ORIGINAL RESEARCH

Comparison of Landmark Guided Posterior and Anterior Approach for Internal Jugular Vein Cannulation

[1]Dr. Timsi J. Gandhi, [2]Dr. Prerak Trivedi, [3]Dr. Vishva D. Shah, [4]Dr. Harmit Shukla, [5]Dr. Pranjal Dave

[1]Assistant Professor, Department of Anaesthesia, NHL Municipal Medical College, Ahmedabad, Gujarat
[2]Ex Resident, Department of Anaesthesia, NHL Municipal Medical College, Ahmedabad, Gujarat
[3]Tutor, Department of Anaesthesia, Narendra Modi Medical College, Ahmedabad, Gujarat
[4]Second Year Resident, Department of Anaesthesia, NHL Municipal Medical College, Ahmedabad, Gujarat
[5]First Year Resident, Department of Anaesthesia, NHL Municipal Medical College, Ahmedabad, Gujarat

Corresponding Author
Dr. Vishva D. Shah
Tutor, Department of Anaesthesia, Narendra Modi Medical College, Ahmedabad, Gujarat

Received: 2 June, 2023 Accepted: 8 July, 2023

ABSTRACT

Background and Aim: Central venous catheterization is commonly performed in elective and emergency major surgeries and in intensive care units. Cannulation of the IJV is usually preferred because of its anatomical position and large diameter in the trendelenburg position. The purpose of our study was to compare the two commonly practiced anterior and posterior approaches for cannulation of internal jugular vein.

Material and Methods: This was a randomized observational study in which fifty adult patients of ASA physical status II and III undergoing elective major gastrointestinal, and cardiothoracic and vascular surgeries requiring central venous pressure monitoring or central venous access were included in the study. Patients were randomly assigned to two groups on a one is to one ratio randomly: Landmark Guided Anterior Approach (A Group) and Landmark Guided Posterior Approach (P Group). The analyzed criteria were number of attempts, time taken to identify the vein (Access time), total duration of cannulation, carotid puncture, hematoma, pneumothorax, hemothorax, catheter kinking, catheter displacement, thrombophlebitis, nerve injuries and overall total complications.

Results: The number of attempts to identify the vein was lesser with the posterior approach than the anterior approach. The access time and duration of cannulation were lesser with the posterior approach. Cannulation by posterior approach reduced the rate of carotid puncture and haematoma.

Conclusion: Landmark guided posterior approach is better than landmark guided anterior approach for internal jugular vein cannulation as it improves the success rate, reduces the access time and overall total duration of cannulation.

Key Words: Cannulation, Internal Jugular Vein, Observational study, Venous Pressure

INTRODUCTION

Central venous catheterization is commonly performed in elective and emergency major surgeries and in intensive care units. Indications for central venous catheterization include administration of noxious medications, hemodynamic monitoring, therapies requiring rapid blood flow rates (hemodialysis, plasmapheresis), insertion of invasive devices, rapid large-volume fluid or blood product administrations and emergency venous access. Noxious medications that require infusion into large central vein include vasopressors, chemotherapy, and total parenteral nutrition (TPN).[1,2] The veins that are usually cannulated are the internal jugular veins (IJV) in the neck, the subclavian veins under the clavicles and the femoral veins under inguinal ligaments, depending on the situation, need, indication and patient characteristics.[3] Cannulation of the IJV is usually preferred because of its anatomical position and large diameter in the trendelenburg position. Also, the minimal likelihood of an obstruction along its route to the right atrium facilitates the introduction of various sizes of catheters.[4,5] There are many approaches for locating the internal jugular vein. The anterior approach is being

practiced widely, since landmarks are easy to identify for beginner. The common complications of this approach are carotid puncture and hematoma.[6,7,8] Many articles have explained a lesser incidence of the complications with the posterior approach. The purpose of our study was to compare the two commonly practised anterior and posterior approaches for cannulation of internal jugular vein.

MATERIALS AND METHODS

This was a randomized observational study conducted from August, 2018 to August,2020. Fifty adult patients of ASA physical status II and III undergoing elective major gastrointestinal, and cardiothoracic and vascular surgeries requiring central venous pressure monitoring or central venous access were included in the study. After obtaining written informed consent the patients were randomly assigned to two groups on a one is to one ratio randomly. The right sided internal jugular vein cannulation was attempted.

A) Landmark Guided Anterior Approach (A Group)
B) Landmark Guided Posterior Approach (P Group)

CRITERIA FOR PATIENT SELECTION

INCLUSION CRITERIA:

- Adult patients > 18 years of age
- Patients with weight between 40-80 kg
- Both genders(male/female)
- Patients of ASA physical status II and III undergoing elective gastrointestinal, cardiovascular surgeries

EXCLUSION CRITERIA

- Patients who do not give consent
- Patients having any contraindications for IJV cannulation
- Skin inflammation at insertion site
- Altered coagulation profile
- Patients with known bleeding disorders
- Prior catheterization
- Subcutaneous emphysema
- Patients undergoing radiation therapy

PREANAESTHETIC ASSESSMET

All the patients underwent a thorough pre anaesthetic check-up. Local part was examined and an informed written consent was taken.

PREPARATION

After taking the patient in the operation theatre, investigations such as CBC, urea, creatinine, coagulation profile, chest x-ray reviewed and basic monitors: ECG, spo2 and non-invasive blood pressure were applied. A peripheral intravenous line was secured. All emergency resuscitation equipment was kept ready.

PARAMETERS

Access time: Access time was defined as the time between the first skin puncture and the aspiration of venous blood into the syringe.

Duration of cannulation defined as time between the first skin puncture and successful placement of venous cannula. Overall success: Successful placement was defined by functional determinants (i.e., no difficulty in the infusion or aspiration of venous blood) and/or as the observation of the catheters in the proper position by X-ray. An unsuccessful attempt was declared when after skin puncture, needle advancement and needle withdrawal there wasn't a return of venous blood from the targeted vein. After three unsuccessful attempts the procedure declared unsuccessful.

DATA ANALYSIS

The collected data was put in tabular form as mean± SD and analysed using unpaired't' test and for the qualitative data Chi square test for proportion was used. P value <0.05 is considered significant.

RESULTS

The characteristics of the 50 patients studied are summarized and recorded. Baseline characteristics in both the groups were comparable with no significant difference in terms of age, gender and body mass index (BMI). In our study, in the landmark guided anterior approach (Group A), 17 patients were undergone cardiothoracic and vascular surgeries while 8 patients were undergone gastrointestinal surgeries. In landmark guided posterior approach (Group P), 16 patients were undergone cardiothoracic & vascular surgeries while 9 patients undergone gastrointestinal surgeries.In our study, mean ± SD of the Neck circumference at the level of thyroid cartilage under landmark guided anterior approach and posterior approach were 38.36 ± 2.94 cms and 37.76 ± 2.86 cms respectively. Whereas the Mean ± SD of distance between suprasternal notch and mastoid process in neck was 17.92 ± 1.75 cms in landmark guided anterior approach and 17.44 ± 1.75 cms in landmark guided posterior approach. Hence with this parameter of neck circumference and neck distance there is no any statistical significant between two groups in both neck dimensions. In our study, mean duration of cannulation was 4.6±0.73minutes in landmark guided group A and 4.06±0.78 minutes in landmark guided group P. Duration of cannulation in group A is higher than group P which is statistically significant. In landmark guided posterior approach, success on first attempt was 80% compared to 52% in landmark guided anterior approach which is statistically significant. Carotid artery puncture was accidently punctured in 6(24%) cases in landmark guided anterior approach where as in posterior approach there were no any cases. (pvalue = 0.005). Hematoma developed in

6(24%) cases in Group A compared to Group P 2(8%). (p-value=0.04). One case of each thrombophlebitis and catheter displacements were observed in landmark guided anterior approach GROUP A. No cases of pneumothorax, hemothorax and any nerve injury were noted during the study in both the landmark guided anterior approach as well as posterior approach. Total number of complications were higher in landmark guided anterior approach in GROUP A compared to landmark guided posterior approach GROUP P. This difference is statistically significant.

Table 1: Types Of Surgeries

Surgeries	Group A	Group P
Cardiothoracic & vascular	17	16
Gastrointestinal	8	9

Table 2: Complications during the procedure

Complications	Group A	Group P
Hematoma	6	2
Carotid artery puncture	6	2
Pneumothorax	0	0
Hemothorax	0	0
Nerve injury	0	0
Thrombophlebitis	1	0
Catheter displacement	1	0

DISCUSSION

Internal jugular vein cannulation can be performed via various approaches and techniques. Comparison of this two landmark guided posterior and anterior approach is selected here because since last two decades central venous catheterization has been increasingly used in clinical practice for various reasons and by comparing this two approaches we can differentiate the major complication caused by each method. The posterior approach is easier and safe to cannulate in critically ill and hemodynamically compromised patients, so this approach was chosen to compare with anterior approach.[9,10] The main reason to compare this posterior and anterior approach is to identify and eliminate the complications that can be life threatening for some patients, to minimize access time and duration of cannulation to locate and cannulate internal jugular vein and to reduce multiple attempts. Chances of major vessel injuries like carotid artery puncture reportedly showed less in posterior approach because via this approach internal jugular vein punctured directly and thereby less chances of hematoma and direction of needle in posterior approach also reduce chance of pneumothorax and hemothorax.[11,12] In our study, we randomly divided 50 selected patients who were undergoing major cardiothoracic and gastrointestinal surgeries into landmark guided anterior approach (GROUP A) and landmark guided posterior approach (GROUP P) and compared both techniques. Age, Gender and BMI were comparable in both the groups with no significant difference. Neck dimensions like neck circumference and neck distance were compared in both the groups and there was no any statistical significant difference found. In terms of access time, we found a statistically significant difference in access time between both the groups. Access time was longer in landmark guided anterior approach GROUP A compared to posterior approach GROUP P. Mean access time was 30.68±6.02 seconds in landmark guided anterior approach (Group A) and 25.48±5.78 seconds in Landmark guided posterior approach (Group P). In this study, mean duration of cannulation in landmark guided group A was 4.6±0.73 minutes and in landmark guided group P mean duration of cannulation was 4.06±0.78 minutes. This duration was higher in group A compared to group P which is statistically significant. (p-value =0.008) A large cross –sectional area in the posterior approach permits earlier identification of vein, hence the time required for cannulation is lesser in the posterior approach.

CONCLUSION

In conclusion, landmark guided posterior approach is better than landmark guided anterior approach for Internal jugular vein cannulation as it improves the success rate, reduces the access time and overall total duration of cannulation. It reduces the major complications like carotid artery puncture and hematoma. Other complications like thrombophlebitis, catheter kinking, catheter displacement also found less likely to occur in posterior approach. Chances of major vessel injuries like carotid artery puncture reportedly showed less in posterior approach because via this approach internal jugular vein punctured directly and thereby less chances of hematoma and direction

SOURCES OF FUNDING
Nil.

CONFLICT OF INTEREST
None declared.

REFERENCES

1. Kastrup, M.; Markewitz, A.; Spies, C.; Carl, M.; Erb, J.; Grosse, J.; Schirmer, U. J. A. A. S. Current practice of hemodynamic monitoring and vasopressor and inotropic therapy in post-operative cardiac surgery patients in Germany: results from a postal survey. **2007**, *51*, 347-358.
2. Flancbaum, L.; Ziegler, D. W.; Choban, P. S. J. J. o. c.; anesthesia, v. Preoperative intensive care unit admission and hemodynamic monitoring in patients scheduled for major elective noncardiac surgery: A retrospective review of 95 patients. **1998**, *12*, 3-9.
3. Trof, R. J.; Beishuizen, A.; Cornet, A. D.; de Wit, R. J.; Girbes, A. R.; Groeneveld, A. J. J. C. c. m. Volume-limited versus pressure-limited hemodynamic management in septic and nonseptic shock. **2012**, *40*, 1177-1185.
4. Bannon, M. P.; Heller, S. F.; Rivera, M. J. R. m.; policy, h. Anatomic considerations for central venous cannulation. **2011**, 27-39.
5. Anand, R.; Gupta, A. N. A comparative study of advantages and disadvantages of anterior and posterior approach for internal jugular vein catheterization. **2019**.
6. Babu, B. V. M.; Rao, A. K.; Srikanth, B. J. I. J. o. S. S. Comparision of Posterior and Anterior Approaches for Internal Jugular Venous Cannulation–A Prospective & Randomised Controlled Study. **2014**, *2*, 35-38.
7. Patel, S.; Metgud, R. J. J. o. c. r.; therapeutics. Estimation of salivary lactate dehydrogenase in oral leukoplakia and oral squamous cell carcinoma: a biochemical study. **2015**, *11*, 119-123.
8. Blaivas, M.; Adhikari, S. J. C. c. m. An unseen danger: frequency of posterior vessel wall penetration by needles during attempts to place internal jugular vein central catheters using ultrasound guidance. **2009**, *37*, 2345-2349.
9. Chudhari, L.; Karmarkar, U.; Dixit, R.; Sonia, K. J. J. o. P. M. Comparison of two different approaches for internal jugular vein cannulation in surgical patients. **1998**, *44*, 57.
10. Turker, G.; Kaya, F. N.; Gurbet, A.; Aksu, H.; Erdogan, C.; Atlas, A. J. C. Internal jugular vein cannulation: an ultrasound-guided technique versus a landmark-guided technique. **2009**, *64*, 989-992.
11. Anesthesia, S. C. o. J. S. o. A. a. a. o. j. J. J. o. Practical guide for safe central venous catheterization and management 2017. **2020**, *34*, 167-186.
12. Yamamoto, M.; Yamada, K.; Horikawa, M.; Kondo, H. J. I. R. Horner syndrome caused by central venous port placement via the internal jugular vein: a case report. **2020**, *5*, 14-18.