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To Study the Methods Followed For Central Venous Catheterisation and To Develop a Protocol for Central Venous Catheterisation as Per International Standard

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I. Introduction And Background

The present study has been taken as a means of evaluation through checklist the current methods/procedure for central venous catheterisation in routine and emergency situation as per the needs for patients, e.g. for administration of IV fluids, medication as well as monitoring of Central Venous Pressure, etc.

Central venous catheterization is an important bedside procedure routinely performed by the resident in routine and emergency situation. It however requires a lot of practice and extreme care, otherwise it could lead to minor and major complication, prolonging hospital stay further adding to complication in already critical patients.

Though central venous catheterization is mostly performed by resident, most of resident do not have prior training experience, moreover they may have limited or no opportunity to practice on dummies of mannequins prior to residency and may have to directly perform the procedure (though under supervision) compromising patient's safety. There are few opportunities for demonstrating the procedure in emergency situation and the demonstration may not be standardized.

Central Venous Catheterization is commonly performed in hospitalized patients. It is a life saving procedure if done properly, but could be life threatening if things go wrong. Central Venous Catheterization is essential in following circumstances.

- Administration of IV fluids, medications, or blood products, either in large quantities or over a prolonged period of time.
- Administration of IV fluids, medications, or blood products in cases of shock.
- Administration of medications that are harmful to peripheral veins (eg, chemotherapy);
- Long-term access to the central venous system for repeated procedures, such as blood sampling.
- Poor or inaccessible peripheral venous access.
- Monitoring of Central Venous Pressure in patient with hypovolemia and shock.
- Total parental nutrition.
- Aspiration of emboli.
- Insertion of transcutaneous leads etc.

The procedure is also related with both major and minor complications; like injury to carotid artery, subclavian artery aneurysm, haemothorax, pneumothorax, wire or catheter embolism, fluid extravasations in neck, blood stream infection etc. Complications result in increased hospital stay, increased cost, increase in morbidity and in extreme cases mortality.

To minimize complication a standard operating protocol should be there for safe Central Venous Catheterization. The aim of this study is to observe the method followed for central venous catheterization using a standardized checklist, analyze the complications and to accumulate all current guidelines on central venous catheterization and to consolidate into one concise document, useful for day to day practice, minimizing the complication.

II. Aim And Objectives

Aim

To study the current method of central venous catheterization based on a standardized checklist, to analyze the complications and to prepare the guidelines for central venous line catheterization.

Objectives

1) To study the cases requiring central venous catheterization in Bharati Hospital, its indication, methods, complication etc. using a standardized checklist.
2) To mark using checklist the procedure for central venous line catheterization.
3) To analyze the current method for central venous catheterization for the procedure related complication and factors responsible for it.
4) To evolve and suggest a protocol for safe central venous catheterization and measures to minimize complications.

III. Materials And Methods

1) This is a prospective observational study in Bharati Hospital.
2) Study has been conducted from August 2009 to August 2011
3) Total number of cases -100
4) Inclusion criteria:- All the patients admitted in department of surgery, medicine, paediatrics and ICU of Bahrain Hospital requiring venous access for one or more of these indications

a) Administration of IV fluids, Medication of blood products either in large quantity or over a prolong period of time.
b) Administration of Iv fluids, medication or blood products in cses of shock.
c) Administration of medication which are harmful to peripheral line (eg. Chemotherapy)
d) Long term access to the central venous system of repeated procedures such as blood sampling.
e) Post operative monitoring in major cases, monitoring of CVP.
f) Poor or in accessible peripheral venous access.

5) Exclusion Criteria :-

a) Blood coagulopathy/bleeding disorders/deranged PT/INR/APTT.
b) Patient who have undergone Cardio-pulmonary resuscitication.

6) The data has been collected and entered in standard protocol and then analysed.

IV. Observations And Results

1. Gender wise distribution of patients.

Gender	Number of patients	Percentage (%)
Male	63	63.00
Female	37	37.00
Total	100	100.00

2. Age (years) wise distribution of patients.

Age group	Number of patients	Percentage (%)
1-20	16	16.00
21-40	39	39.00
41-60	29	29.00
61-80	13	13.00
> 80	3	3.00
Total	100	100.00

Patients of all groups were included in the study, the majority of patients were from age group of 21-60 yrs (68%), 16% belonged to the age group of 1-20 yrs, 39% were in the 21-40 yrs category, 29% in 41-60 yrs, 13% in 61-80 yrs and 3% belonged to the >80 yrs age.

3. Distribution of patients with respect to procedure.

Procedure detail	Number of patients	Percentage (%)
IJV central line insertion	60	60.00
Subclavian vein insertion	31	31.00
Femoral line insertion	9	9.00
Total	100	100.00

4. Distribution of patients with respect to side of vein.

Side of vein	Number of patients	Percentage (%)
Right	97	97.00
Left	3	3.00
Total	100	100.00

Majority of patients (97%) underwent right sided catheterization and only (3%) underwent left sided catheterization.

5. Distribution of patients with respect to emergency or elective.

	Number of patients	Percentage (%)
Emergency	75	75.00
Elective	25	25.00
Total	100	100.00

6. Distribution of patients with respect to emergency, elective and type of procedure.

Side	Line			Total
	IJV central line insertion	Subclavian vein insertion	Femoral line insertion	
Elective	9	13	3	25
Emergency	51	18	6	75

Of all 60 cases of internal jugular vein insertion, 9 were elective and 51 were emergency. Of all 31 cases of subciavian vein insertion, 13 were elective and 18 were emergency and of all 9 cases of femoral vein insertion, 6 were emergency and 3 were elective.

7. Distribution of patients with respect to.

a) Use of barrier precaution and preparation of the skin

Use of barrier precaution and preparation of the skin	Number of patients	Percentage (%)
Adequate	34	34.00
Satisfactory	9	9.00
Poor	57	57.00
Total	100	100.00

b . Number of attempts for vein puncture.

Number of attempts vein puncture	Number of patients	Percentage (%)
1	52	52.00
2	22	22.00
3	21	21.00
4	5	5.00
Total	100	100.00

8. Distribution of cases with respect to complications.

Complications	Number of patients	Percentage (%)
Carotid artery injury	23	23.00
Chatheter line infection	27	27.00
Pneumothorax	13	13.00
Hemothorax	1	1.00
Catheter misplacement	2	2.00

9. Distribution of cases with respect to complication and procedure.

Complications	IJV central line insertion	Subclavian vein insertion	Femoral line insertion
Carotid artery injury (n=23)	18 (29.5%)|	5 (16.4%)	0
Catheter line infection (n=27)	14 (23.4%)	9 (29.1%)	4 (44.5%)
Pneumothorax (n=13)	5 (8.3%)	8 (26%)	0
Hemothorax (n=1)	0	1	0
Catheter misplacement (n=2)	1	1	0

Carotid artery injury was noted in 18 (29.5%) cases of IJV and 5 (16.4%) cases of Subclavian vein insertion. In 5cases of subclavian vein insertion carotid artery injury was noted due ot failure of attempts of insertion on internal jugular vein. Catheter line infection was observed in 14 (23.4%) cases of IJV, 9 (29.1%) cases of subclavian and 4 (44.5%) cases of femoral vein catheterization. Pneumothorax in 5 (8.3%) cases of IJV, 8 (26%) cases of Subclavian vein. Catheter misplacement was seen in I case of subclavian vein insertion and 1 case of internal jugular vein insertion. Haemothorax was seen in 1 case.

10. Distribution of patients with respect to various activities after the procedure and occurrence of complication.

Daily check of dressing and use of anti coagulant occurrence vs. complication.

Daily check of dressing and use of anti coagulant	Complication Present	No Complication	Total
Note done	36 (36%)	0	36
Improperly done	3 (3%)	0	3
Adequately done	8(8%)	53 (53%)	61

There were no complication noted when daily check of dressing and use of anticoagulants in 53 cases (53%), in 8 cases (8%) complications was noted when daily check of dressing was adequately done and use of anticoagulents was adequately given. In 36 cases 36%complication was present. When daily check of dressing was not done and use of anticoagulants was not given. In 3 cases (3%) complications was present, when dressing was improperly doen and anticoagulant was improperly given.

V. Discussion

Central venous catheter is a catheter placed in the superior vena cava or the gight atrium through large vein in the neck (internal/ external jugular vein), chest (subclavian/axillary vein) or groin (femoral vein).[34]

Common indications of central venous catheterization are measurement of central venous pressure. Venous access when peripheral vein are not accessible, administration of vasoactive/inotropic drugs which cannot be given peripherally, administration of fluid or total parenteral nutrition, haemodialysis/plasmapheresis.[20]

In USA, UK and other developed countries central venous catheterization is done mostly as elective cases, it is done in both male and female patients and in all age group of patients.[20]

Peripherally inserted central venous catheters are preferentially placed on the right side due to the anatomic ease of insertion into the superior vena cava.[50] Sperry BW et al[91] conducted a study on the effect of laterality on venous thromboembolism formation after peripherally inserted central catheter placement.[56],[58] They found our no difference in complication rates based on laterality.

Complications of central venous cannulation have been recognized since this technique was introduced into clinical practice nearly 40 years ago.[86] Although serious complications are infrequent are infrequent when these procedures are performed by well-trained, experienced clinicians, significant morbidity and even fatal complications have been reported. Complications amy be divided into those occurring during attempted venipuncture to gain central venous access,[94] those occurring during placement of the venous catheter, those late complications associated with catheter infection when the catheter is in the body, and those associated with misuse of equipment and misinterpretation of data.[92] This categorization is, however, somewhat arbitrary. Some complications, like nerve injury, may go unnoticed at the time of venipuncture but be clinically recognized days following the procedure. In contrast, cardiac perforation and tamponade usually occur in the days following successful central venous cannulation but may occur shortly after the initial catheterization procedure.[88]

Clearly, the incidence of complications depends on various factors, including the site and techniques chosen for venipuncture and the patient's medical condition. Large retrospective and observational studies provide the best estimates of the of the most frequent complications.[90]

In our study, the incidence of arterial is high in 23 out 100 cases. Arterial injury is in 18 cases out of 60 cases in internal jugular vein insertion, and in 5 cases out of 31 cases in subclavian vein, the injury to the carotid artery was noted due to failure of attempts on internal jugular vein.

This high incidence may be attributed to the limited experience and lack of prior training of the residents and ICU physicians. Moreover unlike in the developed countries the central venous catheterization is not performed routinely as in our setup, it is performed only in critical patients as indicated above.

Following the guidelines given in this text, experience on dummies and performing the procedure under supervision this incidence will definitely come down to acceptable standards. Moreover this is a small study and definitive conclusion be drawn for from this.

In general, unintended arterial puncture leads this list of adverse events. Shah et al [91] reported more than 6,000 central venous catheterizations over 5-year period, with more than 95% performed via the internal jugular vein. In this series, the most common complication was carotid artery puncture, which occurred in 120 patients (1.9%) but did not result in any serious morbidity. [86] Authors of other large studies report a somewhat higher incidence of arterial puncture during central venous catheterization, ranging from approximately 3% to 9%. [90] In all likelihood, the frequency of arterial puncture with a small- gauge finding needle is even higher. Although usually benign, on rare occasion even small-gauge-needle arterial punctures may lead to serious complications.[92]

If arterial puncture occurs during central venous cannulation, the needle is removed and external pressure is applied to the puncture site for at least 5 minutes or for as necessary to prevent hematoma formation. The most efficacious clinical management of unintentional cannulation of the carotid artery with a large-gauge catheter is less clear. In the large series of Shah and co-workers[89] arterial cannulation with a 7.5-French introducer sheath occurred in four patients. The sheath was removed immediately when its intra-arrterial location was recognized by the high-pressure backflow of blood. External compression was applied for 5 minutes, there was no hematoma requiring further treatment in any patient. Other reports, however, emphasize that unintertional arterial cannulation may result in hematoma formation after catheter removal, with significant risk of airway compromise that may require urgent tracheal intubation and surgical exploration for hematoma evacuation or arterial repair.[88],[89]

In the meta- analysis by Ruesch and coworkers,[89] arterial punctures were significantly more common with the jugular than with the subclavian approach. However, bleeding from a punctured internal carotid artery can usually be controlled by manual compression.[89],[90]

In our study the incidence of pneumothorax is high in 13 cases out of 100 cases. In internal jugular vein insertion incidence of pneumothorax was in 5 cases out of 31 cases. Haemothorax was present in one patient in subclavian vein insertion. Again this high incidence may be due to the limited experience and lack of prior training of the residents and ICU phusicians in central venous catheterization, number of attempts required to insert the catheter and other factors mentioned earlier.

Pneumothoracx is often cited as the most common common complication of subclavian central venous cannulation, although it appears that unintended arterial puncture occurs more often than pneumothorax, even with the subclavian site of venipuncture. Mansfield et al [93] reported 821 patients who underwent attempted sbclavian venous cannulation, with a 1.5 percent incidence of pneumothorax and a 3.7 percent incidence of subclavian arterial puncture. Pneumothorax occurs even less frequently with the internal jugular approach. Shah et al reported an incidence of pneumothorax of 0.5 percent in their series of nearly 6,000 internal jugular catheterizations.[93] Small pneumothorax may be managed by radiographic observation, with or without needle aspiration, assuming the patient remains clinically stable. Tube thoracostomy is the best treatment, however, for large pneumothorax in the patient receiving positive pressure mechanical ventilation or scheduled for major surgery. The physician must always be prepared for the possibility of tension pneumothorax and its adverse hemodynamic sequelae.[90]

In our study in Bharati Hospital eatheter line infection was present in 27 number of patients out of 100 cases. In internal jugular vein insertion it was in 14 case out of 60 cases, in subclavian vein insertion it was in 9 cases out of 31 cases and in femoral vein insertion it was noted in 4 cases out of 9 cases.

This high incidence may be due to the lack of use of barrier precaution (using mask, cap, gloves and gown), not using proper aseptic precaution while inserting the catheter, not doing the daily dressing after catheterization and improper use of dressing regimen. Moreover in our study it was performed in emergency situation in 75% cases, where the critical condition of the patients tale the precedence over other things. So the infection rate may be higher. To minimize this rate we strongly recommend adherence to aseptic precautions, barrier techniques and other simple measures even in emergency situations.

By far, the most common major late complication of central venous catheterization is infection. Blood stream infections occur in approximately 5 percent of patients with standard central venous catheters, leading to an estimated 150,000 cases of catheter-related bacteremia or fungemia annually.[46] Given that the crude mortality of nosocomial bloodstream infections is nearly 35 percent, most simple efforts to reduce this complication appear to be both cost-effective and life saving.[48] As previously noted, the staring point is meticulous attention to aseptic technique. When more long-term central venous cannulation is anticipated, the subclavian site is preferred, because use of the4 jugular or femoral veins carries a higher risk of infection. Multilumen catheters carry a higher risk than single-lumen catheters,[48].[50] although the added clinical functionality of such catheters may mandate their use. When patients require central venous catheterization for more than 3 to 4 days, some clinicians recommend catheter replacement at a new site. Other suggest exchanging the catheter over a guide wire, and still others belivethat catheters should not be changed unless there are signs of infection or other clinical indications. Clearly, the risks of infection must be weighed against the alternative risks of establishing a new site for central venous catheterization.[52].[54]

A study conducted by Parienti JJ et al[87] comparing Femoral and jugular venous catheterization had similar conclusion that the risk of infection was comparable in both the groups except in adults with high BMI who may have high rates of infection and haematoma with the femoral route.

In the United States, UK and other developed countries physicians insert more than 5 million central venous catheters every year.[21] It is a life saving procedure but unfortunately associated with adverse events that are both hazardous to patients and expensive to treat.

More than 15% of patients who receive these catheters have complications. Mechanical complications (pneumothoprax) are reported in 5-19%, infectious complications (central line associated blood stream infection) in 5-26% and thromobotic complications in 2-26%.[25]

In the meta-analysis by Ruesch and coworkers[89] , the rate of haemothorax or pneumothorax was similar with the subclavian and internal jugular approaches. Patients at increased risk for pulmonary complications (severe emphysema, acute respiratory distress syndrome) were not included in the analysis – a fact that may explain this surprising finding. In a recent prospective study by lovino,[92] the internal jugular approach was associated with a significantly lower risk of pneumothorax (0/661 versus 9/374 with the subclavian approach). It should be noted that failure of the first attempt at catheter insertion was associated with a dramatic increase in risk for pneumothorax associated with subclavian CVC insertion; the rate of pneumothorax was 4/450 when the first attempt was successful and 18/190 when it was unsuccessful. The impact of mechanical complications on patient outcomes in the ICU is largely unknown, but pneumothorax uisally requires chest tube drainage and can be life-threatening in mechanically ventilated patients.

In our study catheter misplacement was present in two patients, one each in internal jugular vein insertion and subclavian vein insertion. Theis again may be due ot the lack of prior training of the resident and ICU physician and other factors as mentioned earlier.

Catheter misplacement can have serious consequences. Positioning of the catheter tip in the cardiac silhouette is associated with an increased risk for cardiac tamponade, and positioning in the subclavian vein with a high risk for thrombus formation in cancer patients. Placement of a subclavian catheter tip in the opposite subclavian vein or neck veins may have more severe consequences that placement of a jugular catheter in the right atrium, which can be corrected simply by pulling the catheter back. However, misplacement of internal jugular vein catheters in the axillary vein is frequently reported.[89]

In the meta-analysis conducted by Ruesch and coworkers (six trials; 1299 catheters),[89] misplacement was significantly less common with the jugular approach (5.3% versus 9.3%). However, in two large case series that focused specifically on mechanical complications, subclavian catheter insertion by experienced operators was associated with misplacement rates of only 4.2%[90] and 6%[90] . Afar higher rate (14%) was observed with internal jugular catheter insertion.[90] Finally, in a recent prospective cohort study not included in the meta-analysis by Ruesch and coworkers,[89] the rate of tip misplacement was 12/661 (1.8%) with the internal jugular approach and 7/374 (1.8%) with the subclavian approach.[89] The misplacement rate was higher with the low lateral jugular approach (3/487) than with the high lateral jugular approach (9/174).

The rates of misplacement of catheter tip that have been reported are

Reported in 1.8 – 14% of Internal jugular placements (Ruesch et al 2002, Gladwin et al 1999, Iovino et al 2001)[90]

Other factors responsible for complications-

Other factors noted in the study are about barrier precautions and proper skin preparation prior to the procedure, number4 of attempts/ pricks for securing the central line, use of anticoagulants to prevent blockage of central line, frequency of dressing done at the site of insertion and culture and sensitivity of the catheter tip after its removal.

In our study in Bharati hospital, it was noted that in 34 cases our of 100 cases the barrier precaution and skin preparation wasproper/adequate, in 9 cases out of 100 cases it was satisfactory and in 57 cases out of 100 cases it was poor. It was observed that where they were poor. The infection rate were high i.e in 57 cases our of 100cases and where they were adequate or satisfactory the infection rate was much lower i.e. in 9 cases out of 100 cases.

Infection rates were high in 36 cases out of 100 cases when daily dressing was not done, in 3 cases out of 100 cases when daily dressing was improperly done, whereas it was much less when it was properly done i.e. in 8 case out of 100 cases, while there was no infection in 53 cases our of 100 cases where proper dressing were done.

The importance of proper asepsis during any invasive procedure has been stressed upon from time immemorial. Study conducted in 1994 by Raad II et al[90] further emphasized that Maximal Sterile Barrier precautions during the insertion of catheter reduced the risk of catheter infection by about 6.3 time. This practice they found was cost effective and was consistent with practice of universal precautions during any invasive procedure.[88],[90]

A study conducted by Schwebel C et al[92] published in 2011 concluded that chlorhexidine-impregnated sponges for arterial and central venous catheterization savews money by preventing major catheter-related infection, even in intensive care units. The decrease in incidence of infection is from 1.4% to 0.6% catheter days.

Transparent, semipermeable polyurethane dressings have become a popular means of dressing catheter insertion sites. Thansparent dressings reliably secure the device, permit continuous visual inspection of the

catheter site, permit patients ot bathe and shower without saturating the dressing, and require less frequent changes than do standard gauze and tape dressings; the use of these dressings saves personnel time.

In the largest controlled trial of daily check of dressing and dressing regimens on peripheral catheters, the infectious morbidity associated with the use of transparent dressings on approximately 2,000 peripheral catheters was examine[(96)] . Data from this study suggest that the rate4 of colonization among catheters dressed with transparent dressings (5.7%) is comparable to that of those dressed with gauze (4.6%) and that no clinically substantial differences exist in either the incidences of catheter-site colonization or phlebitis. Furthermore, these data suggest that transparent dressings can be safely left on peripheral venous catheters for the duration of catheter insertion without increasing the risk for thrombophlebitis[(96)].

A meta-analysis has assessed studies that compared the risk for catheter-related blood stream infections for groups using transparent dressings versus groups using gauze dressing[(96)]. The risk for CRBSIs did not differ between the groups. The choice of dressing can be a matter of preference. If blood is oozing from the catheter insertion site, gauze dressing might be preferred.

In a multi-center study, a chlorhexidine-impregnated sponge (Biopatch^{TM}) placed over the site of shrot-term arterial and CVCs reduced the risk for catheter colonization and CRBSI[(98)] . No adverse systemic effects resulted from use of this device.

These can be overcome by taking certain measures. Develop or revise insertion protocol incorporating hand hygiene specifics. Develop or revise insertion checklist incorporating hand hygiene. Reinforce and educate staff on hand hygiene where possible perform the procedure in OR or other clean areas.

In our study the use of anticoagulants for the patency of central line was studied in 100 cases. In 36 cases out of 100 cases; blockage of catheter was noted when anticoagulant was not give, in 3 cases out of 100 blockage of catheter was noted where the anticoagulants was not used in proper doses, in 8 patients our of 100 cases blockage of catheter was noted when proper dose of anticoagulants was given, in 53 cases out of 100 cases there was no blockage when anticoagulants was properly give. The incidence of blockage of central line was more in 47 cases out of 100 cases.

Anticoagulant flush solutions are used widely to prevent catheter thrombosis. Because thrombi and fibrin deposits on catheters might serve as a nidus for microbial colonization of intravascular catheters[(98,99)], the use of anticoagulants might have a role in the prevention of catheter related blood stream infection.

In a meta-analysis evaluating the benefit of heparin prophylaxis (3U/ml in TPN, 5,000 U every 6 or 12 hours flush, or 2,500 U low molecular weight heparin subcutaneously) in patients with short-term CVCs, the risk for catheter-related central venous thrombosis was reduced with the use of prophylactic heparin[(100)] . However, no substantial difference in the rate for Catheter Related Blood Stream Infection (CRBSI) was observed. Because the majority of heparin solutions sontain preservatives with antimicrobial activity, whether any decrease in the rate of CRBSI is a result of the reduced thrombus formation, the preservative, or both is unclear.

The majority of pulmonary artery, umbilical, and central venous catheters are available with a heparin-bonded coating. The majority are heparin-bonded with benzalkonium chloride, which provides the catheters with antimicrobial activity[(98)] and provides an anti-thrombotic effect.[(99)]

Warfarin also has been evaluated as a means for reducing CRBSI by reducing thrombus formation on catheters [(101)] . in patients with long-term CVCs, low-dose warfarin (i.e., I mg/day) reduced the incidence of catheter thrombus. No date warfarin reduces the incidence of CRBSI.

In our study in Bharati Hospital the number of vein puncture attempts taken before successful catheterization were single attempts in 52 cases out of 100 cases. Two attempts in 22 cases out of 100 cases, three attempts in 21 cases out of 100 cases and 4 attempts in 5 cases out of 100 cases. The incidence of complications were more when the number of attempts for securing the central line were more than one and increased proportionality to the number of attempts required for setting the central line.

Study conducted by George W. Bo-Linn et al[(85)] titled Percutaneous central venous catheterization performed by medical house officers: A prospective study-concluded that- The central vein was successfully catheterized in 363 (77%) of 470 cases. The internal jugular and subclavian vein approaches were significantly more successful (86%) than the external jugular vein approach. The success rate improved significantly when catheterization was attempted under elective circumstances and also after the vein was initially located with a small-gauge needle. Our results suggest that efforts should be abandoned after the third unsuccessful pass with a large-gauge needle in the same site. Complications of catheter insertion bleeding (ten patients), hematoma (15 patients), inadvertent arterial punctures (14 patients), iatrogenic pleural effusions (four patients), and pneumothorax (eight patients). However no complications appeared to have a major adverse effect on a patient's clinical course. The inexperienced operator (fewer than 25 prior catheterizations) has a success rate equal to that of the more experienced operator (more than 25 prior catheterizations), but he may be more likely to produce a complication. Medical house officers can success and at low risk to the patient, with guidelines and training.

In our study, in 27 cases out of 100 cases, catheter line tip was sent for culture and sensitivity and catheter line infection was noted in all 27 cases, various organisms e.g. staphylococcus aureus, klebsiella pneumonia, candida albicans etc. were isolated and systemic antibiotics were given according to there sensitivity.

Since 1970, CDC's National Nosocomial Infection Surveillance System (NNIS) has been collecting data on the incidence and etiologies of hospital-acquired infections, including CVC-associated blood stream infections in a group of nearly 300 U.S. hospitals. During 1992-2001, NNIS hospitals reported ICU rates of CVC-associated BSI ranging from 2.9 (in a cardiothoracic ICU) to 11.3 (in a neonatal nursery for infants weighing <1,000g) BSIs per 1,000 CVC days.[102]

Types of organisms that most commonly cause hospital-acquired BSIs change over time. During 1986-1989, coagulase-negative staphylococci, followed by Staphylococcus aureus, were the most frequently reported causes of BSIs, accounting for 27% and 16% of BSIs, respectively.[102] Pooled data from 1992 through 1999 indicate that coagulase-negative staphylococci, followed by enteroccocci, are now the most frequently isolated causes of hospital-acquired BSIs. [102] Coagulase-negative staphylococci account for 37%[102] and S. aureus account for 12.6% of reported hospital-acquired BSIs.[102] Also notable was the susceptibility pattern of S. aureus isolates.

Candida spp. caused 8% of hospital-acquired BSIs reported to NNIS during 1986-1989,[103] and during 1992-1999.[103] Data from the Surveilance and Control of Pathogens of Epidemiologic Importance (SCOPE) Program documented that 10% of C. albicans bloodstream isolates from hospitalized patients were resistant to fluconazole [103] Additionally, 48% of Candida BSIs were caused by nonalbicans species, including C. glabrata and C. krusei, wich are more likely than C. albicans to demonstrate resistance to fluconazole and itraconazole.[103]

Gram-negative bacilli accounted for 19% catheter-associated BSIs during 1986-1989[103] Compared with 14% of catheter-associated BSIs during 1986-1989 (12). An increasing percentage of ICU-related isolates are caused by Enterobacteriaceae that produce of extended-spectrum B-lactamases (ESBLs), particulary Klebsiella pneumonia.[103] Such organisms not only are resistant to extended-spectrum cephalosporins, but also to frequently used, broad spectrum antimicrobial agents.

In our study carried out in Bharati Hospital in 100 cases the various complications noted was carotid artery injury in 23 cases (23%), catheter line infection in 27 cases (27%), pneumothorax in 13 cases (13%), catheter misplacement in 2 cases and haemothrax in 1 case.

This high incidences may be due to attributed to the limited experience and lack of prior training of the residents and ICU physician of lack of use of barrier precautions, proper hand hygiene, preparation of skin, daily check of dressing or use of anticoagulants etc. or due to more number of emergency cases, patient critical condition where it is more valuable than other things in which residents are not able to follow the standardized guidelines as given in the text.

So the complication rates may be higher, to minimize this rates, we stronglty recommend to follow the guidelines as given in this text. This guideline should be mandatory in the ICU, OR and ward in our hospital, so that everyone follow the guideline stringently and there will by minimum or no complication.

VI. Conclusion

Central venous catheterization has become a standard procedure since introduced to medical practice in the 1950s. eight percent of hospitalized patients receive a central venous catheter and more than five million central venous catheters are inserted in the United States (US) each year. There are some inherent complications are pneumiothorax, hemothorax, catheter related blood stream infection, carotid artery injury, catheter misplacement and bleeding. Since the time of introduction of central venous catheterization it was known to be associated with these complications and innumerable researches to reduce these complications have been carried out.

This study is a humble attempts to evolve a protocol on the basis of accumulating all guidelines as given in this text and analyzing the complications on the basis of our study in Bharati Hospital. The complication noted such as catheter line infection can be minimized by following guidelines stringently as mentioned n this text. In our study the incidence of various complications as motioned in earlier section may be high in comparison to references sited in this text due to not following the guidelines as mentioned such as:-

- Limited experience and lack of prior training of residents and ICU physicians on dummies and manniquines.
- Increase in number of emergency case where critical condition of the patients takes precendence over other things, in which residents not able to follow standardized guidelines.
- Improper barrier precautions and skin preparation at the time of catheter insertion and removal because of lack of awareness or the emergency situation.

Having studied and analyzed- 100 cases of central venous line insertion, for its efficacy, ease of insertion, complications etc and based on our observation, and standardized guidelines described in literature we recommend the following for safe insertion of central venous catheterization and to minimize the complications.

1. Using a multidisiciplinary team approach for safe insertion of central line.
2. Standardizing central line insertion kits with pre-approved products thus ensuring appropriate supplies (e.g., 2% chlorhexidine, large drape) that are readily available should be used.
3. Use of check list to ensure all critical steps have been followed.
4. Display of standardized protocol at prominent places in ICU, Casualty, OR etc. (As mentioned in this text earlier from page no.29 to page no.44.)
5. Training of junior doctors and practice on dummies and mannequins.
6. Standardizing site maintenance supplies (e.g, flush, antiseptic, dressing) and daily checking of dressing and use of anticoagulants to maintain patency.
7. Educating and reinforcing hand hygiene for hygiene for all caregivers, including providing periodic feedback on compliance.
8. Educating and reinforcing and hygiene, skin preparation and application of pressure at catheter site at the time of catheter removal.

Central venous catheterization is an essential procedure and undertaken on number of patients and also associated with significant complications which increase the patient's morbidity and mortality as well as the financial burden of health care. Simple precautionary measure and strict look out for complications and their early treatment can help make this life saving procedure a lot safer. Through our study accumulating all guidelines mentioned in the text we request all residents and ICU physician to make it mandatory in our hospital and to follow it stringently and religiously with sincere effort for the benefit of the patient.

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