

A Study on Use of Pulse Oximeter Perfusion Index as a Predictor of Successful Supraclavicular Brachial Plexus Block

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Abstract: A prospective interventional study was done among 70 patients admitted in orthopaedic department for upper limb surgeries in GSL Medical College. By this study block assessment was done using perfusion index. The baseline mean perfusion index of blocked and unblocked arm was found to have no statistical significance. At the end of 30 minutes the mean perfusion index was 7.73+/- 1.02 in blocked arm and 2.86+/- 1.06 in the unblocked arm with a statistically significant p value of < 0.0001.

Keywords: ASA, PI, BP, COhb, ECG, DBP, FIO2

1. Introduction

- For upper limb surgeries as anaesthesia popular approach followed is ultrasound guided supraclavicular block. ⁽¹⁾
- Assessment of sensory and motor function is used for evaluation of successful peripheral Nerve blocks which is time consuming subjective and requires patient cooperation. ^(1, 2)
- Pulse oximeter is considered as a standard of monitoring device for arterial oxygenation, however it is also used as a marker of peripheral perfusion which is an indirect indicator of vasodilatation and increased blood flow ^(3, 4)
- Objective assessment of block depends on consequent physiological changes such as vasodilation, skin temperature, changes in blood flow, and on evaluation of sympathetic block which requires sophisticated equipment and time consuming ^(1, 4)
- Our study is to evaluate block success by using pulse oximeter index and pulse oximeter ratio which are non invasive and benefits as a marker of peripheral perfusion and as index of sympathetic stimulation.

Aim

To evaluate the use of perfusion index and to predict and provide a cut off value for ultrasound guided supraclavicular nerve block success.

2. Review of Literature

- 1) A. Abdelnasser and colleagues conducted a study in 70 patients and compared manual evaluation of sensory and motor blockade by touch, pin prick and motor movements respectively and compared with perfusion index of the blocked hand and used contralateral arm as control and found that perfusion index and perfusion index ratio at 10 minutes after induction showed 100

percent sensitivity and specificity for block success with a cutoff value of 3.3 and 1.4 respectively.

- 2) In a study conducted by Charles T. Klodell and colleagues ten adult patients undergoing bilateral endoscopic thoracic sympathectomy under General Anaesthesia, hemodynamic variables and perfusion index was monitored every one minute for five minutes after the procedure and they concluded that intraoperative perfusion index is derived from pulseoximetry.
- 3) Seul Gi Park and colleagues conducted study on non invasive haemoglobin and perfusion index of pulse cooximetry before and after induction of general anaesthesia using sevoflurane and proved that noninvasive haemoglobin was increased after the induction of general anaesthesia from - 2.8 to - 0.7 and perfusion index was not changed and proved the correlation between noninvasive haemoglobin and perfusion index was not significant after general anaesthesia.
- 4) Anne sebastiani and colleagues conducted study on perfusion index and plethysmographic variability index in patients with inter scalene nerve catheters in both arms of 30 orthopaedic patients and measured baseline, on application of local anaesthetics, after 5 minutes and 15 minutes and after induction of general anaesthesia and before and after a 500ml colloid fluid challenge and 5 minutes thereafter and concluded that Perfusion Index value increases upto 15 minutes but Perfusion Index of blocked arm remained constant after induction of general anaesthesia. Fluid challenge resulted in Plethysmographic Variability Index in both arms.

3. Materials and Methods

Study Setting: Patients admitted in orthopedic department for upper limb surgeries of GSL Medical college and General hospital posted for elective surgery.

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Method of Collection of Data:

- **Study Design:** Prospective, single blinded study.
- **Study Period:** From October 2020 to June 2022.
- **Study Population:** After getting clearance from ethical committee, convenience sample of 70 Patients posted for elective surgery in orthopedics department of GSL MEDICAL COLLEGE & HOSPITAL who are satisfying inclusion and exclusion criteria are taken into study.

Inclusion Criteria:

- Adult patients aged between 18 to 65 yrs
- Patients of both sexes
- Patients scheduled for elective upper limb surgery in orthopedics

Exclusion Criteria:

- Neck abnormality (like anatomical, congenital, post - burn contracture etc)
- Infection at the puncture site.
- Deranged coagulation profile.
- Known vascular abnormality.
- Morbidly obese patient.
- Patient refusal
- Neurological deficits involving brachial plexus
- Pregnant women.

Statistical Analysis:

Single blinded prospective study.

4. Methodology

- On arrival of patients in operation theatre patients will be given premedication and monitored by three lead ECG, automated non invasive BP monitoring, pulseoximetry.
- The supra clavicular nerve block will be performed under guidance of linear transducer over supraclavicular fossa in coronal oblique plane immediately superior to the mid clavicular point.
- The block is induced in supine position with head of patient turned away from the site to be blocked and the 22 gauge needle inserted in the plane of ultrasound probe.
- The brachial plexus was identified as a compact group of nerves hypoechoic, round and oval located lateral and superficial to pulsatile subclavian artery and superior to first rib.
- 20ml of 0.75% ropivacaine diluted to 30cc with distilled water and injected.
- The limb was evaluated for block success for the sensory blockade for every three minutes by pin prick method and 5 min for motor by ability to flex elbow and hand against gravity.
- The perfusion index will be measured using pulseoximetry applied on index finger and record PI baseline and 10, 20, 30 mins after LA injection in both blocked limb and contralateral unblocked limb using separate pulse oximeters.
- The supraclavicular nerve block was considered successful with regard to neurological examination when

brachial plexus dermatomes C5 - T1 will be completely blocked

- For unsuccessful block in whom General anaesthesia will be needed because of pain sensation at the site of operation will be noted and excluded from the study.

5. Results

Comparison of P values of PI of patients in the present study with other studies. PI Studies Present study Karthick et al⁹² Loretta Raj et al⁹⁵ Abdelnasser A et al⁸ Baseline 0.054 >0.05 1.0 0.379 5min <0.001

| PI | Studies | | | |
|----------|---------------|------------------------------|---------------------------------|--------------------------------|
| | Present Study | Karthick et al ⁹² | Loretta Raj et al ⁹⁵ | Abdelnasser et al ⁸ |
| Baseline | 0.054 | >0.05 | 1.0 | 0.376 |
| 5 min | <0.0001 | <0.01 | - | - |
| 10 min | <0.0001 | <0.001 | <0.001 | <0.001 |
| 20 min | <0.0001 | <0.001 | <0.001 | <0.001 |
| 30 min | <0.0001 | <0.001 | - | <0.001 |

6. Summary

A prospective interventional study was done among 70 patients admitted in orthopaedic department for upper limb surgeries in GSL Medical College. By this study block assessment was done using perfusion index. The baseline mean perfusion index of blocked and unblocked arm was found to have no statistical significance. At the end of 30 minutes the mean perfusion index was 7.73+/- 1.02 in blocked arm and 2.86+/- 1.06 in the unblocked arm with a statistically significant p value of < 0.0001.

7. Conclusion

PI is a non - invasive method that uses the mechanism of evaluating the changes in finger peripheral perfusion. This is done through a pulse oximeter. PI can be defined as the nonpulsatile flow rate of the pulsatile flow. It is a prompt pointer of fluctuations in microcirculation. This can facilitate the anesthetists to access the instabilities in circulation. The perfusion index in patients blocked arm and unblocked arm, there was statistical significance. Hence, it can be used as a trustworthy indicator for the evaluation of the successful ultra - sound guided supraclavicular block.

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List of Abbreviations

- ASA - American society of anaesthesiologist
- ASRA - American society of regional anaesthesia
- BP - blood pressure
- COHb - carboxyhaemoglobin
- CO - carbonmonoxide
- DBP - diastolic blood pressure
- ECG - Electrocardiogram
- FO2Hb - fractional oxygen content
- FIO2 - fractional inspired oxygen
- HDP - Hemidiaphragmatic paresis
- HHb - deoxygenated haemoglobin
- HbF - Fetalhemoglobinemia
- IR - infrared
- LAST - local anaesthetic systemic toxicity
- MetHb - methemoglobinemia
- MAP - mean arterial pressure
- NIBP - non invasive blood pressure
- O2Hb - oxygenated haemoglobin
- PaO2 - partial pressure of arterial oxygen
- PI - perfusion inde