Section: Anaesthesiology

Original Research Article

COMPARISON BETWEEN ULTRASOUND GUIDED OUT OF PLANE SHORT AXIS & IN PLANE OBLIQUE AXIS APPROACHS OF RIGHT INTERNAL JUGULAR VENOUS (IJV) CANULATION IN TERTIARY CARE HOSPITAL

Manisha Kapdi[1], Kirtan Pandya[2], Parth Prajapati[2], Rohit Chauhan[2], Devanshi Jariwala[2], Shruti Singh[2]

[1]*Professor in Anaesthesiology, Narendra Modi Medical College, LG Hospital Maninagar, Ahmedabad, Gujarat, India*
[2]*Resident in Anaesthesiology, Narendra Modi Medical College, LG Hospita,l Maninagar, Ahmedabad, Gujarat, India*

Received *: 22/08/2025*
Received in revised form *: 07/10/2025*
Accepted *: 28/10/2025*

Corresponding Author:
Dr. Manisha Kapdi,
Professor in anaesthesiology, Narendra Modi Medical College, LG hospital Maninagar, Ahmedabad, Gujarat, India.
Email: manisha_kapdi@yahoo.com

DOI: 10.70034/ijmedph.2025.4.372

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2025; 15 (4); 2069-2077

ABSTRACT

Background: Our study was conducted in 60 patients in either sex belonging to 18-60yrs of age group either in elective surgery or ICU setup for right IJV cannulation. **Study place:** Narendra Modi Medical College, LG hospital, Maninagar, Ahmedabad. **Study period:** April2023- september 2024

Material & methods: patients who need central venous canulation were randomly divided into 2 groups: GROUP A - SAX (short axis) ultrasound guided approach, GROUP B - OAX (oblique axis) ultrasound guided approach after matching inclusion criteria in operation theatre & Emergency critical care.The following parameters were recorded & compared: First attempt success, Mean time of cannulation in secs, Mean flash time in secs, Total no of needle passes, Carotid wall puncture, Pneumothorax, Hemothorax, Infections, & Posterior wall puncture.

Results: This intervention study shows that the demographic profile of the patients were comparable (p>0.05). First attempt success rate in OAX group is 90%(27/30 patients) which is better than SAX group 80% patients. Mean flash time of OAX group 19.5+/-3.51secs is faster than SAX group 24.53+/-4.88secs (p=0.0001). Mean cannulation time of OAX group 45.82+/-8.21secs is also faster than SAX group 53.9+/-8.14secs (p=0.0003). Carotid wall puncture was seen in SAX group 6.66% (2/30 patients) while no puncture in OAX group (p=0.150). Pneumothorax was noted in SAX group 3.33% patients while no pneumothorax in OAX approach (p=0.313). Hemothorax was also noted in SAX group 3.33%(1/30 patient) while no hemothorax in OAX approach (p=0.313). Infection was seen in SAX group was 6.66%(2/30 patients) while 1 infection was noted in OAX approach was 3.33%(1/30 patients) (p=0.553). No incidence of posterior wall puncture via both the approaches were noted. Overall complications were seen in patients of 20% in SAX group were as in OAX group it was only 3.33% patient (p<0.001).

Conclusion: Overall consolidated outcome of procedures was better in OAX group than in SAX group.

Keywords: Internal Jugular venous IJV canulation, Oblique axis approach, Short axis approach, Ultrasound guided Right IJV canulation.

INTRODUCTION

Central venous cannulation of the internal jugular vein (IJV) is a fundamental procedure in critical care, anaesthesia, and emergency medicine, facilitating central venous pressure monitoring, administration of drugs, and haemodialysis. The advent of ultrasound-guided techniques has significantly improved the safety and efficacy of this procedure, reducing the risk of complications such as arterial puncture, hematoma, and pneumothorax.[1] Among the various techniques for ultrasound-guided IJV cannulation, the short-axis (SAX) and oblique-axis (OAX) approaches have been widely studied, yet their

comparative efficacy and safety continue to be a topic of ongoing research and debate.[2]

The traditional SAX approach, where the ultrasound transducer is positioned transversely over the IJV, offers the advantage of visualising both the vein and the adjacent carotid artery simultaneously, potentially reducing the risk of arterial puncture. However, this technique has been criticised for its limited view of the needle path, which can lead to difficulties in guiding the needle tip and assessing its depth within the tissue.[3] On the other hand, the OAX approach, a variation of the longitudinal or in-plane technique, involves aligning the ultrasound probe at an oblique angle to the IJV. This method aims to combine the benefits of both the longitudinal and transverse approaches, offering a longer view of the needle trajectory while maintaining the ability to differentiate between the IJV and the carotid artery.[4]

A growing body of evidence suggests that the OAX approach may provide superior outcomes in terms of success rate, time to successful cannulation, and complication rates compared to the SAX approach. A randomised controlled trial by Arellano et al,[5] demonstrated a higher first-attempt success rate and a lower complication rate with the OAX approach. Similarly, a meta-analysis conducted by Brass et al,[6] concluded that the OAX approach might reduce the time to cannulation and improve overall success rates, although the authors noted the need for further high-quality studies to confirm these findings.

Despite these promising results, the literature is not unanimous, and some studies have reported no significant differences between the two techniques in terms of efficacy and safety.[7] The variation in findings across studies may be attributed to differences in operator experience, patient population, and procedural settings, underscoring the importance of context in evaluating the relative merits of each approach.

Furthermore, the choice between the SAX and OAX approaches also involves considerations of operator preference and training. The OAX technique may have a steeper learning curve due to the need for more precise probe and needle handling to maintain the optimal oblique angle. However, proponents argue that the enhanced visualisation of the needle path offered by the OAX approach can lead to greater confidence among operators and potentially reduce the incidence of procedural complications.[8-10]

In light of these considerations, the present article aims to contribute to the ongoing debate by presenting a randomised controlled trial comparing the SAX and OAX approaches for ultrasound-guided IJV cannulation. This study seeks to provide robust evidence on the comparative efficacy, safety, and practical considerations associated with each technique, with the goal of informing clinical practice and optimising patient outcomes in central venous cannulation.[11]

It is used for administering intravenous fluids, vasopressors, antibiotics, and total parenteral nutrition (TPN) in major surgeries,[12] difficulty in obtaining peripheral intravenous lines, central venous pressure monitoring in critically ill patients. CVC plays a vital role in hemodynamic monitoring by enabling the measurement of central venous pressure (CVP), which helps assess intravascular volume status and guide fluid resuscitation strategies. The procedure is essential for the administration of chemotherapeutic agents, long-term antibiotic therapy, and hemodialysis in patients requiring prolonged vascular access. It provides reliable vascular access for managing emergency situations such as cardiac arrest, shock, and trauma, where peripheral access may be difficult or unreliable.[13-34]

Aims and objectives

Aims

Compare the efficacy and safety of ultrasound-guided out-of-plane short-axis and in-plane oblique-axis approaches for right internal jugular vein (IJV) cannulation in patients undergoing vascular access procedures in a tertiary care hospital.

1. Primary Objective

- To evaluate the success rate of right IJV cannulation at first attempt using the ultrasound-guided out-of-plane short-axis and in-plane oblique-axis approaches.

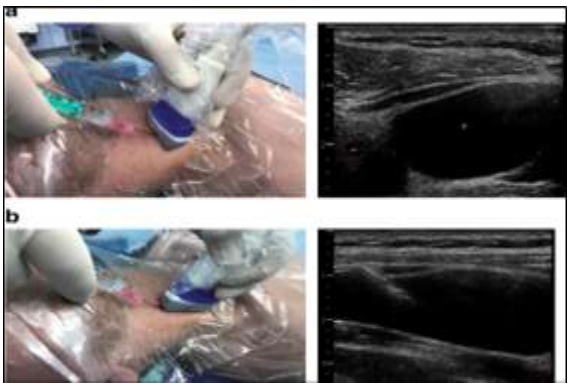
2. Secondary Objective

- To compare the number of attempts required to achieve successful cannulation between the two approaches.
- To determine the time taken for successful cannulation using both approaches.
- To determine mean flash time, mean cannulation time using both approaches.
- To assess the incidence of complications (arterial puncture, hematoma, posterior wall penetration, catheter malposition, and pneumothorax, posterior wall puncture) associated with each technique.

MATERIALS AND METHODS

Short-axis/oblique-axis and out-of-plane/in-plane views: The US probe can be placed in a transverse position relative to the vessel, resulting in a "short-axis" view on the US screen (i.e., a cross-sectional image of the vessel). A "long-axis" view (i.e., a longitudinal image of the vessel) is obtained by placing the US probe in a parallel position relative to the course of the vessel.[35]

The "out-of-plane" and "in-plane" describes the direction of the needle relative to the US plane, referred to as US-guided needle advancement.



a- Short axis approach
b- oblique axis approach

It is important to understand that the user needs to align the US plane and the needle plane containing the needle that appears on the screen as a point (short-axis/out-of-plane) or an echogenic line (oblique-axis/in-plane) with ring-down artefacts.[36]

The US probe is placed perpendicular to the venous anatomy in the SAX approach. OAX approach Here the US probe is aligned at 45° angulation with the venous anatomy, and combined with an in-plane needle insertion technique. The needle is advanced from lateral to medial.[12]

Whether or not one approach is superior to the other cannot be answered rigorously based on the existing data. The advantage of the short-axis/out-of-plane view is that it allows better visualization of the vein in relation to the artery and other anatomical structures, and thus might more sufficiently help to avoid accidental arterial puncture.[37]

However, in the short-axis view, the needle is only visualised as an echogenic point (that must not necessarily be the tip of the needle). In contrast, when using the long axis/in-plane view, the entire needle in its complete course and the depth of the needle tip can be visualized on the US image, thus reducing the risk of penetration of the posterior vessel wall.[37]

Preparation:

1. A peripheral line was secured for all the patients
2. Monitors were applied -

a) ECG
b) NIBP
c) SpO2

Equipments prepared: A portable sterile tray containing:

Disposable syringes of 5,10 ml.
Disposable 23G 1.5-inch block needle
Povidone iodine, spirit and normal saline solutions
Sponge holding forceps
Sterile towel and towel clip
Drug injection Lignocaine 2% 5 ml
Four lumens central venous catheter 8fr 15 cm
Tegaderm
Needle holding forceps
Artery forceps
Ethilon 2-0 suture

- Emergency resuscitation equipment were kept ready.
- Ultrasound machine and its linear probe properly cleaned and aseptically prepared for the procedure.

Position For IJV Cannulation

Position for IJV cannulation was kept same for both the landmark guided and USG guided techniques.

A ring under head and sandbag under shoulder were kept to accentuate the landmarks.

The patient was placed supine and in Trendelenburg position (15 to 20o head down) to distend the internal jugular vein and prevent air embolism.[38] The patient's head was turned slightly to the left at 45o angle to expose the internal jugular vein but not cause overlap with the carotid artery.[39]

The position of the operator performing US-guided CVC placement was kept such that he/she has the insertion site, the needle, and the US screen in their line of sight during needle insertion.[34]

Preparation of the area: The preparation of the sterile field was the same for both the landmark guided and USG guided techniques.

We first painted a broad area of the skin with antiseptic solution, encompassed the side of the neck, clavicle, and anterior chest to below the ipsilateral nipple. Sterile towels were then draped around the site to establish a large sterile field. Local anesthesia (2% Lignocaine 5 ml) was injected at the site of puncture.

Ultrasound Guided Method[41]

We evaluated the potential placement site with ultrasonography before establishing a sterile field. We ensured that the proposed vein was patent by making it compressible.

A standard two-dimensional real-time B-mode image was obtained with a portable unit and a 7.5 MHz linear array ultrasound probe was covered with an ultrasound gel and wrapped in a sterile sheath. The "out of plane" short axis technique was used.

The transducer was positioned such that the internal jugular vein was centred in the resulting ultrasound image and between the two heads of the sternocleidomastoid muscle. With an 18-Gauge needle, the skin was punctured at the centre of the transducer at a 45o angle. our approach includes assessing the target vein (anatomy and vessel localisation, vessel patency),using real-time US guidance for puncture of the vein,and conforming the correct needle, wire, and catheter position in the vein. Negative pressure was maintained in the syringe until the vein was punctured. When the needle was passed caudally underneath the transducer, the needle as well as soft-tissue tenting were viewed on the ultrasound screen.

US guided SAX and OAX approaches to IJV cannulation SAX approach The US probe is placed perpendicular to the venous anatomy in the SAX approach [Figure 2a and b]. OAX approach Here the US probe is aligned at 45° angulation with the venous anatomy, and combined with an in-plane needle insertion technique. The needle is advanced from lateral to medial.[12]

As soon as venous blood was freely aspirated using the Seldinger technique under US guidance, a flexible

guidewire was introduced through the needle and into the vein. The catheter was placed over the guidewire, then the guidewire was removed and sutures were used to secure it. The guidewire within the lumen of the vein was visualised on the screen in both cross-sectional and longitudinal views, which was the main advantage of this technique.
Ultrasonography was used to verify that the catheter was properly placed within the lumen of the vessel. An X-ray chest PA view was done to confirm the proper placement of the catheter.

Seldinger technique:[41]
We had used the Seldinger technique (Catheter over wire) to facilitate the cannulation. First, the right IJV was punctured using a hollow needle. A soft, curved tip guidewire was then inserted through the trocar and advanced into the lumen. The guidewire was held secured in place whilst the introducing needle was removed. A central venous catheter was passed over the guidewire into the lumen. The guidewire was then withdrawn, leaving the central venous catheter in situ.

RESULTS

No. of attempts: (Number of cannulation attempts that have taken place before cannulation success. Any withdrawal of the needle followed by an advance will be considered a separate cannulation attempt. After 2 unsuccessful attempts, procedure will be abandoned and considered as failure.)
Time required for cannulation: (Time elapsed in seconds from the moment the Seldinger needle pierces the skin to the moment the guide wire is inserted inside the vein.)
Flash time: The time interval between skin puncture & observing blood at the syringe hub.
Cannulation success: Time Frame: At the end of the cannulation process (180 seconds,maximum). Cannulation will be considered as "successful" irrespective of no. of attempts, once a flexible guidewire has been inserted into the internal jugular vein during the first 180 seconds from the moment the Seldinger needle pierces the skin & confirmed by ultrasound.
Complications - (clinically assessed & confirmed by US , Doppler , X-ray chest)

1. Carotid Artery puncture :
2. Pneumothorax :
3. Hemothorax:
4. Posterior Vessel Wall Puncture (with help of Ultrasound):

PVWP which was defined as posterior wall penetration by the needle after penetrating the anterior wall of the vessel once. The absence of guidewire in IJV as confirmed by the investigator with the US at the end of the procedure was also considered as PVWP.

5. Infection:

Post-Procedure Monitoring and Follow-Up:

- Patients were monitored for early and late complications such as haematoma, catheter malposition, thrombosis, or infection, and post procedure x-ray chest was done.
- Any adverse events occurring during or after the procedure were recorded.
- Data were entered into a secure database for further analysis.

Post-procedure complications after 24 hours:

- Thrombosis.
- Infection at the catheter site patients were followed up until point of catheter withdrawal.

Patients were inquired & long term follow up was taken for above complications
Post procedure complications when noticed, & were treated with standard critical care.

Statistical Analysis: Statistical analysis was performed using appropriate statistical software to compare the outcomes between the SAX out-of-plane and OAX in-plane groups.
1. Descriptive Statistics: Continuous variables such as age, time to guidewire insertion, and number of needle passes were summarized as mean ± standard deviation (SD) or based on data normality. Categorical variables such as success rate and complication rates were expressed as frequency (percentage).
2. Comparative Analysis: Student's t-test (for normally distributed data) or Mann-Whitney U test (for skewed data) was used to compare continuous variables between the two groups. Chi-square test or Fisher's exact test was used for categorical variables, such as the proportion of first-attempt success rates and complication rates.

3. Significance Level and Confidence Intervals: A p-value < 0.05 was considered statistically significant.95% confidence intervals (CIs) were reported for all comparative estimates.

Table 1: Age-wise Distribution of Study Participants

Age Group	SAX Count out of 30	SAX Percentage	OAX Count out of 30	OAX Percentage
18–30	5	16.67	6	20.0
31–45	10	33.33	9	30.0
46–60	10	33.33	11	36.67
>60	5	16.67	4	13.33

Mean age group in SAX group was 45± 16.76yrs & in OAX group is 46± 16.03yrs (p >0.05)

Table 2: Gender Distribution of Study Participants

Gender	SAX Count out of 30	SAX Percentage	OAX Count out of 30	OAX Percentage
Male	16	53.33	17	56.67
Female	14	46.67	13	43.33

Table 3: Distribution based on BMI

	SAX	OAX	P Value
MEAN BMI	22.24± 1.54	22.25± 1.52	0.9799

Table 4: Distribution Based on Clinical Setting

Clinical Setting	SAX Count out of 30	SAX Percentage	OAX Count out of 30	OAX Percentage
Elective Surgery	20	66.67	18	60.0
ICU	10	33.33	12	40.0

[Table 4] provides the distribution of study participants based on their clinical setting—Elective Surgery or ICU admission. In the SAX group, 66.67% of patients were from the elective surgery setting and 33.33% from ICU, while in the OAX group, 60% were from elective surgery and 40% from ICU.

Table 5: First Attempt Cannulation Success Rate

First Attempt Success	SAX Count out of 30	SAX Percentage	OAX Count out of 30	OAX Percentage
Success (Yes)	24	80.0	27	90.0
Failure (No)	6	20.0	3	10.0

[Table 5] compares the first attempt success rate of IJV cannulation between SAX and OAX approaches

Table 6: Flash time(Seconds)

Approach	Mean (Seconds)	SD (Seconds)	P-Value
SAX	24.53	4.88	0.0001HS
OAX	19.5	3.51	

[Table 6] presents data on the flash time, which refers to the duration from needle insertion to successful vein puncture.

Table 7: Time Required for Cannulation (Seconds)

Approach	Mean (Seconds)	SD (Seconds)	P value
SAX	53.9	8.14	0.0003 HS
OAX	45.82	8.21	

[Table 7] shows the comparative analysis of time required for successful cannulation using SAX and OAX techniques.

Table 8: Total Number of Needle Passes

Needle Passes	SAX Count	SAX Percentage	OAX Count	OAX Percentage
1 Attempt	24	80.0	27	90.0
2 Attempts	6	20	3	10
>2 Attempts	0	-	0	-

[Table 8] analyzes the number of needle passes required to achieve successful cannulation.

Table 9: Incidence of Carotid Artery Puncture

Carotid Artery Puncture	SAX Count	SAX Percentage	OAX Count	OAX Percentage	P-Value
Yes	2	6.67	0	0.0	0.150
No	28	93.33	30	100	

[Table 9] presents the incidence of carotid artery puncture, a significant complication during IJV cannulation.

Table 10: Incidence of Pneumothorax

Pneumothorax	SAX Count	SAX Percentage	OAX Count	OAX Percentage	P-Value
Yes	1	3.33	0	0.0	0.313
No	29	96.67	30	100.0	

[Table 10] evaluates the incidence of pneumothorax, a potentially life-threatening complication of central venous access.

Table 11: Incidence of Hemothorax

Hemothorax	SAX Count	SAX Percentage	OAX Count	OAX Percentage	P-Value
Yes	1	3.33	0	-	0.313
No	29	96.67	30	100	

[Table 11] focuses on the incidence of hemothorax, another vascular complication.

Table 12: Incidence of Infection

Infection	SAX Count	SAX Percentage	OAX Count	OAX Percentage	P-Value
Yes	2	6.67	1	3.33	0.553
No	28	93.33	29	96.67	

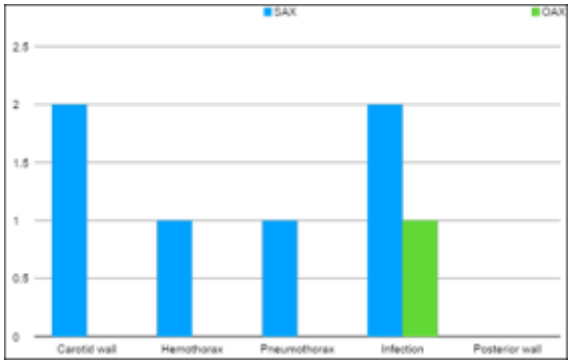
6/30(20%) patients in SAX group had complications where as only 1/30(3.33%) patient in OAX group had encountered infection post procedure 24hrs.($p<0.001$).

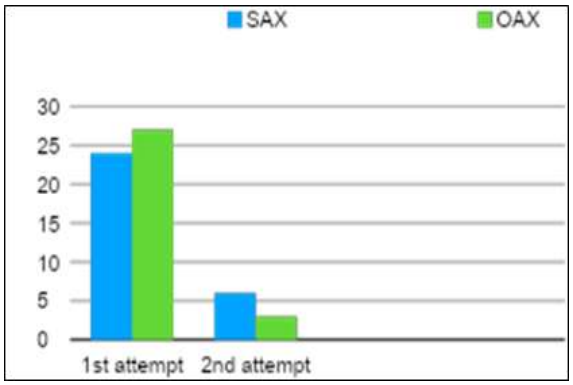
As we have successfull IJV cannulation in both groups within 2 attempts there is no failure in any group.

Table 13: Comparison of All Outcomes Between SAX and OAX

Parameter	SAX	OAX
First Attempt Success (%)	80.0	90.0
Mean Time for Cannulation (s)	52.53	46.5
Mean Flash time (s)	24.53	19.5
2 Needle Passes (%)	20.0	10.0
Carotid Artery Puncture (%)	6.67	3.33
Pneumothorax (%)	3.33	0.0
Hemothorax (%)	3.33	0.0
Infection (%)	6.67	3.33
PVWP	0.0	0.0
Overall Complications	20	3.33

[Table 13] offers a consolidated comparison of key performance of procedures & shows that in our study performance of OAX group is better than SAX group.





DISCUSSION

In our study we have done right IJV cannulation under US guidance by two different approaches (orientation) i.e SAX / OAX approach.

According to the study of AG Randolph et al 1996,[15] they have compared landmark guided vs US guided insertion. When used for vessel location and catheter placement real-time, ultrasound guidance or Doppler ultrasound guidance improves success rates and decreases the complications.

In our study we compared SAX out of plane vs OAX in plane approach while Badiya DK et al,[24] 2018

also compared SA- OOP(out of axis plane) & MO-IP(in plane axis).

Mitsuzu ishizuka et al,[18] 2010 studies shows that right ijv has much wider diameter & runs more superficially than left ijv , right side approach for cvc insertion is more acceptable than left side cvc insertion via ijv. Our study includes right sided us guided ijv insertion.

In the study of Arin Eliza Sunny et al,[12] 2022 US guided OAX approach when compared with the SAX approach, is helpful in preventing acute complications, as PVWP, due to the advantage of full visualisation of the needle. The SAX approach fared better in terms of success rate of cannulation. Number of attempts at cannulation and access times had no significant differences between the two approaches, our study includes the comparison between the same two groups and its complication. Also in the study of Jatinlal et al,[27] 2021 they studied comparison of all the 3 axis SAX,OAX&LAX in which SAX & OAX approach did not have complications compared to LAX approach.

Demographics: In our study in table 2 we had male & female comparable groups , 53.33% of the patients undergoing ijv insertion via SAX were male while 56.67% of the patients undergoing ijv insertion by OAX approach were male rest were females in both the group.

In the study of Daniel Hind et al 2003,[16] they included ijv insertion in paediatric age group while in our study in [Table 1] we have taken adult age only (>18yrs of age) which were divided into 4 groups 18-30,31-45,46-60,>61yrs with a mean age group for SAX is 45+/-16.67 and mean age group for OAX is 46+/-16.07(p>0.05).

Regarding the BMI, in [Table 3] for SAX group it was 22.24+/-1.54 & for OAX group it was 22.52+/-1.52 with a p-value of 0.9799 which suggest that both the groups were comparable in terms of BMI.

In the study of Kapdi et al,[30] 2022 gave done comparison of long &short axis method in obese patients of cardiac surgeries; BMI of S group was 31+/-4 and L group was 30+/-3 with a p value of 0.03. Above discussion suggest that our both the SAX group & OAX group were comparable in terms of demographic data.

Clinical setting: [Table 4] provides the distribution of study participants based on their clinical setting—Elective Surgery or ICU admission. In the SAX group, 66.67% of patients were from the elective surgery setting and 33.33% from ICU, while in the OAX group, 60% were from elective surgery and 40% from ICU while in the study of Arin Eliza et al. (2021),[12] Central venous catheter (CVC) placement is a frequently performed procedure in the emergency department (ED). They aim to compare two different ultrasound (US)-guided techniques, the short-axis (SAX) approach and the oblique axis (OAX) approach for the insertion of internal jugular vein (IJV) catheters in an ED setting. Similarly in the study of Kapdi et al,[30] 2022 both the SAX approach & LAX approach were carried out in the patients undergoing cardiac OT i.e in the OR setting. Jatinlal et al 2021,[26] studied in both ICU & OR setting.

First attempt success: In our study in table no.5 we have 80%(24/30 patients) success rate in first attempt of cannulation in SAX group while 90% (27/30 patients)success rate in first attempt of cannulation via OAX approach. Total success at first attempt was 85%(51/60 patients).

While in the study of Jatin Lal et al 2020,[27] on 80 patients via either SAX; OAX, LAX approach right side ijv insertion 88.9% ,97.2% & 77.2% respectively.

Arin Eliza et al. (2021),[12] they have first attempt success rate of 73.3% via SAX approach & 76.7% via OAX approach. They have total success at first attempt of 75%(45/60 patients).

Bhutia et al 2023,[13] had a first attempt success of 90.91% (47/52 patients) via in plane approach while 85.19% (44/52 patients) via out of plane approach.

FLASH TIME (in secs)

In our study in [Table 6] first pass needle time for SAX group was 24.53+/-4.88 & for OAX group was 19.5+/-3.51 with a p value of 0.0001 which suggest a highly significant data. This data were compared with the data studied by Arin Eliza Sunny et al 2022,[12] in which mean flash time via SAX approach was 28.07+/-17.69secs & 26.07+/-25.17secs via OAX approach. In the study of Wilson et al 2014[20] mean flash time was 11.9sec via SAX & 15.4sec via OAX.

Time Required For Cannulation

In our study in [Table 7] patients undergoing right ijv insertion via SAX approach mean time was 53.9+/-8.14sec & in the patients undergoing right ijv insertion via OAX approach was 45.82+/-8.21sec with a p-value of 0.0003 which suggest a highly

Solanki Rekha et al 2021,[28] had venous access time for right ijv via SAX of 65.27+/-19.47 while that of OAX was 61.95+/-28.32 with a p value of 0.5412.

Arin Eliza et al. (2021),[12] Had a mean cannulation time of 331.83secs via SAX approach & 323.37secs via OAX approach.(p=0.420).This incidence may be due to different definition of experienced operators(at least 10 successful ijv insertion) in their group.

Carotid Wall Puncture

In our study in table 9 we had come against 2 incidence of carotid wall puncture via SAX approach while no incidence via OAX approach which was compared with the study of Arin Eliza Sunny et al 2022,[12] in which with the same sample size of 30-30 in both SAX-OAX approach group had same incidence rate of 2&0 respectively in both the groups. Jatinlal et al 2020,[27] had no incidence of carotid puncture in SAX & OAX approach & 2 patients(5.6%) had carotid puncture via LAX approach. Badiya DK et al 2018,[24] have summarised that guidewire can be visualised throughout during OAX approach of cannulation & so incidence of carotid artery puncture is less compared to SAX approach.

Pneumothorax: In our study in table 10 we experienced pneumothorax in only one patient(3.33%) who had undergone right sided ijv

insertion via SAX approach while no incidence(0.00%) of pneumothorax via OAX approach.

Which was compared with the study of Jatinlal et al 2020,[27] which had a incidence of no pneumothorax in any of the SAX,LAX,OAX approach similarly in the study of Arin Eliza Sunny et al 2022,[12] had reported 1 pneumothorax via SAX approach & no incidence via OAX approach.

Hemothorax

In our study in table 11 we experienced hemothorax in a single patient (3.33%) via SAX approach while no incidence (0.00%) of hemothorax via OAX approach. This study was compared with the study of Arin Eliza Sunny et al 2022,[12] which had similar results of 3.33% incidence via SAX approach & 0.00% via OAX approach.

Posterior Wall Puncture

No incidence of posterior wall puncture was noted in our study which was compared with the study of M Baltori et al 2016,[23] with a sample size of 73 in each group. They registered 8 posterior wall puncture via SAX approach i.e.11% while 1 incidence via OAX approach i.e.1.4% & no incidence via LAX approach. Arin Eliza Sunny et al 2022,[12] had encountered 50%(15/30 patients)incidence via SAX group & 0% in OAX group. This incidence may be due to different definition of experienced operators (at least 10 successful ijv insertion) in their group.

In our study we have no incidence of posterior wall puncture while in the study of Wilson et al 2014,[20] the rate of PWP was 14.7% by SAX & 2.9% by OAX approach.Badiya DK et al 2018,[24] have summarised that guidewire can be visualised throughout during OAX approach of cannulation & so incidence of posterior wall puncture is less compared to SAX approach.

Infection: In our study in table 12 we had encountered infection post procedural after 72hrs in 2 patients who had undergone rt ijv insertion via SAX approach that is 6.67% while only in 1 patient in the OAX group that is 3.33% of the same group.

M Baltori et al,[23] 2016 had encountered catheter related bloodstream infection in 2 patients via LAX approach while no infection via SAX/OAX approach.

Overall Complications: Total 6/30(20%) patients in SAX group had complications where as only 1/30(3.33%) patient in OAX group had complication (post procedure 24hrs) ($p<0.001$). In the study of Arin Eliza Sunny et al 2022,[12] had 20/30 patients 66.67% complication by SAX approach & 6/30 20% patient had complications by OAX group. In the study of Jatinlal et al 2020,[27] had 7/36 19.4% complications via SAX approach & 3/36 patients 8.3% via OAX group.

Overall Consolidated Outcome: In present study overall outcome of OAX group is better than SAX group in terms of first attempt success,mean flash time,less 2nd attempt needle passes & lesser incidence of complications. Overall outcome of Wilson et al 2014,[20] & Arin Eliza Sunny et al 2020,[12] has same outcome as our study.

Limitations: Larger randomised control trial is required to prove clinical superiority of OAX over SAX approach.

CONCLUSION

In nutshell OAX approach is better alternative to SAX approach in terms of faster flash time, better first attempt success, lesser time required for cannulation, negligible incidence of complications, specially nil carotid artery puncture, nil posterior wall puncture and also better overall consolidate outcome.

REFERENCES

1. Maecken T, Marcon C, Bomas S, Zenz M, Torsello G. Ultrasound-guided central venous catheter placement: A structured review and recommendations for clinical practice. Crit Care. 2007;11(5):R139.
2. Troianos CA, Hartman GS, Glas KE, Skubas NJ, Eberhardt RT, Walker JD, Reeves ST. Guidelines for performing ultrasound guided vascular cannulation: Recommendations of the American Society of Echocardiography and the Society of Cardiovascular Anesthesiologists. J Am Soc Echocardiogr. 2011;24(12):1291-318.
3. Blaivas M, Adhikari S. An observational study of emergency department intern success with ultrasound-guided peripheral intravenous lines in patients with difficult access. Am J Emerg Med. 2009;27(1):1-5.
4. Vezzani A, Brusasco C, Palermo S, Manca T, Santori G, Peluso F, Violini R, Silvestri E. Ultrasound-guided central venous catheter placement: A structured review and recommendations for clinical practice. J Clin Anesth. 2017;40:39-49.
5. Arellano R, Nurmohamed A, Rumman A, Day AG, Winemaker M, Dennie C, Phelan R. A randomized controlled trial comparing the oblique axis and short-axis techniques for ultrasound-guided internal jugular vein cannulation. Br J Anaesth. 2015;115(5):743-8.
6. Brass P, Hellmich M, Kolodziej L, Schick G, Smith AF. Ultrasound guidance versus anatomical landmarks for internal jugular vein catheterization. Cochrane Database Syst Rev. 2015;(1):CD006962.
7. Stone MB, Moon C, Sutijono D, Blaivas M. Needle tip visualization during ultrasound-guided vascular access: Short-axis vs long-axis approach. Am J Emerg Med. 2010;28(3):343-7.
8. Slama M, Novara A, Safavian A, Ossart M, Safar M, Fagon JY. Improvement of internal jugular vein cannulation using an ultrasound-guided technique. Intensive Care Med. 1997;23(8):916-9.
9. Troianos CA, Hartman GS, Glas KE, et al. Guidelines for performing ultrasound guided vascular cannulation: Recommendations of the American Society of Echocardiography and the Society of Cardiovascular Anesthesiologists. J Am Soc Echocardiogr. 2011;24(12):1291-1318.
10. Kane D, Grassi W, Sturrock R, et al. A brief history of musculoskeletal ultrasound: 'From bats and ships to babies and hips'. Rheumatology (Oxford) 2004;43:931–3.
11. Troianos CA, Savino JS. Internal jugular vein cannulation guided by echocardiography. Anesthesiology 1991;74:787–9.
12. Sunny AE, Abraham SV, Krishnan SV, Rajeev PC, Palatty BU. A comparison between ultrasound-guided short-axis approach and oblique axis approach for internal jugular venous cannulation in the emergency department. J Med Ultrasound 2022;30:81-6.
13. KO Bhutia, Ankur Sharma, Shilpa Goyal, Nikhil K, Kamlesh K, Akhil DG, Priyanka Sethi, Pradeep Bhatia. Comparison of novel anteroposterior short-axis in-plane technique with conventional short-axis out-of-plane technique for ultrasound-guided internal jugular vein cannulation: A randomized-

controlled trial.Turk J Emerg Med. 2023 Jan 2;23(1):17–23. doi: 10.4103/2452-2473.366485
14. Kane D, Grassi W, Sturrock R, et al. A brief history of musculoskeletal ultrasound: 'From bats and ships to babies and hips'. Rheumatology(Oxford) 2004;43:931–3.
15. Randolph AG, Cook DJ, Gonzales CA, Pribble CG. Ultrasound guidance forplacement of central venous catheters: a meta-analysis of the literature. Crit Care Med 1996; 24:2053–2058.
16. Hind D, Calverut N, McWilliams R, Davidson A, Paisley S, Beverley C, Thomas S. Ultrasonic locating devices for central venous cannulation: meta-analysis. BMJ 2003; 327:361.
17. Karakitsos D, Labropoulos N, De Groot E, Patrianakos AP, Kouraklis G, Poularas J, et al. Real-time ultrasound-guided catheterisation of the internal jugular vein: a prospective comparison with the landmark technique in critical care patients. Crit Care 2006; 10:R162.
18. Ishizuka, M., Nagata, H., Takagi, K., & Kubota, K. (2010). Right Internal Jugular Vein Is Recommended for Central Venous Catheterization. Journal of Investigative Surgery, 23(2), 110–114. https://doi.org/10.3109/08941930903469342
19. Lennon M, Zaw NN, Popping DM, Wenk M. Procedural complications of central venous catheter insertion. Minerva Anestesiol 2012; 78:1234–1240.
20. Wilson JG, Berona KM, Stein JC, Wang R. Oblique-axis vs. short-axis view in ultrasound-guided central venous catheterization. J Emerg Med. 2014 Jul;47(1):45-50. doi: 10.1016/j.jemermed.2013.11.080. Epub 2014 Mar 27. PMID: 24685453.
21. V ogel JA, Haukoos JS, Erickson CL, Liao MM, Theoret J, Sanz GE, KendallJ. Is longaxis view superior to short-axis view in ultrasound-guided central venous catheterization? Crit Care Med 2015; 43:832–839.
22. Gao YB, Yan JH, Ma JM, Liu XN, Dong JY, Sun F, et al. Effects of long axis in-plane vs short axis out-of-plane techniques during ultrasound-guided vascular access. Am J Emerg Med 2016; 34:778–783.
23. Batllori M, Urra M, Uriarte E, Romero C, Pueyo J, López-Olaondo L, et al. Randomized comparison of three transducer orientation approaches for ultrasound guided internal jugular venous cannulation. BJA Br J Anaesth 2015;116:370-6.
24. Baidya DK, Chandralekha, Darlong V, Pandey R, Goswami D, Maitra S. Comparative Sonoanatomy of Classic "Short Axis" Probe Position with a Novel "Medial-oblique" Probe Position for Ultrasound-guided Internal Jugular Vein Cannulation: A Crossover Study. J Emerg Med. 2015 May;48(5):590-6. doi: 10.1016/j.jemermed.2014.07.062. Epub 2015 Jan 24. PMID: 25630474.
25. Liu C, Mao Z, Kang H, Hu X, Jiang S, Hu P, et al. Comparison between the long-axis/inplane and short-axis/out-of-plane approaches for ultrasoundguided vascular catheterization: an updated meta-analysis and trial sequential analysis. Ther Clin Risk Manag 2018; 14:331–340.
26. Aithal G, Muthuswamy G, Latif Z, Bhaskaran V, Haji Sani HS, Shindhe S, Manap NBA, Vadaje KS, Dato Paduka Buntar WS, Daiwajna RG. An Alternate In-Plane Technique of Ultrasound-Guided Internal Jugular Vein Cannulation. J Emerg Med. 2019 Dec;57(6):852-858. doi: 10.1016/j.jemermed.2019.08.029. Epub 2019 Oct 18. PMID: 31635927.
27. Lal J, Bhardwaj M, Verma M, Bansal T. A prospective, randomised, comparative study to evaluate long axis, short axis and medial oblique axis approach for ultrasound-guided internal jugular vein cannulation. Indian J Anaesth. 2020 Mar;64(3):193-198. doi: 10.4103/ija.IJA_785_19. Epub 2020 Mar 11. PMID: 32346165; PMCID: PMC7179781.
28. Dr. Rekha N. Solanki (MD, Assistant Professor), Dr. Amita H. Jansari (Junior Lecturer, DA, DNB), Dr. Jayshree M. Thakkar (MD, Professor, HOD), Department of Anaesthesia, Gujarat Cancer and Research Institute, B.J.Medical college, Ahmedabad, Gujarat, India. Corresponding Author: Dr. Amita H. Jansari.Comparison of Short Axis and Oblique Axis Approaches for Ultrasound Guided Internal Jugular Vein Cannulation.International Journal Dental and Medical Sciences Research Volume 3, Issue 4, July-Aug 2021 pp 402-408 www.ijdmsrjournal.com ISSN: 2582-6018.
29. Soares PR, Maia A, Fernandes JR, Faustino D, Campos AL, Almeida LR, Mariz J. Point-of-Care Ultrasound Protocol for Insertion and Confirmation of Central Venous Catheter Placement. Cureus. 2022 Sep 17;14(9):e29259. doi: 10.7759/cureus.29259. PMID: 36277575; PMCID: PMC9578662.
30. Manisha Kapdi, Vishwa Shah, Shruti Desai.Comparision of Ultrasound Guided Out Of Plane Short Axis Method / In Plane Long Axis Method For Right Internal Jugular Venous Cannulation In Tertiary Care Hospital.IJAR Volume - 12 | Issue - 09 | September - 2022 | . PRINTISSN No 2249 - 555X | DOI : 10.36106/ijar.
31. Gray, Henry. Anatomy of the Human Body. Philadelphia: Lea & Febiger, 1918; Bartleby.com, 2000. www.bartleby.com/107/.
32. Vishram Singh. Textbook of Anatomy: Head, Neck and Brain, Vol 3, 3rd Updated Edition, Blood Supply and Lymphatic Drainage of Head and Neck, page no: 231-250.
33. Ultrasound for Regional Anesthesia." Ultrasound for Regional Anesthesia. N.p., n.d. Web. 20 Apr. 2016. <http://usra.ca/characteristics.php>.
34. Lamperti M, Bodenham AR, Pittiruti M, Blaivas M, Augoustides JG, Elbarbary M, Pirotte T, Karakitsos D, Ledonne J, Doniger S, Scoppettuolo G, Feller-Kopman D, Schummer W, Biffi R, Desruennes E, Melniker LA, Verghese ST. International evidence-based recommendations on ultrasound-guided vascular access. Intensive Care Med. 2012 Jul;38(7):1105-17.
35. Saugel B, Scheeren TWL, Teboul JL. Ultrasound-guided central venous catheter placement: a structured review and recommendations for clinical practice. Crit Care. 2017 Aug 28;21(1):225.
36. Dietrich CF, Horn R, Morf S, Chiorean L, Dong Y, Cui XW, Atkinson NS, Jenssen C. Ultrasound-guided central vascular interventions, comments on the European Federation of Societies for Ultrasound in Medicine and Biology guidelines on interventional ultrasound. J Thorac Dis. 2016 Sep;8(9): E851-E868.
37. Troianos CA, Hartman GS, Glas KE, Skubas NJ, Eberhardt RT, Walker JD, Reeves ST; Councils on Intraoperative Echocardiography and Vascular Ultrasound of the American Society of Echocardiography; Society of Cardiovascular Anesthesiologists. Special articles: guidelines for performing ultrasound guided vascular cannulation: recommendations of the American Society of Echocardiography and the Society of Cardiovascular Anesthesiologists. Anesth Analg. 2012 Jan;114(1):46-72.
38. Botha R, van Schoor AN, Boon JM, Becker JH, Meiring JH. Anatomical considerations of the anterior approach for central venous catheter placement. Clin Anat. 2006 Mar;19(2):101-5.
39. Marcus HE, Bonkat E, Dagtekin O, Schier R, Petzke F, Wippermann J, Böttiger BW, Teschendorf P. The impact of Trendelenburg position and positive end-expiratory pressure on the internal jugular cross-sectional area. Anesth Analg. 2010 Aug;111(2):432-6.
40. Duffy M, Sair M. Cannulation of central veins. Anaesthesia & Intensive Care Medicine 2007; 8: 17-20.
41. Seldinger SI. Catheter replacement of the needle in percutaneous arteriography. A new technique. Acta Radiol Suppl (Stockholm). 2008 Aug; 434:47-52
42. Ortega R, Song M, Hansen CJ, Barash P. Videos in clinical medicine. Ultrasound-guided internal jugular vein cannulation. N Engl J Med. 2010 Apr 22;362(16): e57.