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COMPARISON OF ULTRASOUND GUIDED OUT OF PLANE SHORT AXIS METHOD / IN PLANE LONG AXIS METHOD FOR RIGHT INTERNAL JUGULAR VENOUS CANNULATION IN TERTIARY CARE HOSPITAL.

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ABSTRACT **Background** Ultrasound (US) guidance for Internal Jugular Venous (IJV) placement is considered gold standard in localization and cannulation, making the procedure safer with less complications. **Aims & Objectives** To compare the short-axis/out-of-plane (SAX) with the long-axis/in-plane (LAX) technique for US-guided CVC insertion in internal jugular vein in intensive care practice in terms of safety and efficacy. **Methods** In this Retrospective observational study we have enrolled total 232 patients admitted in our tertiary care hospital during June 2016 to June 2020 at NHLMMC, VS & SVP hospital, Ahmedabad, India after taking written informed consent and explaining the procedure to patient & their relatives. Randomisation was done at time of procedure by odd & even numbers put in opaque sealed envelope. There were two groups: Group S which included 116 patients in whom the out of plane short axis SAX technique was performed and Group L which also included 116 patients in whom the in plane LAX technique was performed for US-guided IJV insertion in Right internal jugular vein. The primary outcome was first-attempt success rate of both the approaches for US-guided vascular catheterization. The secondary outcomes were total success rate, which was defined as successful venous cannulation without complication; cannulation time calculated in seconds; the number of attempts and complications (hematoma and arterial puncture). **Results** US-guided venous cannulation was successful without complications in 99% patients in group S & 95% in group L. Venous access time, cannulation time, and US imaging time were significantly lower in the group S than in the group L ($P<0.05$). Complications in both groups had no statistically significant difference. Hematoma formation was evident in one patient in group L. Multiple puncture was more in LAX group with no significant difference. **Conclusion:** Out of plane SAX approach is better than in plane LAX approach for ultrasound guided IJV cannulation.

KEYWORDS : Central Venous catheter (CVC), internal jugular vein, long-axis (LAX)/in-plane, short-axis (SAX)/out-of-plane, ultrasound guidance

INTRODUCTION

Since last 2 decades, numerous studies proved that using real-time ultrasound (US) guidance for central venous catheter (CVC) placement increases the success rates and decreases mechanical complications of the procedure, as well as it represents one of the most important advances in patient safety for critical care[1,2]. Recently, the use of dynamic real-time, two-dimensional US guidance for CVC insertion is highly recommended as a standard technique regardless of the provider's prior experience level as it is beneficial for all operators [3].These two main approaches were according to the position of the US probe with respect to the vessel main axis. Each approach has distinct pros & cons that may either increase or decrease complications [4]. In the SAX approach, the relationships of the target vessel to the adjacent vessels are visualized, but the needle tip may not be continuously visualized during catheter placement. In the LAX approach, the needle path including the tip can be continuously visualized during cannulation, however, the relationship of the target vessel to adjacent vessels may be lost [5,6]. The American Society of Anesthesiologists guidelines recommended using real-time US guidance for the internal jugular vein (IJV) catheterization without any recommendation about which US visualization plane should be used [7].

Despite the great progress in the utilization of US guided CVC insertion, physicians have not yet achieved perfection when placing these catheters, and the controversy about specific techniques still remains[8]. Therefore, studies attempting to optimize the use of US guidance for CVC placement remain necessary because these catheters are extremely needed for patients' critical care.

The aim of this study was to compare the SAX with the LAX technique for US-guided CVC insertion in IJV, for intensive care practice in terms of its safety and efficacy.

MATERIALAND METHODS

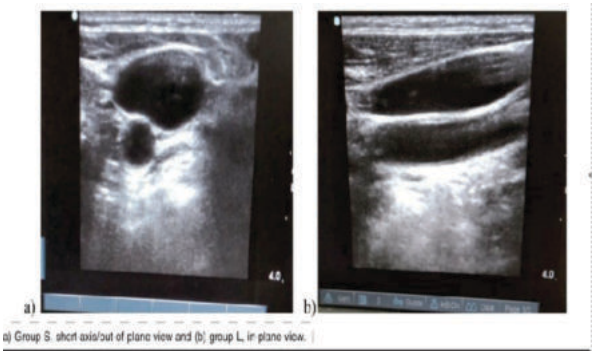
This Retrospective observational study was carried on 232 adult patients in the age group of 18-60 years of either sexes, with a BMI not greater than 35 kg/m2

Exclusion criteria

- Patient refusal ,
- Age less than 18 years
- Presence of coagulation disorders
- Ultrasound evidence of venous occlusions.

Procedure

Under complete aseptic conditions and total coverage of US probe, we used a six-step systematic approach for US-guided central venous access in both groups, out plane and in plane (Fig. 1). Using the Certofix R CVC B BRAUN set and Sono-Site M-Turbo Ultrasound Machine, our approach includes assessing the target vein (anatomy and vessel localization, vessel patency),using real-time US guidance for puncture of the vein,and confirming the correct needle, wire, and catheter position in the vein. Real-time US guidance describes a technique of needle advancement and vessel puncture under permanent US control (i.e. the needle is permanently visualized on the US screen) [9].All of the mentioned approaches were performed



a) Group S, short axis/out of plane view and (b) group L, in plane view.

Figure 1
(a) Group S, short-axis/out-of-plane view and (b) group L, in-plane view

Primary outcome was first-attempt success rate of both the SAX and LAX approaches for US-guided vascular catheterization.

Secondary outcomes were total success rate, which was defined as successful venous cannulation without complication; cannulation time calculated in seconds; the number of attempts and complications such as hematoma, pneumothorax, and arterial puncture.

Statistical Analysis

Continuous variables were expressed as the mean ± SD, and the categorical variables were expressed as a number (percentage). Continuous variables were checked for normality by using Shapiro–Wilk test. Independent Student t test was used to compare two groups of normally distributed data. Percentages of categorical variables were compared using the $\chi 2$ test. All tests were two sided. P value less than 0.05 was considered statistically significant. All data were q analyzed using the Statistical Package for Social Science for Windows, version 22.0 (SPSS In c.Chicago, Illinois, USA).

RESULTS

Table 1 Demographic parameters

Demographic data	SGroup(n=116)	L group(n=116)	P value	Inference
Age(yrs)	42.5+/-16.2	44.2+/-15.8	1.00	NS
Gender (M:F)	60/56	65/51	0.5	NS
BMI	31+/-4	30+/-3	0.03	S

Table 1 shows that the two groups were comparable regarding the patient characteristics in the term of demographic data of patients.

Table 2 Clinical variables

Clinical Variables	Group S (n=116)	Group L (n=116)	P value	Inferences
Total success rate	114(99%)	110(95%)	>0.05	NS
First attempt success rate	108(93%)	100(86%)	>0.05	NS
Venous access time (sec)	16.2+/-5	24.2+/-6	<0.001	HS
Cannulation time (mins)	8.4+/-1.1	9.2+/-1.6	<0.001	HS
Attempts(1/2/3/4)	(108/7/1/0)	(100/8/6/2)	>0.05	NS
US imaging time(mins)	9.1+/-1	12.2+/-2.8	<0.05	S

In Table 2, there was a statistically significant difference between group S regarding venous access time, catheterization time, and US imaging time, which were faster than group L. There was no significant difference in total success rate & attempts in both groups.

Table 3 Complications

Complications	Group S (n=116)	Group L (n=116)	P value	Inferences
Local Hematoma	0	1(0.86%)	0.3	NS
Arterial puncture	1(0.86%)	4(3.4%)	0.1	NS
Multiple punctures	8(6.9%)	16(13.7%)	0.08	S
Pneumothorax	0	0	1	NS
Hemothorax	0	0	1	

Table 3 shows no significant difference in both groups regarding arterial puncture and hematoma formation

DISCUSSION

Internal Jugular Venous cannulation is associated with a number of technical complications. The common ones are arterial puncture (10.6–13%) and hematoma formation (4–8.4%) [12]. In our study, the results regarding total success rate, venous access time, cannulation time, and US imaging time in both groups are in agreement with previously conducted trials [11,13–15] The complications experienced in our study groups were arterial puncture occurred in four (3.45%) patients in group L and one (0.86%) patient in group S and hematoma occurred in a single (2.5%) patient in group L only.

Vascular puncture by its longitudinal US view has the advantage to visualize the entire needle through its trajectory up to the vein. It is the so-called in-plane US-guided puncture. However, this US view did not show surrounding structures of the target vessels. Therefore, if the prompt visualization of the needle on the US plan is not achieved, it is possible to perforate or injury unintentionally the structures closed to the target. Pneumothorax was not seen in any patient, which is in agreement with a pervious meta-analysis study for the US usage in IJV cannulation [17].

CONCLUSION

In nutshell we concluded that in view of less US imaging time and increased first-attempt cannulation, less complications were noted in SAX approach compared with LAX approach. So out of plane SAX was more advantageous than in plane LAX approach for real time ultrasound guided CVC for IJV cannulation.

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