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# TO COMPARE CENTRAL VENOUS CATHETER AND PERIPHERAL INTRAVENOUS CATHETER IN PATIENTS OF LAPAROTOMY: AN OBSERVATIONAL COMPARATIVE STUDY

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**Abstract**

**Background:** The laparotomy is one of the major surgery require ample amount of intravenous fluids administration, blood transfusion ,and sometime parental nutrition, repeated blood sampling to monitor patients condition. These all things fulfilled by either use of peripheral intravenous catheter or central venous catheter. Both of these intravenous catheters are compared on basis of their life span, hospital stay of the patient, and their complications to evaluate the efficacy of both in patients undergoing laparotomy.

**Methods:** An observational comparative study was conducted among 50 patients of laparotomy in the department of general surgery, sir t hospital Bhavnagar. All patients were randomly assigned to two groups A and B. Patients of group A were subjected to central venous catheter and patients of group b were subjected to peripheral intravenous catheter.

**Results:** The mean of hospital stay of patients in group a was 20.4 (± 4.9) and group b was 15.4 (± 6.12) . The mean life span of catheter was 18.8 ± 4.25 days in group A and 6.04 ± 1.947 days in group B. Rate of major complication in group A was 12% as compare to group B having 40% complication rate. Rate of intermediate complication in group A was 20% as compare to group B having 72% complication rate. . Rate of minor complication in group A was 8% as compare to group B having 56% complication rate. Rate of overall complication in group A was 28% as compare to group B having 72% complication rate.

**Conclusion:** Life span of central venous catheter is greater as compare to the peripheral intravenous catheter and rate of complications is more in patients with peripheral intravenous catheter.

**Keywords:** Central Venous Catheter, Peripheral Intravenous Catheter, Laparotomy

## Introduction

Laparotomy is a surgical procedure involving a incision through the abdominal wall to gain access to the abdominal cavity. As it is a major surgical procedure patient undergoing laparotomy must be pre-optimized in terms of i.v fluid, blood products, parenteral nutrition etc. before operation, during operation, and post operative period. To provide i.v. Fluids and other drugs and nutrients safe and dependable intravenous access is necessary which may be in peripheral veins or in large central veins. There are two type of intravenous catheter peripheral i.v catheter and central venous catheter. Type of access is selected based on duration of intravenous therapy, type of medication or solution and patients specific consideration. Both of them having advantages and complications. Millions of central vein catheterization is done annually by various clinicians for Monitoring as well as therapeutic purposes. Central lines insertion was first described By Aubaniac[1] in 1952 when he inserted a needle in subclavian vein under the clavicle. Various other routes of central venous access were described subsequently in the next Decade including the infraclavicular axillary vein approach, jugular venous route and Supraclavicular approach to subclavian vein. Soon after the description of subclavian insertion by Aubaniac, in the following year Seldinger [2] modified the technique of Catheter insertion by passing a guide wire through the needle and threading the Catheter over the guide wire. This technique became popular worldwide and now goes by the name Seldinger Technique. There are several types of central venous catheters like single lumen, double lumen, triple lumen central venous catheter [3]

Single lumen catheter consist of a tube or lumen ending in hub that can be connected to tubing for continuous infusion of fluid or medication or capped and use for the intermittent infusion. Hemodialysis catheters are large diameter double lumen catheters (up to 16 French or 5.3mm) capable of flow rates of 200–300 ml/min, which is necessary to maintain the high flow rates of hemodialysis. The most commonly used catheter for central venous access is the triple lumen catheter .They are preferred (particularly in the ICU) for their three infusion channels

that allow for multiple therapies to be administered simultaneously. A peripherally inserted central catheter, or PICC line (pronounced "pick"), is a central venous catheter inserted into a vein in the arm (via the basilic or cephalic veins) rather than a vein in the neck or chest. The basilic vein is usually a better target for cannulation than the cephalic vein because it is larger and runs a straighter course through the arm.[4] Complications of central venous catheterization include arterial puncture, hematoma, haemothorax , pneumothorax, arterial-venous fistula, air embolism, nerve injury, infections and thrombosis. The insertion of a plastic catheter and withdrawal of the needle was introduced as a technique in 1945. Newer catheters have been equipped with additional safety features to avoid needle stick injuries. Modern catheters consist of synthetic polymers such as Teflon. The peripheral intravenous catheter is short and placed via venipuncture into peripheral vein. Peripheral intravenous catheter mostly indicated for short term administration of intravenous fluids and drugs blood/blood products, dye/contrast agent. Common site for peripheral intravenous catheter insertion are generally describe as lower arm , the dorsum of the hand, superficial veins of lower limb. Blood sampling can be carried out at the time of insertion of a peripheral venous catheter. Peripheral intravenous catheter having complications like Infection, phlebitis, extravasation, infiltration, air embolism, hemorrhage (bleeding) and formation of a hematoma (bruise) may occur. This is prospective comparative study to compare role of central venous catheter and peripheral intravenous catheter in patient of laparotomy in terms of life span, hospital stay of the patient, complications associated with both.

**Material and Methods:**

A prospective, comparative randomized study was conducted on patients of laparotomy in the Department of general surgery Sir T hospital and government medical college Bhavnagar from October 2019 to October 2020. After Institutional ethics committee approval and written informed consent, fifty patients were included in the study. The patients were randomly assigned to two groups, each having equaled number of patients. Randomization was done by using online random number generator which is commonly used for such research purpose. Fifty patients of scheduled laparotomy surgery who required intravenous access in the form of central venous catheterization or peripheral intravenous cannulation, were taken up for the study. The patients were randomly allocated to one of the two groups (25 in each group). Patients of first group had central venous catheter while, Patients in second group had peripheral intravenous catheter. It Was Conducted In Sir T Hospital, Bhavnagar Gujrat-364001 India. All the patients undergone laparotomy was taken as study population.

**Inclusion criteria:-**

• Patients undergoing laparotomy in general surgery department in sir t hospital Bhavnagar, Gujarat who has been put peripheral or central venous catheter.
• Age 18 to 80 years

**Exclusion Criteria**

• Coagulopathy
• Pregnancy
• Skin Infection at insertion site

All Patients were randomly assigned to two groups A and B using online random number generator which is commonly used for such research purpose this study was done in consultation with an independent statistician. Patients of group A were subjected central venous catheter and patients of group B were subjected to peripheral intravenous catheter.

**Evaluation Parameters**

1. Life span of central venous catheter and peripheral intravenous catheter from the data of date of insertion and date of removal.
2. Hospital stay of patients by the data obtained from Date of admission and Date of discharge.
3. Rate of complication assessed in 25 patient with peripheral line and 25 patients with central venous catheter undergone laparotomy was observed from time of insertion of intravenous catheter up to the time of discharge by every alternate day follow up with examination of following Complication like Pneumothorax, haemothorax, Thrombophlebitis extravasation, arrhythmias, hematoma, cellulites, catheter dysfunction catheter related blood steam infection etc.

**Statistical methods**

All data was entered in Microsoft Excel spreadsheet. Numerical data was reported as mean ± SD and range. Categorical variables were reported as number and percentages. Student's t-test was used to compare numerical variables and the chi-square test or Fischer's exact test was used for categorical variables. Data was processed using Statistical Package for Social Sciences (SPSS version 20.0 for Windows, SPSS inc., IBM, and Armonk, NY) statistical software. For all statistical tests, a p value of less than 0.05 was taken to indicate significant difference.

**Results:**

This study was carried out in sir T hospital and government medical college Bhavnagar in 50 patients of laparotomy

divided in 2 group first group A central venous catheter and group B peripheral intravenous catheter.

**Table 1: Age-wise distribution**

| Age group | C.V.C Group A | P.I.V.C Group B |
|---|---|---|
| | N (%) | N (%) |
| 18 –30 years | 11(44) | 3 (12) |
| 31 –40 years | 4(16) | 6(24) |
| 41 –50 years | 3(12) | 4 (16) |
| 51 –60 years | 2(8) | 6(24) |
| More than 60 years | 5(20) | 5(20) |
| Total | 25 (100) | 25 (100) |
| Mean ± SD | 20.00± 14.142 | 19.02±5.215 |
| P value, Sig | | 0.07891, NS |

In present study the mean age of group A was 20.0± 14.14 years and group B was 19.02±5.21 years. The difference in the age between the CVC and PIVC group was not statistically significant. Thus the two groups were comparable with respect to age. Most of the subjects in group A belonged to 18-30 years of age and in group B belonged to 31-40 and 51-60 years of age. About 76% in the A group and 80% of the study subjects in B group were males. This difference in the sex was not statistically significant.

**Table 2: Duration hospital stay**

| Hospital stay of Patients(Days) | C.V.C GROUP A | P.I.V.C GROUP B |
|---|---|---|
| Mean ± SD | 20.4 ± 4.9 Days | 15.4± 6.12 Days |

The mean of hospital stay of patients in A group was20.4 ± 4.9 and B group was 15.4 ± 6.12. This difference in hospital stay was not statistically significant with (p value 0.003).

**Table 3: Life span of catheter.**

| Life span(Days) | C.V.C Group A | P.I.V.C Group B |
|---|---|---|
| Mean ± SD | 18.8 ± 4.25 | 6.04 ± 1.947 |

The mean life span of catheter was18.8 ± 4.25 in A group and 6.04 ± 1.947 in B group. This difference in life span of catheter was statistically significant with (p-value0.0003).

**Table 4: Complication among central venous catheter**

| | Complication | Number Of Patients(N)=25 | Percentage (%) |
|---|---|---|---|
| **Major** | Pneumothorax | 1 | 4 |
| | Haemothorax | 1 | 4 |
| | Air Embolism | 0 | 0 |
| | Arrhythmias | 1 | 4 |
| **Intermediate** | Haematoma | 2 | 8 |
| | Arterial Puncture | 3 | 12 |
| | Catheter Related Blood Stream Infection | 0 | 0 |
| **Minor** | Catheter Dysfunction | 1 | 4 |
| | Malpositioning | 1 | 4 |

**Table 5: Complication among peripheral intravenous Catheter**

| | Complication | Number of Patients (N)=25 | Percentage (%) |
|---|---|---|---|
| **Major** | Thrombophlebitis | 6 | 24 |
| | Cellulites | 4 | 16 |
| | Air Embolism | 0 | 0 |
| **Intermediate** | Haematoma | 7 | 28 |
| | Arterial Puncture | 1 | 4 |
| | Phlebitis | 5 | 20 |
| **Minor** | Catheter Dysfunction | 4 | 16 |
| | Malpositioning | 4 | 16 |
| | Extravasation | 6 | 24 |

**Table 6: Rate of complication**

| COMPLICATION | C.V.C GROUP (A) | P.I.V.C GROUP (B) |
|---|---|---|
| | Number and Percentage of Patients (N) (25) (%) | Number and Percentage of Patients (N) (25) (%) |
| **Major** | 3 (12%) | 10 (40%) |
| **Intermediate** | 5 (20%) | 18 (72%) |
| **Minor** | 2 (8%) | 14 (56%) |

Rate of major complication in group A was 12% as compare to 40% in group B, rate of intermediate complication in group A was 20% as compare to 72% in group B having rate of minor complication in group A was 8% as compare to 56% in group B so, there is statistically significant difference in rate of major, intermediate and minor complication between both group.

**Discussion:**

The laparotomy is major surgery require pre operative , intra operative and post operative resuscitation of patients in form of intravenous fluids, total parental nutrition and blood transfusion to provide such amounts of intravenous fluids and blood sampling for reports intravenous access in form of either central venous catheters or peripheral intravenous catheters.There are advantages and disadvantages of both of this intravenous access. Several studies have been conducted to study the advantages and disadvantages of both of this intravenous access and efficacy of one over another. The indirect comparison of central venous catheters with peripheral intravenous catheters appears to be the best way to assess their efficacy and safety. A observational comparative was conducted among 50 patients of laparotomy in the Department of General Surgery, sir t hospital, Bhavnagar. From October 2019 to September 2020 for a period of two years. The mean age of A group was 20.0 ± 14.14 years and B group was 19.02 ±5.21 years. The difference in the age between the A and B group was not statistically significant. About 76% in the A group and 80% of the study subjects in B group were males. This difference in the sex was not statistically significant. The mean of hospital stay of patients in A group was20.4 ± 4.9 and B group was 15.4 ± 6.12 . This difference in hospital stay was not statistically

significant. The mean life span of catheter was18.8 ± 4.25 in A group and 6.04 ± 1.94 in B group. This difference in life span of catheter was statistically significant. That rate of major complication In Group A was 12% as Compare to Group B having 40% complication rate, so there is Statistically significant difference in rate of major complication between both group. Rate of intermediate complication in group A was 20% as compare to group B having 72% complication rate so, there is statistically significant difference in rate of intermediate complication between both group. Rate of minor complication in Group A was 8% As Compare to Group B having 56% complication rate so, there is Statistically significant difference in rate of minor Complication Between Both Group. Rate Of overall Complication in Group A was 28% as compare to Group B having 72% Complication rate so, there is Statistically significant difference in rate of overall complication between both group. Hospital stay of patients depends on many others factors like post operative wound infection, prolonged post operative ventilator support, post operative complication etc. The relation between number of days of hospitalization and type of venous access not much significant as it was influenced by other factor. According to our study life span of central venous catheter is far greater than peripheral intravenous catheter. long life span of central venous catheter provide advantages to patients as there is no need of repeated insertion of intravenous catheter and no need of repeated skin punctures for blood investigations that is main disadvantage of peripheral intravenous catheter. In the study of dae sik hong the median central venous catheter life span was 45 days (95% confidence interval [ci],32.3-57.6).[ 5 ] In study of Birhane, E., Kidanu, K., Kassa, M. *et al.*Life span of peripheral intravenous catheter and the duration of patency of peripheral intravenous catheter (n = 178) ranges from 1 to 96 h for a median and IQR of (30 ± 28). This study revealed that the proportion of short life span of peripheral intravenous catheter was 52.8% (94) and of this proportion, 37.6% (67) catheters were removed within 24 hr. [6] Complications of central venous catheter and peripheral intravenous catheter are totally different so direct comparison is not possible so, in our study we had first divided their particular complications in three group like major , intermediate , and minor complication in which each category contains different type of complication pertinent to type of intravenous catheter used. In study of M. Jha, and Sunil Kumar. V,(n= 542) for Complications of central venous catheter cannulation in tertiary care hospital ICU Incidence of arterial punctures (16.6%), hematoma (4.4%) and pneumothorax (2.2%) ,Sepsis (13.3%) and thrombosis (8.8%)[7] . as compare to this in our study (n=25) incidence of arterial punctures were(12%), hematoma (8%), pneumothorax (4%).there is no sepsis or thrombosis occur. In study of Mostafa A.Abolfotouh and Mahmoud Salam for P.I.V.C related complication Phlebitis ranked first among complications, with a CI of 148 (17.6%), where (n=379). As compare to this in our study rate of phlebitis is 5(20%) (n=25)**[**8] In study of Pranjal Rai for thrombophlebitis in patients undergoing peripheral i.v catheterization 830 participants who were clinically observed for 2 months thrombophlebitis. Among these, 53 participants developed thrombophlebitis which gives an incidence of 6.4%.[9] In study Dragana Simin for incidence, severity and risk factors of peripheral intravenous catheter-induced complications Phlebitis ranked first among complications with occurrence of 44%, followed by extravasation of 16.3%, while the incidence of occlusion and catheter dislodgement was 7.6% and 5.6%, respectively compare to this in our study (n=25) rate of phlebitis is 5(20%) ,rate of extravasation 6(24%) and catheter occlusion dysfunction 4(16%).[10]

**Conclusion :** Our present study had concluded that there was significant difference between use of central venous catheter and peripheral intravenous catheter when life span of catheter and catheter related complications were compared the central venous catheter had more life span and less complications. While peripheral intra-venous catheter had less life span and more complications. The study had shown that there was no significant difference between central venous catheter and peripheral intravenous catheter with respect to duration of hospital stay. Main drawback of central venous catheter is its cost and requirement of expert person for insertion. However cost can be overcome by its prolong duration of use and less complication rate, however Peripheral intravenous catheter may be preferable option in developing countries like India due to its low cost and even easily accessed by trained nursing staff. Overall present study favours that C.V.C is more advisable in management of laparotomy patient than P.I.V.C.

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