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Comparison Of Anterior and Posterior Approach for Percutaneous Catheterization of Internal Jugular Vein under real time ultrasound guidance in patients Requiring Central Venous Catheterization.

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Abstract-
Background- Acentral venous catheter (CVC) also known as acentral line or central venous access catheter, is a catheter placed into a large vein of the neck, chest or groin region. Centralvenousaccessisanessentialcomponentofpatientmanagementandmonitoring in various critical care settings like Central venous pressure monitoring, administering Fluids andmedicationslikevasoactivedrugs,chemotherapyandirritantdrugstotheperipheralveins.
Aim- The aim of the study is to Comparison of anterior and posterior approach for percutaneous catheterization of internal jugular vein under real time ultrasound guidance in patients requiring central venous catheterization in critically ill patients.
Methods and materials- Atotal of 50 patients were selected and randomly divided into two groups of 25 each. Patients undergoing Right Internaljugular veincannulationbyanterior approachwerecategorized as GroupAand those by posterior approach as Group P. The analysed criteria were time taken to identify the vein, number of attempts to locate the vein, venous puncture time, duration of cannulation, total accesstimeandcomplicationslikecarotidpuncture,haematomaformation,cardiacarrythmia, pneumothorax, haemothorax and thrombophlebitis.All patients were comparable in terms of Demographic data.
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 was lesser with the posterior approach. Cannulation by posterior approach showed no incidence of carotid puncture, haematoma formation, cardiac arrythmia, pneumothorax, haemothorax and thrombophlebitis. Theposteriorapproachimprovesthesuccessrate,permitseasieraccessandless complications in patients in critical care setting. Complications were negligible on my study participants. Only one patient had accidental carotid artery puncture. No patient had haematoma formation, cardiac arrythmia, pneumothorax, haemothorax and thrombophlebitis in this study.
Conclusion- Ultrasonography provides the benefit of real time visualization of the anatomical structures at the time of procedure and significantly reduces the total procedural time.We also found that Ultrasound guided cannulation of the internal jugular vein significantly improves the success rate, access time and reduces the complication rate compared to the landmark technique. In landmark technique it’s likely to have higher rate of various

complications.Theuseofultrasoundshouldbeseenasan extensionofthetraditionalskillsratherthan a completely new technique even though it requires hands-on training. In addition, the Ultrasound guided technique is a potentially useful technique in complicated cases where landmarks are not defined, or landmark technique is unsuccessful.

Keywords- central venous catheter, ultrasound guided, complications, jugular vein.

I. Introduction

Acentral venous catheter (CVC) also known as acentral line or central venous access catheter, is a catheter placed into a large vein of the neck, chest or groin region.

Centralvenousaccessisanessentialcomponentofpatientmanagementandmonitoring in various critical care settings like Central venous pressure monitoring, administering Fluids andmedicationslikevasoactivedrugs,chemotherapyandirritantdrugstotheperipheralveins. In Perioperative period Central venous pressure and pulmonary artery pressure monitoring is indicatedalongwithfluidanddrugadministrationincardiacsurgeriesandsurgeriesinvolving large fluid shifts or blood loss, Temporary haemodialysis and for Transvenous cardiac pacing also requires central venous cannulation.[1]

Femoralrouteiseasytofindandsafestveintoplacelargelines.Incasesofinadvertent puncture of femoral artery pressure can be applied easily to stop bleeding. Risk of Femoral nerve damage, infection and deep vein thrombosis always there.[2]

Use of Ultrasound guidance for internal jugular venous cannulation provides proper visualization of anatomical structures, lower numbers of puncture of skin and internal jugular veinandaccurateplacementofcatheter,withshorterperformancetimeandlowercomplication rate.[3]

There are three approaches for Internal Jugular Venous Catheterization Central, Anterior and Posterior depending on site of needle insertion in relation to the borders of the sternocleidomastoid muscle. Central approach for IJV cannulation is widely practised, it has higherincidenceofCarotidarterialpuncture.Anterioranddposteriorapproacheshaveemerged assaferalternativetocentralapproachforIJVcatheterizationintermsofeaseofinsertionand less rate of complications.

Theanteriorapproachissimpler,sincetheidentification oflandmarksandpalpationof carotid artery permits a beginner to learn the procedure easily. The major complications are carotid artery puncture and haematoma formation.

Posterior approach has lesser incidence of these complications as quoted in literature. ItisalsoeasiertoperformincriticallyillpatientsastheTrendelenburgpositionisnotrequired whichcausehemodynamicinstability.Eachapproaches hasitsownprosandcons,sothisstudy wasplannedtocomparetheanteriorandposteriorapproachesforcatheterizationoftheInternal jugular vein under Ultrasound guidance technique in patients in critical care unit.

AIM- Comparison of anterior and posterior approach for percutaneous catheterization of internal jugular vein under real time ultrasound guidance in patients requiring central venous catheterization in critically ill patients.

II. Materials and methods

Studydesign-Aprospectiverandomizedsingleblind study.

Setting- StudywasconductedinDepartmentofAnaesthesiology andcriticalcare,Chhattisgarh Institute of Medical Science, Bilaspur (Chhattisgarh)

Study participants – Critically ill patients in intensive care unit, either sexes age 18-70 yrwere required central venous catheterization.

Study duration – Our study was started after getting permission from institutional scientific and ethics committee and was completed after the target sample size is achieved.

Data collection procedure: Data was collected using data collection sheet (proforma).

Samplingprocedure- Patientswasdividedintwogroups(AandP)of25each,randomization was done by sealed envelope technique using computer generated random number table.

Samplesize-

Minimum Samplesizedetermination:

Forequivalentdesign,thefollowingformulaisapplicableinprospective study.

$$N=2\left[\frac{z1-\frac{\alpha}{2}+z1-\beta}{\delta}\right]2x\ P(1-P)$$

Where, N=minimumsamplesize,

P=Prevalencerate(As peraccording50%=.50, becauseitis unknown

1-P=1-.50=.50, α =Level ofsignificance, taken(1-β) =Power of test=80%

So, δ = The real difference between two treatment or clinical acceptance margin or error=20%(assumed)=.20, Z1- α= Standard normal variable =1.64 (from statistical table), Z1- β= 0.845 (From statistical table),Hence, N= (1.64+.845/.20)2 x..50x.50

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=(2.49/.2)2 x..25=38.5,
N=40(Round Figure)
Hence,minimumsample sizeis 40.
Therefore, as per our objective, we were taking sample size of 50 patients and divide them in two group of 25 each.

Inclusion criteria
1) Patients/Relativesgivingvalidconsent.
2) PatientsAgebetween18to70yrofbothsexes.
3) Requiringcentralvenouscatheterizationforvarious reasons.
4) Criticallyillpatientsinintensivecareunit (ICU).

Exclusioncriteria-
1) Hypersensitivitytolignocaine.
2) Superiorvenacavasyndrome.
3) Recenttraumaandinfectionattheproceduresite.
4) Coagulopathies/patientsonheparinandwarfarin.
5) Presenceofcarotiddisease.
6) Historyofnecksurgery/thyroid mass.
7) Presenceofpneumothoraxandhaemothorax.
8) Recentcannulationsofinternaljugularvein.
9) Pregnantpatients.

VARIABLES
Independentvariable-

- Age
- Gender
- Height
- Weight

Dependent variable-

- Numberof attempts
- Heartrate
- NIBP
- SPO2
- Time–Venousvisualizationtime

-Venous puncture time
-Catheterizationtime –Total access time
Thisstudywasconductedindepartmentofanaesthesiologyandcriticalcareunit CIMS Bilaspur, after approval from institutional scientific and ethics committee. Written and informed consent was obtained from all the randomly selected study participants or patient's relatives (in case of unconscious patients), after explaining in detail about Ultrasonography guided Right internal jugular venous catheterization procedure and benefits in their own language.
Routine investigation Haemoglobin, complete blood count, platelet count, random blood sugar, renal function test, liver function test and serum electrolyte, Coagulation Profile (Prothrombintime(PT-INR),activatedprothrombintime(aPTT),bleedingtime ,clottingtime, x-ray, viral markers including HBsAg, Hepatitis C virus (HCV), Human immunodeficiency virus (HIV) was checked in all patients. Lignocaine sensitivity test was confirmed to be negative in all patients. Base line vitals (electrocardiogram, heart rate, non invasive blood pressure, Spo2) were recorded and that monitoring was continued throughout the procedure.
Patients admitted in ICU, their detailed history was obtained by relatives or other reliable source. General and systemic examination was carried out. Quick sequential organfailureassessmentscore(SOFA)wasassessed.Thosepatientswhowereonmechanical ventilation with positive end expiratory pressure (PEEP), PEEP was withdrawn during cannulation, resumed after catheterization.7 French double lumen catheter was used for catheterization in all patient.
Patientswererandomlydividedinto2groupsof25eachbysealedenvelopetechnique: -
GroupA:-
Patientsunderwentrightinternaljugularvenouscatheterizationunder ultrasound guidancethroughanterior approach.
GroupP:-
Patientsunderwentrightinternaljugularvenouscatheterizationunder ultrasound guidance through posteriorapproach.

Materials required-
- 7Frenchdoublelumencentrallinecatheterkit.
- Realtimeultrasonographymachineandgel.
- Multiparamonitor–pulseoximeter,electrocardiogram,non-invasiveblood pressure monitoring.
- Steriletraycontaininginstrumentsanddrapes.
- Appropriatesuture materials.
- Normal saline
- Intravenousdripset
- Bloodtransfusionneedle
- Surgicalgloves
- Bedblinding screen
- Patientonatiltingbed,trolleyoroperatingtable.
- Sterilepackorantiseptic solution
- Localanaestheticagent
- Syringesandneedle.
- Heparinisedsalinetoflushthelineafter insertion
- Suture material.
- Steriledressing
- Facilityforchestx-rayifavailable
- Emergencyairwayequipment
- Emergencycrashcart trolley.
- Defibrillator

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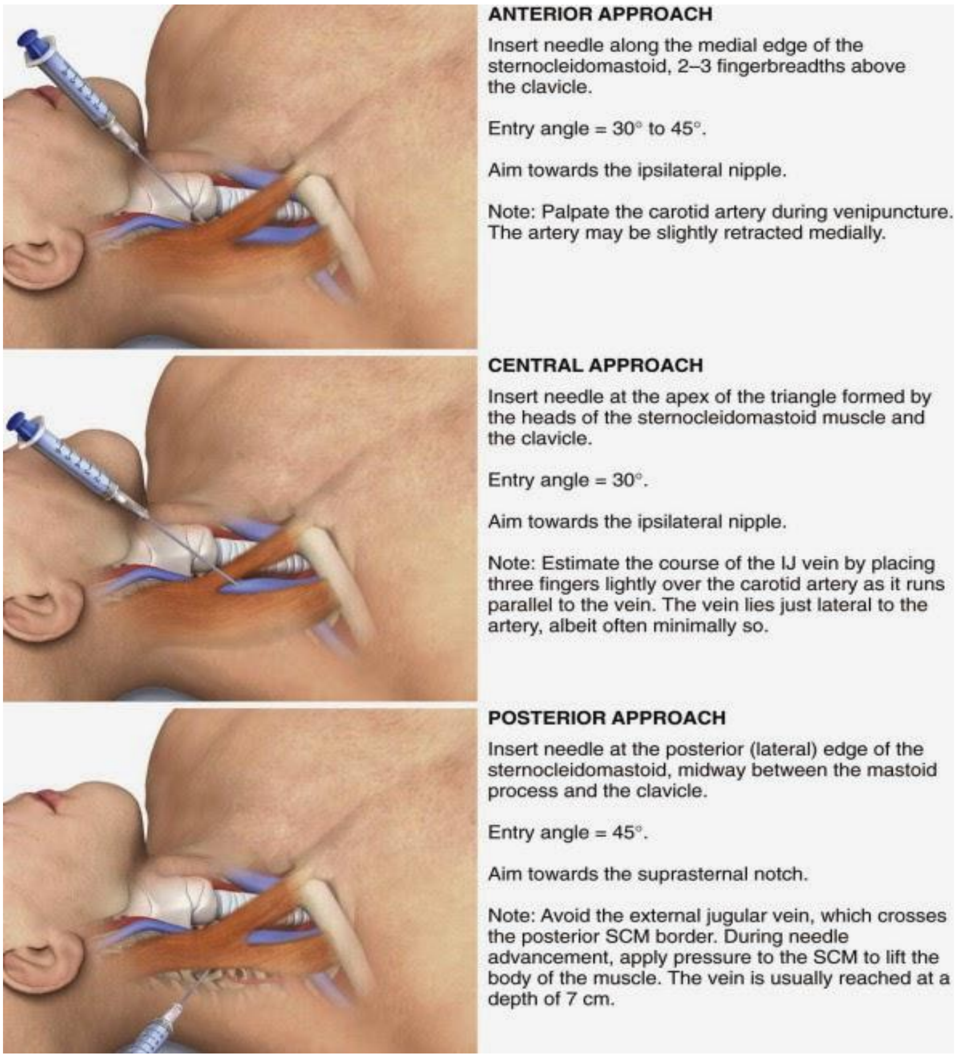
Parameters-
IJVcannulation weredoneby the investigator and following parameters was recorded and noted by fellow resident.

1. **Venousvisualizationtime**(insec):-TimetakenfromtheplacementofUSGprobeover the skin to the time when clear image of the internal jugular vein will be identified on the screen of USG machine.
2. **Number of attempts to locate the vein** whether single or double. 3 or more than 3 attempts were taken as a failure and further catheterizations was carried out through another approach.
3. **Venous puncture time** (in sec): - Time interval between initial skin puncture to the aspiration of dark venous blood from the internal jugular vein.
4. Thenumberofattemptsrequiredforsuccessful guidewireinsertion.
5. **Catheterization time** (in sec): -Timetaken from the beginning ofaspiration ofblood through the needle to the time till successful aspiration of blood from the catheter.
6. **Total access time**: -Time taken from placement of linear probe on skin to successful aspiration of blood from both the port of catheter.
7. Vitalsparameters:-HeartRate,MeanBloodPressure,Spo2theserecorded throughout the procedure
8. Immediatemechanicalcomplicationslikecarotidarterypunctureandsubsequent hematoma formation, cardiac arrythmias
9. Restrictionofneck movements,any complaintsor discomfort.
10. Postproceduralcomplicationslikepneumothorax,haemothoraxandthrombophlebitis.

There are three different approaches for Internal Jugular Venous catheterization:-

1. Central approach,
2. Anterior approach,
3. Posterior approach.



Ultrasound guided catheterization technique-

After proper positioning, cleaning and draping a two-dimensional ultrasound linear probe 7.5 MHz covered by sterile plastic bag and gel is placed in transverse position to the patient's neck axis, levelled with the separation of the sternal and clavicular heads of the sternocleidomastoid muscle, lateral to cricoid cartilage at the midpoint between lower jaw angleandtheclavicle.The**internalcarotidartery**isidentifiedasawellcircular,pulsatileand noncompressiblevesselandthe**internaljugularveinwere**identifiedasacompressible,non- pulsatile structure and is located beside ICA.

After choosing the proper position and under all aseptic precaution the skin were infiltratedwith2ml2%lignocaine.Internaljugularvein waslocatedbydirectvisualizationof 18GneedleinIJVlumenbyultrasoundprobeandtheaspirationofdarkvenousbloodintothe syringe.Aftersuccessfulaspirationofdarkvenousblood,guidewirewasthreadedthroughthe needle into the vein and then needle were gently removed. A small incision was placed over theskinatthesiteofguidewireinsertionandthedilatorwascarefullypassed,dilatorwasgently removed and the catheter was threaded over the wire and advanced into the Internal jugular vein(Seldinger'stechnique).Afterremovalofguidewirefromcatheter,allportswerechecked forbackflowofvenousbloodandflushedwithnormalsaline,catheterwassecuredinplaceby proper sutures and aseptic dressing.[36]

Ultrasound guided RightInternal Jugular Venous catheterization via anterior approach (group A) :-

After proper positioning, cleaning and draping a two-dimensional ultrasound linear probe 7.5 MHz covered by sterile plastic bag and gel is placed in transverse position to the patient's neck axis, levelled with the separation of the sternal and clavicular heads of the sternocleidomastoid muscle, lateral to cricoid cartilage at the midpoint between lower jaw angleandtheclavicle.The**internalcarotidartery**isidentifiedasawellcircular,pulsatileand noncompressiblevesselandthe**internaljugularveinwere**identifiedasacompressible,non- pulsatile structure and is located beside ICA.

After choosing the proper position and under all aseptic precaution the skin was infiltratedwith2mlof2%lignocaine.Internaljugularveinwaslocatedbydirectvisualization of18GneedleinIJVlumenbyultrasoundprobeandneedlewasinsertedalongthemedialedge of sternocleidomastoid muscle, 2-3 breadths above the clavicle and the aspiration of dark venousbloodintothesyringe.Aftersuccessfulaspirationofdarkvenousblood,guidewirewas threaded through the needle into the vein and then needle was gently removed. A small incisionwasplacedovertheskinatthesiteofguidewireinsertionandthedilatorwascarefully passed,dilator was gently removed and the catheterwas threaded overthe wire and advanced into the Internal jugular vein (Seldinger's technique). After removal of guide wire from catheter,allportswerecheckedforbackflowofvenousbloodandflushed withnormalsaline, catheter wassecured inplace bypropersuturesandasepticdressing.Allthestudyparameters were recorded and noted in the proforma by fellow residents during the procedure and vitals parameters were monitored like Heart Rate, Blood Pressure, Spo2, Respiratory rate was monitored throughout the procedure and 24 hr post procedure.

After proper positioning, cleaning and draping a two-dimensional ultrasound linear probe 7.5 MHz covered by sterile plastic bag and gel is placed in transverse position to the patient's neck axis, levelled with the separation of the sternal and clavicular heads of the sternocleidomastoid muscle, lateral to cricoid cartilage at the midpoint between lower jaw angleandtheclavicle.The**internalcarotidartery**isidentifiedasawellcircular,pulsatileand noncompressible vessel and the **internal jugular vein** was identified as a compressible, non- pulsatile structure and is located beside ICA.

ULTRASOUND GUIDED INTERNAL JUGULAR VENOUS CATHETERIZATIONVIAPOSTERIORAPPROACH(GROUPP):

After choosing the proper position and under all aseptic precaution the skin were infiltratedwith2mlof2%lignocaine.Internaljugularveinwaslocatedbydirectvisualization of 18G needle in IJV lumen by ultrasound probe and needle was inserted and advanced at an angle of 45 degree to the skin, directed towards the suprasternal notch and dark venous blood wasaspiratedintothesyringe.Aftersuccessfulaspirationofdarkvenousblood,guidewirewas threaded through the needle into the vein and then needle will be gently removed. A small incisionwasplacedovertheskinatthesiteofguidewireinsertionandthedilatorwascarefully passed,dilator was gently removed and the catheterwas threaded overthe wire and advanced into the Internal jugular vein (Seldinger's technique). After removal of guide

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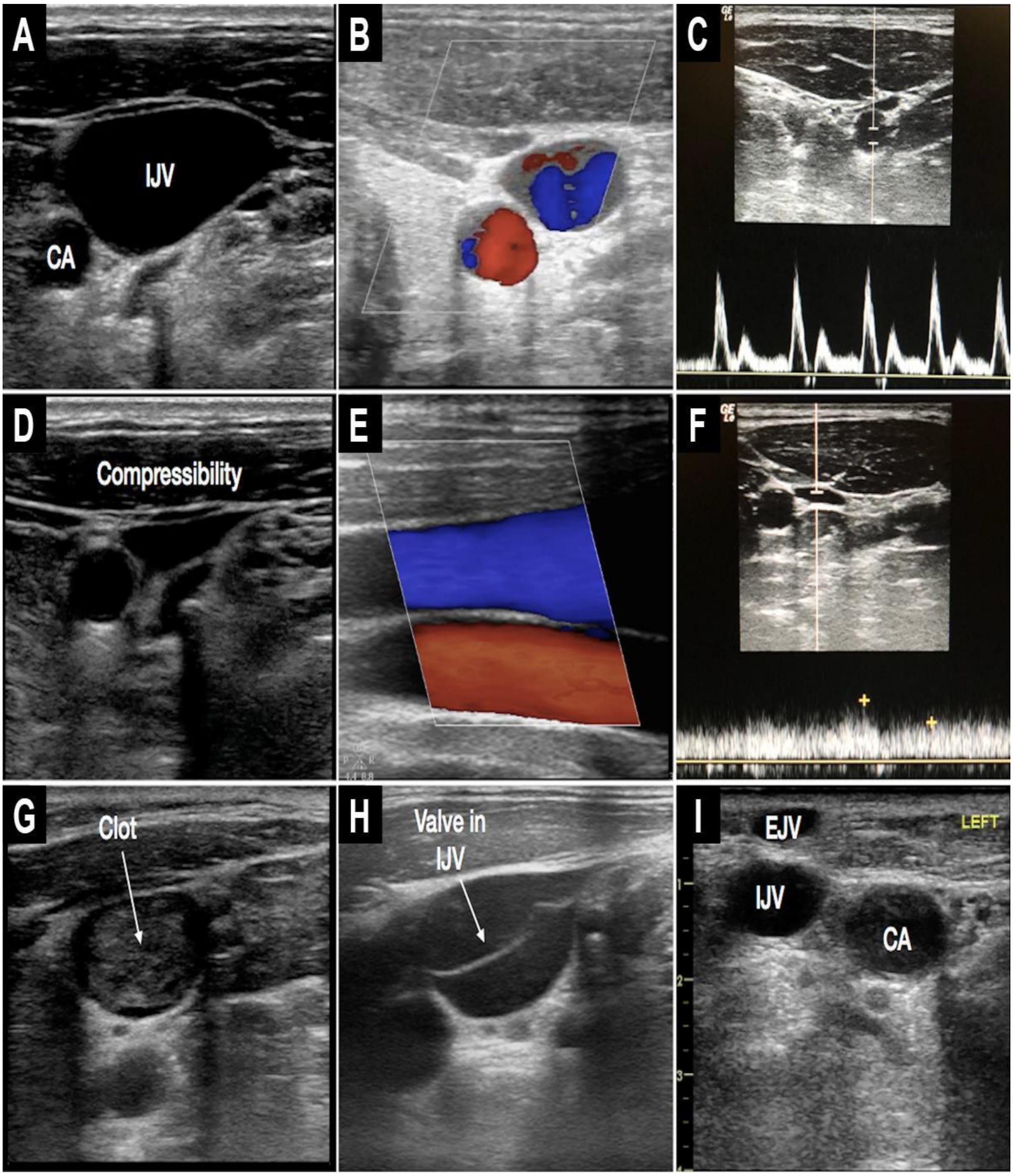
wire from catheter,allportswerecheckedforbackflowofvenousbloodandflushed withnormalsaline, catheter was secured in placeby propersutures and asepticdressing. All thestudy parameters were recorded and noted in the proforma by fellow residents during the procedure. complications if any were noted. Vitals parameters were monitored like Heart Rate, Blood Pressure, Spo2, Respiratory Rate was monitored throughout the procedure and 24 hr post procedure.[36]



Figure–ultrasonographicimagesofinternaljugularvein,carotidarteryandcolour doppler image

StatisticalAnalysis-
All numerical values were entered in Microsoft Excel 2021. Data analyses were performed by SPSS software 22.0 trial version. Continuous data was summarized as mean+/- sd (standard deviation) while discrete (Categorical data) in number and

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percentage with appropriate graphs. Statistical test whichever is/are applicable were applied. Categorical data were analyzed by chi square test or fisher exact test for non-normality data.All are test were apply after ascertaining normality by Shapiro-wilk test. A two tailed P value less than 0.05(P<0.05) will be considered statistically significant. [52,53]

SubjectConfidentiality&Consent:

Study was initiated following the approval by the Institutional Ethical Committee. Informed consent process was initiated prior to the individual agreeing to participate in the studyandcontinuingthroughouttheindividual'sstudyparticipation.Allcareandcautionwere exercised while utilizing the patient data for current research as outlined in the hospital guidelines pertaining to the usage of patient's data for this study and confidentiality was maintained throughout. All the patient specific data was kept in strict confidence. Patient identifiable data (name, contact details, etc.) will not be presented in journal or any public forum.

III. Observations And Results

In Group A, the age distribution shows that 8 participants (32.0%) are in the 18–25- year age range, 8 participants (32.0%) are in the 26-35 yr age range, another 5 participants (20.0%)areinthe36-45yragerange,3participants(12.0%)areinthe46-55yragerangeand 1 participant (4.0%) is over 55 years old. In contrast, Group P has similar distribution with 9 participants(36.0%)inthe18-25yragerange,7participants(28.0%)inthe26-35yragerange, 5participants(8.0%)inthe36-45yragerange,2participants(8.0%)inthe46-55yragerange andremaining2patients(8%)werebelongingtoover55yearsold.Themean+/-SDforGroup A is (35.08+/- 13.00 yr), while Group P has a mean +/- SD (32.64+/- 13.72). The Chi-Square value is 0.658 with a P value of 0.956, indicating no significant difference in the age distribution between the two groups. My study out of 50, 31paricipants come into younger age group because most of the participants belongs to reproductive age group (18-35 yrs).
GroupAhas 8 males (32.0%) and 17 females (68.0%). Group P has 7 males (28.0%) and 18 females (72.0%). The significance level is reported with a P-value of 0.3946. This P-value indicates that there is no statistically significant difference in gender distribution between the two groups. Overall, the results suggest that gender does not appear to influence the grouping inthisstudy.Inmystudyoverallfemaleparticipantsaremorecomparedtomalebecausemost of the cases admitted in our critical care units are in reproductive age group.
InGroupA,themajorityofparticipants, 56%(14participants),fallwithinthe35-45kgweightrange.Thisisfollowedby16%(4 participants) in the 46-55 kg range, 8% (2 participants) in the 56-65 kg range, and 20% (5 participants) weigh more than 65 kg. In Group P, a larger proportion of participants, 68% (17 participants),areinthe35-45kgrange.The46-55kgrangeincludes8%(2participants),while 16%(4participants)fallwithinthe56-65kgrange.Finally,8%(2participants)weighmore than 65 kg.
The mean weight for Group A is 50.08 kg with a standard deviation of 11.87, while Group P has a mean weight of 47.00 kg with a standard deviation of 10.72. The Chi-Square value is 2.909 with a P value of 0.405, suggesting no significant difference in the weight distribution between the two groups.
BothGroupAandGroupPexhibitahighprevalenceofunderweight individuals,with 64% of participants falling into this category. The percentages of individuals categorized as overweightorobesearerelativelylowinbothgroups.Thereisnosignificantdifferenceinthe BMIdistributionbetweenGroupAandGroupP,asindicatedbythechi-squaretest(P-value= 0.938). In conclusion, the table reveals that both GroupAand Group Phave a predominantly underweight population with minimal representation in the overweight and obese categories. Despite a slight difference in mean BMI, the overall BMI distributions of the two groups are not significantly different. This suggests that factors other than group affiliation may be influencing the BMI profiles of these individuals.
Out of 50 participants, 33 cases (66%) were from the obstetrics and gynaecological department. Within this group 9,18 and 6 cases were from antenatal, postnatal and gynaecological cases respectively. 14 cases from surgical dept,1 case from ENT and rest 2 cases from dental department
These figures highlight that a significant portion of patients in your intensive critical careunitarefromtheobstetricsandgynaecologicaldepartment,withpostnatalcasesbeingthe most prevalent.
ThemeanvenousvisualizationtimeforGroupAis41.96+/-4.31seconds,whileGroup P has a mean of 32.2 +/- 4.1 seconds. The T-Test statistics is reported as 8.205, indicating a significantdifferencebetweenthetwogroups.TheP-Valueislessthan0.001,whichsuggests that the difference in venous visualization times is

statistically significant.

Table-1 Comparison ofVenous visualizationtime(in sec)between GroupAandGroup P(n=50)

	GroupA		GroupP		T-Test	P-Value
Venousvisualizationtime (in sec)	**Mean**	**SD**	**Mean**	**SD**		
	41.96	4.31	32.20	4.10	8.205	**<0.001**

ThemeanvenousvisualizationtimeforGroupAis41.96 +/-4.31seconds,whileGroup P has a mean of 32.2 +/- 4.1 seconds. The T-Test statistics is reported as 8.205, indicating a significantdifferencebetweenthetwogroups.TheP-Valueislessthan0.001,whichsuggests that the difference in venous visualization times is statistically significant.

Most participants in both groups (80% in GroupAand 88% in Group P) vein was located by 1stattempt.Asmallerproportionrequiredasecond attempt(20%inGroupAand12%inGroup P). The difference was not statistically significant (P value = 0.440). This suggests that both groups performed similarly in terms of the number of attempts needed to locate the vein.

TheaveragetimetakenforvenouspunctureinGroupAwassignificantlylongerthanGroupP (42.12secondsvs.31.32seconds).Thestandarddeviations(SD)forbothgroupsweresimilar, indicating a relatively consistent spread of data within each group. The resulting p-value of 0.0001 is significantly less than the commonly used alpha level of 0.05, providing strong evidencethattheobserveddifferenceinmeansisnotduetochance.Therefore,wecanconclude thatthereisastatisticallysignificantdifferenceinthetimetakenforvenouspuncturesbetween Group A and Group P.

Table:2 Comparison ofVenous puncture time (in sec) between GroupAand Group P (n=50)

	GroupA		GroupP		T-Test	P-Value
	Mean	**SD**	**Mean**	**SD**		
Venouspuncturetime(in sec)	42.12	5.30	31.32	4.53	7.747	**<0.0001**

thenumberof attempts required for successful guidewireinsertion betweentwostudygroups.Thisindicatesthatwehadsuccessfullyachieved guidewireinsertion on the 1st attempt 100 % (25 participants) of group p compared to 88 % (22 participants) on group A, while the remaining 12% (3 participants) of group required a second attempt. Conversely,GroupPhada100%successrateonthefirstattempt,withnoparticipantsneeding a second attempt. The average time for GroupA was slightly longer than Group P (134.04 seconds vs. 121.20 seconds). The standard deviations (SD) for both groups were similar, indicating a relatively consistent spread of data within each group.At-test was conducted to determine if the difference in mean catheterization times between the two groups was statistically significant.Theresultingp-valueof0.0000issignificantlylessthanthecommonlyusedalpha level of 0.05, providing strong evidence that the observed difference in means is not due to chance.Therefore,wecanconcludethatthereisastatisticallysignificantdifferenceinthetime taken for catheterizations between GroupAand Group P.

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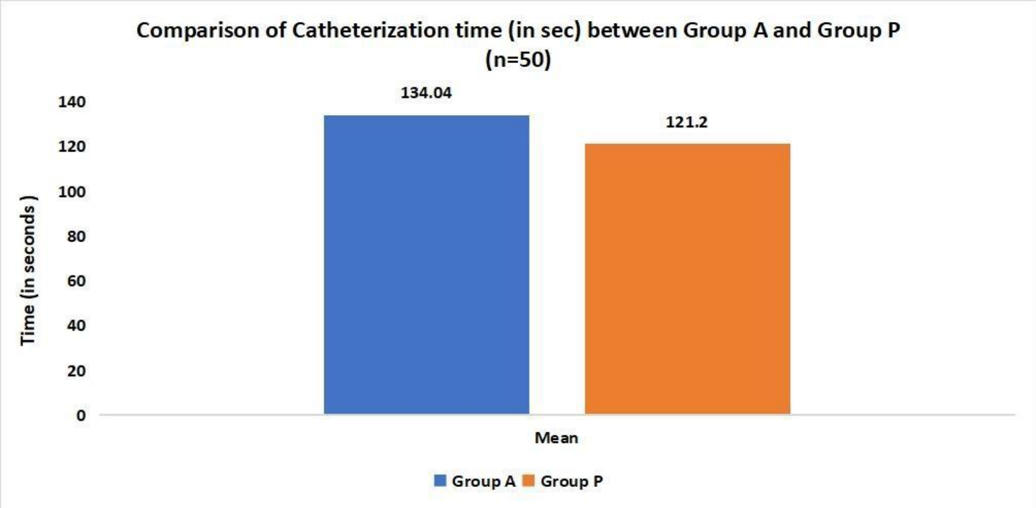

Graph 1: Comparison of Catheterization time (in sec) between GroupA and Group P (n=50)

The average total access time for Group A was significantly longer than Group P (218.12 seconds vs. 184.72 seconds). The standard deviations (SD) for both groups were similar, indicating a relatively consistent spread of data within each group.At-test was conducted to determineifthedifferenceinmeantotalaccesstimesbet weenthetwogroupswasstatistically significant.Theresultingp-valueof<0.0001issignificantlylessthanthecommonly usedalpha level of 0.05, providing strong evidence that the observed difference in means is not due to chance.Therefore,wecanconcludethatthereisastatistic allysignificantdifferenceinthetotal access time between GroupA and Group P.

The table displays heart rate measurements for GroupsAand P at various time points, from pre-procedureto24hourspost-procedure.GroupAhasapre-proceduremeanheartrateof 86.36 bpm, while Group P's is 83.88 bpm, with no significant difference (P = 0.232). Throughout the study, heart rates decrease for both groups, but no significant differences are observed at any time point, including immediately after the procedure and at subsequent intervals.Theresultsindicatethatbothgroupsmaintainc omparableheartratesthroughoutthe study, suggesting similar physiological responses to the procedure.

Table 3: HeartRateamongtheparticipants(n=50)

	GroupA		**GroupP**			
Heart Rate	**Mean**	**SD**	**Mean**	**SD**	**T-Test**	**P-Value**
Pre-Procedure	86.36	12.60	83.88	11.13	0.737	0.232
Immediatelyafterprocedure	81.80	11.15	82.20	10.81	-0.128	0.449
After15minutes	80.76	8.76	81.20	7.12	-0.194	0.423
After30minutes	79.24	5.12	77.88	6.02	0.860	0.196
After45minutes	79.56	6.73	79.28	7.72	0.136	0.445
After1hour	79.08	7.38	77.96	8.04	0.513	0.305
After2hours	77.56	5.66	77.60	7.16	-0.054	0.478
After3hours	79.08	7.15	78.40	6.90	0.342	0.366
After4hours	80.00	6.30	79.00	6.38	0.557	0.289
After6hours	79.16	5.66	79.00	5.63	0.100	0.460
After8hours	77.68	9.35	78.80	8.37	-0.446	0.328
After10hours	77.84	8.51	78.40	9.06	-0.225	0.411
After12hours	79.20	6.61	79.40	7.18	-0.102	0.459
After14hours	78.36	9.73	81.44	9.55	-1.129	0.132
After16hours	80.36	9.04	80.84	9.25	-0.185	0.426
After20hours	81.28	9.18	82.24	8.39	-0.385	0.350
After24hours	79.72	10.22	80.44	9.53	-0.257	0.398

Thetablepresentsmean arterialbloodpressure (MAP)measurementsatvarioustimepoints, from pre-procedure to 24 hours post-procedure for groupA and group P. Both groups show similarMAPtrends,withnosignificantdifferencesatmosttimepoints.However,asignificant difference is observed at the 2-hour mark, where Group A's mean MAP is 64.48 mmHg comparedtoGroupP's66.44mmHg,yieldingaP-Valueof0.006.ThisindicatesthatGroupA experiences a more pronounced drop in blood pressure at 2hour time point, while overall, the groups maintain comparable MAP levels throughout the study.

the oxygen saturation levels (SpO2) for Groups A and P at various time points, from pre-procedure to 24 hours post-procedure. Group A has a pre-procedure mean SpO2of96.76%, whileGroupP'smeanis96.44%,withnosignificantdifference(P=0.290). Throughoutthestudy,SpO2levelsfluctuate,butnosignificantdifferencesareobservedatany time point, including immediately after the procedureand at subsequent intervals.The results indicatesimilaroxygensaturationlevelsinboththegroups,suggestingcomparablerespiratory function and physiological responses to the procedure across the measured time points.
The findings, as illustrated in Table, revealed that there was one instance of carotid artery puncture reported in Group A, whereas no such complications were observed in Group P. Additionally,therewerenocasesofhaematomaformationandcardiacarrythmianotedineither group.

Table 4: Comparison of Complications between Group A and Group P during the procedure (n=50)

Complications	**GroupA**	**GroupP**
Carotidartery puncture	1	0
Haematoma formation	0	0
Cardiac arrythmias	0	0

there were no reported cases of pneumothorax, haemothorax,orthrombophlebitisineitherGroupAorGroupP.Thisindicatesthatbothgroups experienced no complications related to pneumothorax, haemothorax, or thrombophlebitis post-procedure. The absence of these complications in both groups suggest a favourable outcome for all participants involved.

IV. DISCUSSION

Internal jugular vein cannulation can be performed by numerous approaches, but the success depends on anatomical variations and operator experience. The purpose of this study wastoevaluatearoutethatwouldbesaferandmoreefficientthanthewidelypracticedcentral approach toIJVcannulation.Ourstudy compares thewidelypractised anteriorapproach with posterior approach via ultrasound guided catheterization. Real time ultrasound of central venous catheter insertion provides the operator with visualization of the desired vein and the surrounding anatomical structure prior to and during insertion of the catheter.
During thelast two decades, central venous catheterization has been increasingly used inclinicalpractice.However,despitetheincreasedexperiencefromthepartofmanyclinicians, who perform central venous catheterization, the classical anatomic landmark method is associatedwithasmallbutpotentiallysignificantmorbiditylikearterialpuncture,haematoma formation or pneumothorax. In the ultrasound-guided technique needle is advanced under ultrasonographic guidance (real-time), allowing its safe introduction into the internal jugular vein,whilethecarotidarteryisvisibleduring theprocedure.Theultrasoundguidedtechnique requires the appropriate devices and an adequately trained operator. It allows direct visualization of the great vessels of the neck.This has a significant clinical importance, given thattheinternaljugularveinshowsagreatvariabilityinitsanatomicpositionrelativetocarotid artery. IJV could not be accurately predicted only by external landmarks method.
Sincemanystudies have showntheposterior approach to be better in terms ofvarious procedural parameters and success rates, we selected it for comparison with the anterior approach.Inmystudyweevaluated**venousvisualizationtime,numberofattemptstolocate the vein, venous puncture time, number of attempts to guide wire insertion, catheterization times, total access time and complications in both anteriorand posterior approachesofIJVcannulation.**Ultrasoundguidance hasconsistentlybeenshowntoimprove success rates and minimize complications in both the routes.Various international guidelines alsoadvocatetheuseofUSGguidancefortheseprocedur

es.Therefore,wedecidedtoinclude USG guidance as a part of the study protocol.

DEMOGRAPHIC

There were no statistically significant differences in the two groups included in this studyintermsofvariousdemographicparameters(age,gender,weight,heightandBMI).The meanageforGroupAis(35.08+/-13.00yr),whileGroupPhasamean+/-SD(32.64+/-13.72) withaPvalueof0.956,indicatingnosignificantdifferenceintheagedistributionbetweenthe twogroups.Inmystudyoutof50,31participants comeintoyoungeragegroupbecausemost of the participants belong to reproductive age group (18-35 yrs).

Intermsofgenderdistribution,GroupAhas8males(32.0%)and17females(68.0%). Group Phas 7 males (28.0%) and 18 females (72.0%).The significance level is reported with a P-value of 0.3946 which is no statistically significant difference in gender distribution between the two groups. In my study out of 50 participants 35 participants are female gender andrest15participantsbelongstomalegender,overallfemaleparticipantsaremorecompared tomalebecausemostofthecasesadmittedinourcriticalcareunitsarereproductiveagegroup.

The mean weight for GroupAis 50.08+/- 11.87 kg, while Group Phas a mean weight of47.00+/-10.72kgwithaPvalueof0.405,suggestingnosignificant differenceintheweight distributionbetweenthetwogroupsandmostofthestudy participantsbelongstolowerweight groups.

In my study most of the participants are short height, because in our central India (Chhattisgarh) mean average height is 152 cm (5feet), most of the woman is belong to short height compared to north Indian population with a P-Value of 0.829. This P-Value indicates thatthereisnostatisticallysignificantdifferenceinheightdistributionbetweenthetwogroups.

VENOUSVISUALIZATIONTIME

Time taken from the placement of USG probe over the skin to the time when clear imageoftheinternaljugularveinwillbeidentifiedonthescreenofUSGmachineastakenas venous visualization time.

Duringtheprocedure,theaveragevenousvisualizationtimewas**32.20+/-4.10seconds** intheposteriorgroupand**41.96+/-4.31seconds**intheanteriorgroupwhichwaslessingroup P. This difference was statistically significant **p < 0.001**. Our findings align with previous studies, which also reported shorter visualization times for the posterior approach.

Mishra T et al. 22 compared the anterior vs posterior approach of percutaneous catheterizationofInternaljugularveinunderrealtimeultrasonographyguided.Theyobserved intheirstudy,venousvisualizationtimeof**14.65+/-2.21seconds**intheposteriorgroupand **38.52 +/- 4.33 seconds** in the anterior group with **p < 0.001**. Similarly, **Kedarreshvara K.S. et al.** 20 compared posterior approaches to internal jugular venous cannulation vs central approachesvialandmark technique.They reportedvenousvisualizationtimesof **12.04±1.49 seconds** in the posterior group and **14.27 ± 2.30 seconds** in the central group **p < 0.001**.

In the study conducted by **Babu et al.** 14 they compared posterior vs anterior approachesofinternaljugularvenouscannulationvialandmarktechnique.Theynotedthatthe timerequiredtoidentifytheveinwassignificantlyshorterwiththeposteriorapproach(**0.18+/-0.12min**)comparedtotheanteriorapproach(**1.06+/-0.56min**).Similarly,**ManjulaB.P.etal**. 17theycomparedanteriorvsposteriorapproachesforIJVcannulationvialandmarktechnique and reported a venous visualization time of **0.20 ± 0.12 min** in the posterior group, compared to**1.05±0.37min**intheanteriorgroup,showingasignificantlyshortertimewiththeposterior approach.

KarakitsosDetal.10theycomparedlandmarktechniquevsultrasoundguidedInternal jugular venous cannulation central venous catheterization technique with 450 patients in each group,theyobservedvenousvisualizationtimeinultrasoundgroupwas**17.1+/-16.5**seconds compared to **44+/-95.4** seconds in landmark group.The likely reason for these findings is the **greater cross-sectional area** of the vein in the posterior approach, which allows for **faster identification and easier differentiation** from surrounding structures.

Numberofattemptstolocatethe Vein

In this study, the number of attempts required to successfully locate the vein was analysed.A single or double attempt was considered successful, while 3 or more than three attempts were classified as failure, requiring an alternative approach.

- DuringtheprocedureinGroupP,theveinwassuccessfullylocatedonthefirstattempt in 22 patients (**88%**), compared to 20 patients (**80%**) in Group A. The remaining patients required a second attempt with 3 patients (**12%**) in Group P and 5 patients **(20%)** in Group A. No further attempts were needed for vein localization in either group.

Theseresultsalignwithpreviousstudies:

- **RiazAetal.**15founda**99%**first-attemptsuccessrateinthe**ultrasound-guided**group compared to **89%** with the landmark technique, with second-attempt success rates of **1%** and **7%**, respectively, which was statistically significant.
- **Chandralekha M et al.** 9 observed a **higher success rate** with fewer attempts in the **posterior approach (93.8%)** compared to the **anterior approach (87.5%)**. they compared anterior vs posterior approaches via landmark technique.
- **Mishra T et al.** 22 reported a first-attempt success rate of **82.2%** for the posterior approach and **80%** for the anterior approach in the ultrasonography guided catheterization.
- **Babu M et al.** 14 compared anterior vs posterior approaches via landmark technique andfoundfirst-attemptsuccessratesof **80%fortheposteriorapproach** versus**52% for the anterior approach**. The second-attempt success rates were **16% and 24%**, respectively.
- **Kedareshvara K S et al.**20 compared central vs posterior approaches of IJV cannulation through landmark technique and reported first-attempt success rates of **85% via the posterior approach**, and **70% via the central approach**, with second- attempt success rates of **15% and 30 %**, respectively.

Our study findings align with previous research, demonstrating **comparable first- attempt success rates** between the anterior and posterior approaches under real-time ultrasound guidance. The use of ultrasound enables more accurate vein identification and localization, reducing the variability between approaches. While the posterior approach showed a slightly higher first-attempt success rate, the difference was **not statistically significant**.

VENOUSPUNCTURETIME

In our study, the average venous puncture time—defined as the duration from initial skinpuncturetotheaspirationofdarkredvenousbloodfromtheinternaljugularveininsyringe —was significantly lower in the posterior group compared to the anterior group $p < 0.0001$. Theposteriorapproachhadameanvenouspuncturetime of31.32+/-4.53seconds,whereasthe anterior approach required 42.12+/- 5.30 seconds.

The present study correlates well with the study conducted by by **Mishra T et al.** 22**, Chandralekha M et al**9 **and Manjula B.P.et al.**17 Our findings align with previous studies. **Mishra T. et al.** 22 compared the anterior and posterior approach of percutaneous catheterization of internal jugular vein under real time ultrasound guidance in critically ill patients, theyreported avenous puncturetimeof24.16+/-2.55 seconds intheposteriorgroup and 47.60+/- 4.79 seconds in the anterior group ($p < 0.001$), demonstrating a statistically significant difference.

Similarly, **Chandralekha M. et al.** 9 compared the internal jugular vein cannulation central approach (palpation method) vs posterior approach (non-palpation method) and they concluded that the posterior approach was superior in terms of venous access and puncture time.

Manjula B. P. et al. 9compared anterior and posterior approach of internal jugular venous cannulation they observed venous puncture time in posterior approach was 20+/- 12 seconds and in anterior approach 60+/- 37 seconds with p value <0.005 which is statistically significant. This difference can be explained based on superior visualization of the vein posterior in posterior approach and thus a more confident and accurate puncture.

The shorter venous puncture time in the posterior approach can be attributed to better visualization of the vein, leading to a more confident and accurate puncture.

NUMBEROFATTEMPTSREQUIREDFORSUCCESSFUL GUIDEWIRE INSERTION

In our study number of attempts required for successful guidewire insertion in 1st attempt was 88% in group A compared to 100% of guide wire insertion in all the participants ingroupP,restofthe(12%)participantsingroupArequired2ndattemptguidewireinsertion.

❖ **Chudhari L. S. et al.** 4 compared two different approaches for internal jugular vein cannulationinsurgicalpatientsandtheyreportedthat90.05%ofpatientshadguidewire insertedinanteriorapproach,while95.8%weresuccessfullyguidewireinsertedviathe posteriorapproach in1stattemptremaining10%ofpatientsinanteriorgroup and4% of patients in posterior group required 2nd attempt guidewire insertion, which is statistically significant.

❖ **Babu M. et al.** 14 compared anterior and posterior approaches of internal jugular venouscannulation,andtheyfoundthateaseofthreading wasachievedin80%ofcases in the posterior group, compared to only 72 % in the anterior group in 1st attempt, remaining20%ofparticipantsofgroupPand28%ofparticipantsrequired2ndattempt guidewire insertion.

❖ **SwathiB.etal.**24comparedanteriorandposteriorapproachesforinternaljugularvein cannulation and they observed that guidewire insertion in 1st attempt 50% of patients

usingtheanteriorapproach,whereas83.3%ofpatientshadsuccessfullyinsertedguide wireviaposterior approach, remaining 50% of patients in anterior groupand 16 % of patientsinposteriorgrouprequired2ndattemptforguide wireinsertionwithp-valueis 0.05whichisstatistically significant.
Thesefindingssuggestthattheposteriorapproachgenerallyfacilitateseasierguidewire insertion compared to the anterior approach, the reason for easier threading of catheter in posterior approach could be a large cross-sectional area of the internal jugular vein in this approach.

CATHETERIZATIONTIME

Inourstudy,theaveragedurationofcatheterization—measuredfromtheconfirmation of venous blood from the needle to the successful aspiration of blood from both the ports of catheter(insertedupto12–13cminthevein,excludingsuturingandfixationtime)—was **121.20 +/- 5.82 seconds** in the posterior group and **134.04 +/- 8.05 seconds** in the anterior group. The difference was highly statistically significant **p < 0.0001**, indicating a shorter catheterization time with the posterior approach.
ChorariaSetal.18foundthatthecatheterizationtimeintheultrasound(USG)-guided groupwas**69.14+/-54.94seconds**whileinlandmark-basedgroupwas**95.4+/-88.24seconds p<0.03**,demonstratingasignificantreductionwithultrasoundguidance.Ourresultswerelike study conducted by **Mishra T et al** 22**, Choraria S et al** 18**.**
Similarly**, Mishra T et al.** 22 compared anterior and posterior approach of percutaneous catheterization of internal jugular vein under real time ultrasound guidance in critically ill patients and they reported a catheterization time of **92+/- 0.07 seconds** in the posterior group **120 seconds +/- 0.17 seconds** in the anterior group **p < 0.001**, which is a statistically significant**.**
Swati B et al. 24compared anterior and posterior approaches for internal jugular vein cannulation, they observed catheterization time in posterior group was 2 min 41 seconds and in anterior group 3 min 50 seconds with p value is <0.05 which is statistically significant.
A possible explanation for the shorter catheterization time in the ultrasound-guided posterior approach is the **larger cross-sectional area of the vein** in this approach, especially withthepatientinthe**Trendelenburgposition**.Alarger veincross-sectionallowsforquicker vein identification, easier catheter threading, and, consequently, reduced cannulation time.

TOTALACCESSTIME

In our study, the average total access time—defined as the duration from placing the linear probe on the skin to the successful aspiration of blood from both ports, excluding suturingandfixationtimewas**184.72+/-11.04**secondsintheposteriorgroupand**218.12+/-14.57**secondsintheanteriorgroup.Thisdifferencewasstatisticallysignificantp<0.0001.
Multiple studies have reported a shorter total access time with the posterior approach comparedtotheanteriorapproach.**MishraTetal.**22foundthatthetotalaccesstimewas206 seconds in the anterior group and 130.81 seconds in the posterior group p < 0.001.
Similarly**, Manjula B.P. et al**. 17 reported a mean total access time of 3.05 ± 1.06 minutesintheanteriorgroupversus1.38±0.18minutesintheposteriorgroupp<0.001.**Riaz A et al**. 15 observed a significantly shorter total access time in the ultrasound-guided group (34.95±11.47 seconds) compared tothelandmark-based approach(146.59±40.20 seconds).
Kedareshvara K.S. et al20 documented a mean total access time of 4.64 minutes in thecentral group and 3.42 minutesin theposteriorgroupp <0.001. Additionally, **Babu Met al**.14 reported a shorter access time in the posterior approach (2.43 minutes) compared to the anterior approach (3.64 minutes).
Manjula B P et al 17concluded that the posterior approach facilitates easier cannulation than the anterior approach, requiring fewer attempts and less time.

A possible explanation for this efficiency is the larger cross-sectional area of the vein intheposteriorapproachwhenthepatientisintheTrendelenburgposition.Thisincreasedvein diameter allows for easier identification, smoother needle insertion, and quicker catheter threading, ultimately reducing the time required for cannulation.

DURINGANDPOSTPROCEDURALCOMPLICATIONS

Inourstudy,singleincidenceofcarotidarterypunctureh adoccurredingroupA(1out of 25 patients) and nil in the posterior approach under real-time ultrasound (USG) guidance.
MishraTetal.22reportedahigherincidenceofcarotidarterypunctureintheanterior approach and none in the posterior approach under USG guidance. Similarly, **Swathi B et al.** 24 found that in the anterior approach, the carotid artery was encountered in 50%

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of patients, with complications including hematoma formation (40%), pneumothorax (10%), catheter kinking(43.3%),andcatheterdisplacement(10%).Incontrast,theposteriorapproachshowed significantly lower rates: carotid artery encountered in 13.33% of patients, hematoma formation (10%), pneumothorax (3.3%), catheter kinking (3.3%), and catheter displacement (3%). These differences were statistically significant. In our study no other complications noted.

Choraria S et al. 18 noted a hematoma incidence of 20% in the landmark technique group and 8% in the USG-guided group (p-value = 0.016). Arterial puncture (10%) and pneumothorax (2.5%) were observed in the landmark group, whereas no complications were noted in the USG-guided group. Similarly, **Chudhari L S et al**. 4 reported six cases of hematoma in the anterior approach compared to three cases in the posterior approach.

Riaz A et al. 15 found carotid artery puncture in 9% and hematoma formation in 7% of patients using the landmark technique, while the USG-guided group had a significantly lower incidence (1% carotid puncture, no hematoma). **Kedareshvara K.S. et al** 20 . reported arterialpuncture in21.7%of central approach casesand5% inposterior approach cases, with hematomaformationin5%and2%ofcases, respectively(p<0.005,statisticallysignificant).

Manjula B.P. et al. 17 observed a higher complication rate in the anterior approach, with 22% carotid artery puncture, 20% hematoma formation, and 16% catheter kinking. In contrast, the posterior approach had significantly lower rates: 6% carotid puncture, 4% hematoma formation, and 4% catheter kinking. **Chandralekha M et al.** 9 found a lower incidence of carotid puncture in the posterior approach (7 out of 80 patients) compared to the central approach (18 out of 80 patients). **Chowdhary et al.** 18reported an overall carotid puncture incidence of 5% in the anterior approach versus 2% in the posterior approach.

Anand R et al.19 noted carotid artery puncture in two patients in the anterior group, while no complications were observed in the posterior group. Similar findings were reported by**Babuetal.,**14**ManjulaBPetal.**17**andChandrasekharanetal.**13 whoattributedthe lower complication rate to anatomical variations in the IJV's relation to the carotid artery.

Inourstudy,IJVcannulationwasperformedunderreal-timeUSGguidance,whichhas been shown to reduce carotid artery puncture and hematoma formation. In case of carotid puncture,theneedlewaswithdrawnimmediatelyandfirmcompressionwasapplied.Thevein was successfully cannulated again on the same side after two hours, with no hematoma formation. No cases of pneumothorax or haemothorax were observed, likely due to the increased accuracy of USG-guided punctures.

ChandralekhaMVetal.9alsoreported alower incidenceofarterialpunctureinthe posteriorapproach(7/80)comparedtothecentralapproach(18/80).**ChudhariLSet**al.4found a higher incidence of carotid puncture in the anterior approach (5%) than in the posterior approach (2%).

USG-guided techniques have been shown to be superior to landmark techniques for centralvenouscatheter(CVC)insertion,significantlyreducingcomplicationrates. Theefficacy of Ultrasonography in reducing the incidence of various immediate and delayed complication even in the inexperienced operator was very less.

LimitationoftheStudy

-Itdoesnotconsiderthepaediatric agegroup.
-In our study during ultrasonography long-axis approach was not used at any point while making needle punctures and guidewire advancement.
-Patients admitted in ICU included in the study were not categorized further according to their primary diagnosis and comorbidities such as patients in severeshockonvasopressorsupportorpatientswithcardiacfailureorpatients with bleeding diathesis which could affect the success rates of catheterization, ease of identifying the vein, catheterization time, and incidence of complications.
-Inourstudy,wedidnotincludeoperative cases.

V. CONCLUSION

Ultrasonography provides the benefit of real time visualization of the anatomical structures at the time of procedure and significantly reduces the total procedural time.

We also found that Ultrasound guided cannulation of the internal jugular vein significantly improves the success rate, access time and reduces the complication rate compared to the landmark technique. In landmark technique its likely to have higher rate of various complications.

Theuseofultrasoundshouldbeseenasanextensionofthe traditionalskillsratherthan a completely new technique even though it requires hands-on training. In addition, the Ultrasound guided technique is a potentially useful technique in complicated cases where landmarks are not defined, or landmark technique is unsuccessful.

RealtimeultrasonographyguidedRightinternaljugular venouscatheterizationthrough posterior approach is better than the anterior approach for, as it permits easy cannulation, reduces the access time and duration of cannulation thus it's improved the success rate.

The incidence of complications like carotid puncture, haematoma formation, pneumothoraxandthrombophlebitisarealsosignificant lylowerwiththeposteriorgroupwith the use of ultrasonography.

Thus to sum up, though the Anterior approach is being practiced more widely and frequently for percutaneous internal jugular vein catheterization under real-time ultra- sonographicguidancein critically ill patients admitted in ICUsbut theposteriorapproach has beennotedtobebetterintermsofaccuracy,accesstime,d urationofcatheterizationandlower complication rate in this study and could be a safer alternative in terms of ease and speed of catheterization in patients who are already having increased morbidity

"Ultrasonography guided Right internal jugular venous catheterization via posterior approach was better as compared to Ultrasonography guidedanterior approach. Thus,morestudiesshouldbeperformed.

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