Comparison of different injectate volume on spread of drug in intermediate cervical plexus block: A cadaveric study

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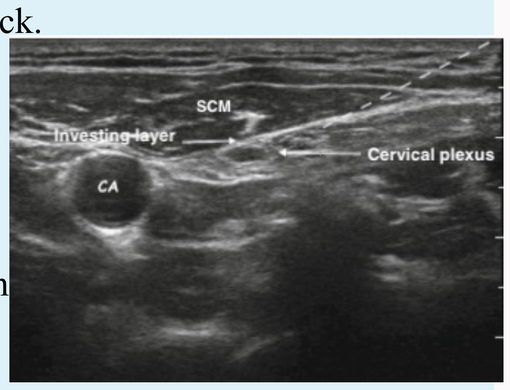
INTRODUCTION

Cervical plexus block (CPB) is an effective method to block the branches of cervical plexus, thereby providing anaesthesia to head and neck region.

Intermediate CPB is a relatively newer technique in which drug is deposited deep to investing layer of deep cervical fascia besides the cervical plexus. This has shown to provide superior analgesia to superficial cervical plexus block and similar efficacy to deep cervical plexus block.



Phrenic nerve blockade in intermediate CPB is debatable as studies point towards partial blockade of phrenic nerve. While cadaveric studies investigating the spread of intermediate CPB have used volumes of 20-30 ml, clinical studies and usual practice of giving CBP is with a volume of 10 ml.

We anticipated that larger volume of drug will result in spread beyond the prevertebral fascia and blockade of phrenic nerve, while lower volume may spare the phrenic nerve.

OBJECTIVES

Primary objective

To compare and analyze the spread of intermediate cervical plexus block to cutaneous branches in two different volumes of injectate – 10 and 20 ml

Secondary objectives

1. To compare the spread to phrenic nerve in both groups
2. To compare the spread to prevertebral fascia and the cervical nerve roots lying deep to the fascia

METHODOLOGY

Study design: Observational interventional cadaveric study

After ethical approval, study was conducted on four soft embalmed cadavers.

Inclusion criteria: Fresh soft embalmed adult human cadaver

Exclusion criteria : Cervical trauma to cadaver, deformity in cervical region of cadaver

Cervical plexus block

USG guided CPB was given (in plane technique,20G,10 cm needle inserted from lateral to medial direction at C4 level to pierce the investing layer of deep cervical fascia just beneath the sternocleidomastoid muscle). Either 10 or 20ml of 0.01% of methylene blue solution was be injected bilaterally in four cadavers. Thus, a total of 08 CPB blocks were given with volume of injectate as 10 and 20 ml in four blocks each.

Anatomical dissection

After 30 minutes of injection of solution, cadavers were submitted to anterior cervical region dissection by an anatomist and the dispersion and impregnation of the blue solution was analyzed.

Identification of branches of cervical plexus, prevertebral fascia, brachial plexus, phrenic nerve, cervical nerve roots was done and staining with methylene blue was visualized. Spread was noted in craniocaudal direction. Dye penetration to various anatomical structures was defined as - dark stained, light stained or not stained depending upon the colour of methylene blue staining.

RESULTS

Branches of cervical plexus were stained in all the blocks

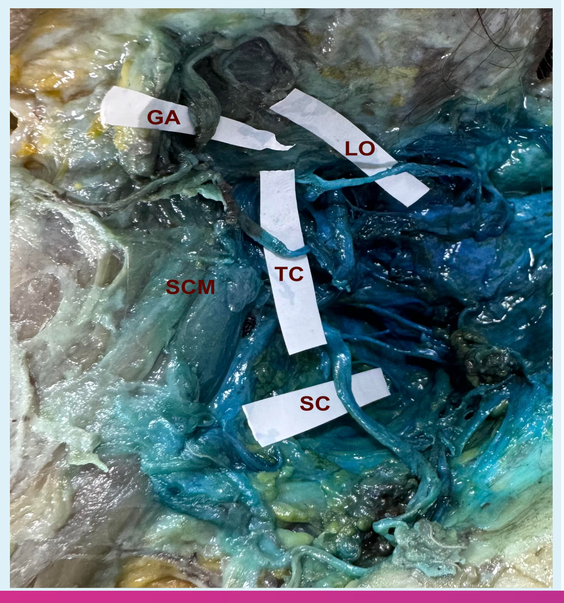


Figure 1: Cutaneous branches of superficial cervical plexus are stained deeply

Carotid sheath and vagus nerve were involved in 2/4(50%) of CPB with 20 ml.

Higher volume of drug resulted in deep staining of phrenic nerve and upper trunk of brachial plexus.

With 10 ml injectate volume, phrenic nerve was lightly stained in 3/4 (75%) of the blocks.

Cervical nerve roots were not stained in any of the blocks.

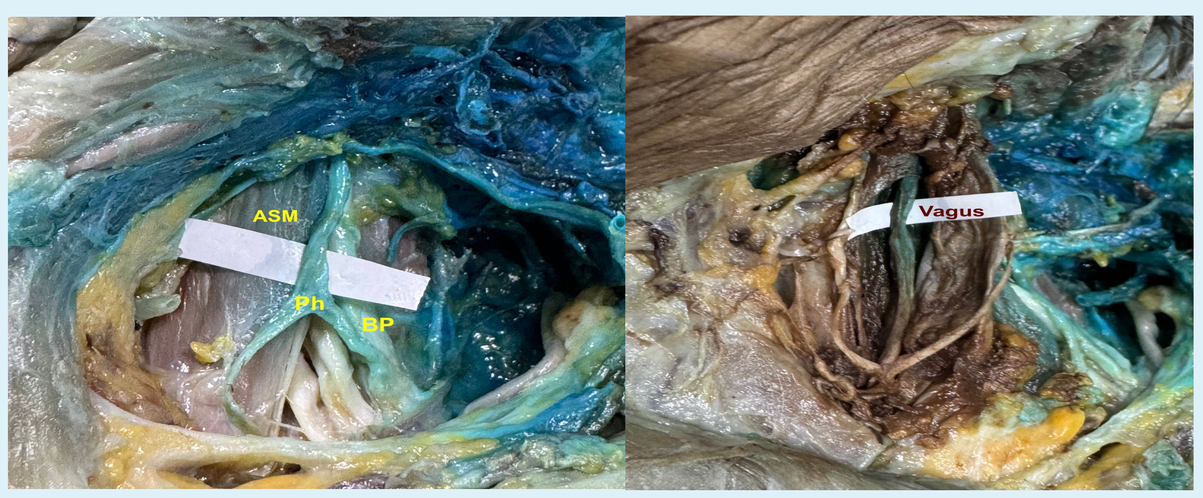


Figure 2: Left image - Staining of phrenic (Ph) nerve, anterior scalene muscle and upper trunk of brachial plexus (BP); Right image – Staining of vagus nerve

Characteristics of injectate spread and structures stained in cervical plexus blocks

Cadaver no.	Injection	Cervical Plexus	Phrenic nerve	Brachial plexus	Vagus	Anterior scalene	Middle scalene	Cervical nerve root
1	Left (20 ml)	Dark	Dark	Dark	Dark	Light	Light	
2	Left (20 ml)	Dark	Dark	Light		Dark		
3	Right (20 ml)	Dark	Dark	Light		Dark	Light	
4	Right (20 ml)	Dark	Dark	Dark	Light	Dark	Light	
1	Right (10 ml)	Dark	Light	Light		Dark	Light	
2	Right (10 ml)	Dark	Light	Light		Light		
3	Left (10 ml)	Dark						
4	Left (10 ml)	Dark	Light			Light	Light	

Dark stained | Light stained | Not stained

DISCUSSION

Both low and high volume injectate result in consistent spread to superficial cervical plexus branches.

Prevertebral fascia is a porous structure and drug deposited superficial to it can permeate through it to block the brachial plexus and phrenic nerve. Higher volume results in more drug permeation which may completely block the nerve conduction.

Phrenic nerve blockade may result in decreased diaphragmatic excursion which can be of clinical significance in patients with respiratory diseases.

Vagus nerve block may be seen with higher volume of drug.

These findings support use of 10 ml of drug in intermediate CPB for providing analgesia for neck surgeries with possible sparing of phrenic nerve, vagus nerve and brachial plexus function.

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