MCA: Medial cutaneous nerve of arm; MCN: Musculocutaneous nerve  
MN: Median nerve; LC: Lateral cord; LT: Lower trunk  
PC: Posterior cord; UN: Ulnar nerve; UT: Upper trunk

to form the upper trunk; the lower trunk being formed by  $C_8$  and  $T_1$ . In our case, the two trunks were formed, but the middle trunk ( $C_7$  root) had joined  $C_8$  and  $T_1$  instead of joining  $C_5$  and  $C_6$ . So, it was different from the one which was reported by them.

## Ontogeny

Rao and Chaudary [7] are of the opinion that developmentally, the human brachial plexus appears as a single radicular cone in the upper limb bud. Initially, a plexus is formed by the anastomosis between the spinal nerves and then it develops into a solid plate that finally divides into separate trunks and then, divisions. The posterior division supplies the extensor muscles and their surfaces and the anterior division supplies the flexor muscles and their surfaces [8].

The guidance of the developing axons is regulated by the expression of chemoattractants and chemorepulsants in a highly co-ordinated site specific fashion.

Tropic substances such as the brain-derived neurotropic growth factor, *neutrin-1*, *neutrin-2*, the *c-kit ligand*, etc. attract the correct growth cones that happen to take the right path [9]. Any alterations in the signalling between the mesenchymal cells and the neuronal growth cones or the circulatory factors at the time of fission of the brachial plexus cords, can lead to significant variations [10].

Ontogenically, the present variation may be due to a failure on the part of the radicular cone of the nerves of the upper limb to divide into different trunks. This may be attributed to the disproportionate display of the chemoattractants and the chemorepulsants.

## Phylogeny

If we trace the phylogeny, no trunk formation is seen in amphibians, reptiles and dogs. Two trunks are formed in marsupials and Lemurs. However, in them, the two lowest roots form an inferior trunk and the others form a superior trunk. Similarly, in gorilla, two trunks are formed, with a root value of  $C_{4,5,6}$  for the first trunk and of  $C_{7,8}, T_1$  for the second trunk [11]. Thus, the present case was more close to that of a gorilla, with the upper trunk being formed from the  $C_5, C_6$  roots ( $C_4$  not contributing) and the lower trunk being formed from  $C_{7,8}, T_1$ .

## Clinical implications

The knowledge on the variations which are involved in the formation of the brachial plexus is important, not only for anatomists, but

also for radiologists, anaesthesiologists, neurosurgeons and orthopaedic surgeons. It will be of great use in the surgical treatment of tumours of the nerve sheaths, such as schwannomas and neurofibromas. The awareness on the variations might also help in treating non-neural tumours like lipomas. Orthopaedic procedures of the cervical spine also need a thorough knowledge on the normal and the abnormal formation of the brachial plexus [12].

Such a variant brachial plexus with two trunks, with the lower trunk having a root value of  $C_{7,8}, T_1$ , may give a confusing clinical picture if it is affected by Klumpke's paralysis. In such cases, the injury may not be restricted to  $T_1$  or  $C_8$  only, but rather, it may extend to  $C_7$  as well. So, clinicians must be familiar with such an anomaly when they encounter an extended Klumpke's paralysis case.

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