

A variation of the phrenic nerve: case report and review

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ABSTRACT

During routine dissection in the department of anatomy, the following anatomical variations of the phrenic nerve were observed on the right side of the neck of a 30-year-old male cadaver. The phrenic nerve, in its early course close to its origin, gave a communicating branch to the C5 root of the brachial plexus. At the level of the root of neck just before entering the thorax, the phrenic nerve was located anterior to the subclavian vein. This unique case of phrenic nerve variation gains tremendous importance in the context of subclavian vein cannulation, implanted venous access portals, and supraclavicular nerve block for regional anaesthesia.

Keywords: anatomical variations, brachial plexus, neck anatomy, phrenic nerve variations.

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INTRODUCTION

Variations of the phrenic nerve have been observed and reported in the past.⁽¹⁻³⁾ Right subclavian vein cannulation is a commonly-performed procedure for vascular access for haemodialysis, and the phrenic nerve palsy manifesting as hemidiaphragmatic paralysis is an important complication associated with it.⁽⁴⁻⁸⁾ Right phrenic nerve paralysis is an acknowledged immediate and late complication of implanted venous access portals.⁽⁹⁾ Bigeleisen reported a case of simultaneous diaphragmatic and brachial plexus stimulation, followed by a successful nerve block, and demonstrated the necessity of a thorough knowledge of anatomical variations and standard anatomy, for the safe and efficient practice for regional anaesthesia.⁽¹⁰⁾

CASE REPORT

The following important variations were observed only on the right side during routine dissection in a 30-year-old male cadaver. The phrenic nerve, in its early course close to its origin, gave a communicating branch to the C5 root of the brachial plexus (Fig. 1).



Fig. 1 Photograph shows the variations of the phrenic nerve. AC: ansa cervicalis; CB: communicating branch to brachial plexus; C5: C5 root of brachial plexus; PN: phrenic nerve; IJV: Internal jugular vein; SCV: subclavian vein

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The phrenic nerve at the level of the root of the neck, just before entering the thorax, was located in front of the subclavian vein (Fig. 1). It is usually located posteriorly, in between subclavian vein and artery. This variation of phrenic nerve makes it highly vulnerable to injury during subclavian catheterisation for vascular access.

DISCUSSION

The accessory phrenic nerve proceeds caudally and joins distally with phrenic nerve, and is present in up to 75% of cadavers.⁽¹⁰⁾ On the contrary, in this particular case, the variation is not an accessory phrenic nerve; as the communicating branch from the phrenic nerve to the C5 root of the brachial plexus proceeded distally and laterally in caudal direction and joined the C5 root of the brachial plexus. Hollinshead described that the entire phrenic nerve, in ten out of 138 (7.25%) sides of cadavers studied, passed anterior to subclavian vein as it leaves the neck,⁽¹⁾ whereas in the present case, this particular variation of phrenic nerve was accompanied further by a communicating branch to the C5 root of the brachial plexus.

Bigeleisen reported that more distal blocks, such as a low interscalene or supraclavicular block, may also give rise to a partial phrenic nerve block, even if the phrenic nerve anatomy is standard.⁽¹⁰⁾ In the context of the present case, this will lead to complete phrenic nerve block manifesting as right diaphragmatic paralysis. The guidance of the developing axons is regulated by expression of chemoattractants and chemorepulsants, in a highly-coordinated site specific fashion. Any alterations in signalling between mesenchymal cells and neuronal growth cones can lead to significant variations, which probably in the present case, resulted in phrenic nerve communication with the C5 root of the brachial plexus, along with subclavian vein located posterior to the phrenic nerve. Once formed, any developmental differences would persist postnatally.⁽¹¹⁾

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