Volume : 4 | Issue : 6 | June 2015 • ISSN No 2277 - 8179

Research Paper

Evolution of Central Venous Catheterization for its Complications in Intensive Respiratory Care Unit in a Tertiary – Level Centre.

Medical Science

KEYWORDS : CVC- Central venous catheterizations ,IRCU-intensive respiratory care unit , mechanical complications ,infectious complications ,IJV-internal jugular venous,CRBSIs- catheter related blood stream infections , scv –subclavian vein

Dr.Ramakrishna Ghubde — Associate professor in Pulmonary medicine.Smt kashibai Navale medical college & GH Narhe Pune 411041 Maharashtra

Dr.Archana Shekokar — Professor in Anatomy , Smt kashibai Navale medical college & GH Narhe Pune 411041 Maharashtra

ABSTRACT

Cvcs are associated with infections ,thrombotic & mechanical complications Aims & objectives - To study 1] the incidence of infections thrombotic & mechanical complications associated with cvcs 2] factors influencing it

Settings & design -This was a prospective ,observational study carried out in an adult intensive respiratory care unit of SKNMC –GH Narhe Pune India at tertiary level hospital

This study was carried out over a period of 1 yr from February 2014 to January 2015 .This study was approved by research & ethical, ,committee of the institute. Written permission were taken from patients ,or next kin or legal surrogate.

Material & methods- Cv catheterization were landmark-based, were studied for complications .Statistical analysis .Spss software for windows ,versions spss 16.o &Epi info [3.5 -1]software Result -A total 241 patients central venous catheterizations in IRCU were studied

Introduction

Cvcs are increasingly used in hospitals to manage critically ill patients. cvcs are an integral part of patients care in critical care unit.

However complications associated with cvcs occur nearly 15.1% of patients mainly infections [5-26%],mechanical complications [5-20%].thrombotic complications [2-25%]

These results in prolongation of stay in critical care unit /IRCU hospital stay , increasing hospital costs ,increasing hospital complications ,increasing morbidity ,mortality .

The ultrasound guided cvc canulation has reduced the incidence of insertion complications but in India & developing countries still using landmark based

Technique for cannulation which has reported success rate of 75-99% however there has been limited data reported, in India adult Critical care unit .

From India adult cvcs on the rate of complications associated with cvcs insertion & infection complications & others too.

Results

For different indications [IJVC 121 ,SCVC 120] Mechanical complications occurred in 42 patients, bleeding complications 25, catheter related complications 14 , pneumothorax 03.

The IJVC was associated with higher incidence of bleeding complications [p= 0.009]

The twenty five patients had infection complications [9.78%] like exit site infection [n= 7] catheter tip infection n=12 & catheter related blood stream .infection [CRBSI] [H]n= 6

The significantly higher incidence of infections complications if cvc was in situ for longer than 7 days [p=0.009] particularly with IJV route.

The incidence of cvc tip infection was 7.69 per 1000catheter days & CRBSIS was 2.80per 1000catheter days

Conclusion

Infectious complications occurres significantly higher with cannulae left in situ for longer than 7 days .

Bleeding complications occurred significantly more with IJV Catheterization .

Material & methods

All cvc insertions were performed by icu consultants with minimum prior experience of at least 25 cvc insertions .Strict aseptic precautions were –followed for all cvc insertions .cvc insertions was left to the discretion of icu consultant after insertion of the cvc sterile non-occlusive dressings were used over the sites.

The site side of insertions of cvc date ,name of pts ,no of punctured required .complications if present noted . CXR AP view ,portable , PA View if this is ambulatory to see position of tip of cvc & to detect any complications like pneumothorax ,hemothorax etc .

Daily examinations all pts for any purulence or soiling .if exit site infection was found ,swabs was sent for microbiological exam .if catheter tip infection or catheter related 6 blood stream infection CRBSIS were suspected, then cvc was removed & the catheter tip with two sets of blood samples for culture analysis were sent .An cvc tips were cultured using the semiquantitative method .

Routinely, cvcs were removed when no longer required or infections suspected.

We documented the outcome of all cvc inserted pts in study at the end of IRCU stay either discharged or expired 6,7

Catheter related infections were defined 4

1 Exit site infections -Erythema ,tenderness ,induration ,purulence Within 2 cm of skin at the insertion site of catheter along with microbiological growth of culture of purulent exudates .

2 Catheter tip colonization- growth of more than 15 colony forming units on culture of distal segment of cvcs with clinical signs of infections

3 CRBSIs-Isolation of same organisms from the catheter tip culture & from at least one of the two blood sample cultures with symptoms & signs of infections .

4 when clinical evidence of infection as along with positive growth of same organization .

On blood culture as well as cvc tip were diagnosed to have CRB-

Volume : 4 | Issue : 6 | June 2015 • ISSN No 2277 - 8179

SI .when cvc tip yielded a positive growth but without bacterimia was considered as catheter tip infections .for a statistical analysis ..to process data generate statistics we were used .the SPSS software for windows ,version SPSS 16.0& Epi info software [3-5.1]were used to process the data & generate statistics .mean & SD were calculated for numerical variables.univariable analysis was performed to compare the survivor with the non survivor groups & p value <0.05 was considered significant .

RESULTS

A total of 241 cvc insertions fulfilled our criteria [inclusion ,exclusion] of these 121 IJV ,120 subclavian vein cannulation .

No differences between the two groups in terms of age ,gender , distribution , co-morbid conditions . APACHE II score number of attempts required for successful canulation .

The IJV canulation were significantly associated with higher number of failed attempts [p-0.0066] .table 1

Mechanical complications occurred in 42 pts insertions attempts table2

This included bleeding complications [25 pts].

Catheter related complications [14 pts] pneumothorax 3 pts .we documented that the risk of bleeding complications were [arterial puncture ,hematoma]significantly higher with IJV cannulation [p=0.009]. in patients who had two or more attempts for cvc insertion [p=0.003]

Catheter related complications induced kinking of guidewire [5] patients

Catheter tip malposition [7pts] ,guide wire kinking were observed & recorded when more than one needle attempt for cvc procedure was made .The IJV & Scv route had similar numbers of catheter related complications .Pts developed pneumothorax during cvc procedure where more than one attempt were required . p=0.0058.

The site of cvc procedure didn't influence the occurrence of this complications

The total duration of cvc use in 241 patients were 1207 days with a mean [standard deviation]duration of use 5.45 -3.70 days per catheter [table 3]

The scv catheters were used for longer period ,than IJV catheters .[p<0.0001] 25 patients developed infectious complications which include exit site infections [7pts] ,catheter tip infections [12pts] & catheter related blood stream infections [CRBSI 6 PTS] table 3 exit –site infections based on clinical signs of inflammations at the exit site were suspected in pts [12.92%].

But were microbiologically confirmed in only 7 pts .

Catheter tip infections were present in 12pts [4.58%].

CRBSI was used in =6 pts 1.67 % . the incidence of catheter tip infections & CRBSI ,were similar bet IJV & scv cannulations table 3 . however we documented significantly more incidence of cvc tip infections /colonizations [p=0.006]7 CRBSIS [p=0.009] in pts with catheter in situ for longer than 7 days ,SCVC had higher incidence of CRBSIS when SCVC in situ more than 7days .The incidence density of infections was 10.40 versus 5.20 [IJV versus scv catheters]

Per 1000 catheter days for catheter tip infection 3.72 versus 1.95 [.IJV versus scv catheters].per 1000catheter days for CRBSIS ..table 1,2,3

On microbiological culture catheter evaluation common organisms cultured were gram negative bacterias like Acinetobacter species [13 pts],Escherica coli [9] ,followed by staphylococcus aureus [4]

.all pts were followed upto study their outcome from IRCU . in all 45 %. pts discharged & 55%pts died

There were no significant relation bet occurrence of mechanical or infectious complications & overall mortality rate of pts table 3

DISCUSSION

Vascular catheters are most frequently used indeweling medical devices & important tool for the successful treatment of chronically ill critical care conditions , placements of these catheter however has an associated risk of morbidity & mortality & increased health care cost associated with .

In the reported literature world wide the overall rate of unsuccessful cvc insertion attempts have been 12% for scv route& 12.20 for IJV route [5,6] .unsuccessful attempts ,insertion attempts reported to be stronger predictor of mechanical complications & are reported to occure in up to 28% of failed insertion 7

In our study cvcs inserted via IJV route had a significantly higher proportion failed cannulations ,possibly more incidence of mechanical complications by IJV route compared to scv route.

In our study bleeding complications were the greater among all , mechanical complications with IJV route cannulation & when more than two insertion attempts were required .This is similar to the figures reported in study 8,9

In our study guidewire kinking & catheter tip malposition, former was significantly associated with more than two attempts for cvc insertions.

Some studies recorded guidewire have been reported to be entrapped , knotted ,fractured , embolized & even lost in side the patients 16

Catheter malpositions may results in vascular perforations & cardiac arrhythmias 11 catheter tip malposition are reported to occure equally with IJV 9 & scv insertions 8,12 .

Pneumothorax is dangerous complications cvc insertion occurs inup to 0.1 – 3.1%,with increased risk with no of attempts for procedure & using longer needle size, in emergency scv insertions [7,13]

In our study this complications occurred with equal incidence with IJV& SCV routes .

Catheter related infections in the critical care unit are a cause for significant morbidity & mortality & burden of health care cost .

In past study international nosocomial infections control consortium [INICC] reported cvc related blood stream infections up to 30% as all device associated infections with an incidence density of 12.5 cases per 1000 catheter days [14].

The occurence catheter infections reported to increase with average length of ICU stay by 2.4 days & hospital stay by 75 days [15]

Our study revealed a total of 9.78 % of cvc related infection .this included exit site infections [7] , catheter tip infections & CRBSIS [6]

World wide reported incidence of exit site infections vary from 6 to 15 % ,catheter tip infections from 4to 15%& CRBSIS from ,1 to 13 % [16,17]

The IJV route is associated with more infections complications [19,18]

In our study both routes IJV & SVC insertions showed same incidences of all 3 infectious complications .

In past study when 2595 cvc insertions were studied both cvc related infections as well as CRBSIS related incidence densities were found to be higher with IJV catheters as compared with SCV catheter s [7.65versus 1.57 per 1000] catheter days & 2.99 versus 0.97 per 1000 catheter days respectively .16

This difference is due to proximity of IJV insertion site to mouth & the oropharyngeal secretions higher density of local skin flora

Due to higher local skin temperature & difficulty in maintaining occlusive dressings. 16

The risk of infections complications with cvc ,has been reported to be more with increased duration of use 17-18

In our study cvc tips revealed predominantly Acinobacter species

Data from other Indian hospital critical care units reveal same pattern of our study ,& includes Acinotobacter enterobacteriaceaa pneumonia ,candida ,species 19

In western countries reported coagulase –negative staphylococci & staphylococci aureus species [16,18]

Crude mortality rates from CRBSIS are 35.2% reported from studies in India [14] with a greater cause in hospital among critical care unit pts [odd ratio of 1.8]20

Our study says that cvc insertions were associared with infectious mechanical complications .This will affect in terms morbidity . mortality ,expenditure for health care

Estimated cost for cvc related infectious complications range from 4777 to $56165 with an associated increase in hospital stay by 7-19 days [17,21] This is huge economic burden on any critical ill pts in India .where more than 80 % of pts are self paying 1227

In our study with landmark based technique ,of cvc insertions were associated with infectious .mechanical, thrombotic complication with their different incidence of occurrence .this data is valuable for planning in preventive & control strategies for infections in any We performed CVC insertions only when the platelet count > 50,000/cumm & PT INR ratio[prothrombine time international normalized ratio] was less than 1.5 seconds as per IRCU protocol .cvc insertions that were performed without coagulation profile as in an emergency were not included in the study .22,23

populations ,so all invasive vascular catheter /devices that are not necessary ,especially that has been in situ ,that more than 7 days must be removed.

In present study we didn't randomize the site of cvc insertions but left it to the choice of ICU/IRCU consultant so there may be bias in intensivist who have expertise in particular vascular cannulation

we excluded an emergency cvc insertion & patients with uncorrected coagulopathy & this might have excluded a significant no of patients precluding the study of complications associated with emergency insertions. Mortality rates comparison who developed catheter related immediate complication. We performed CVC insertions only when the platelet count > 50,000/cumm & PT INR ratio[prothrombine time international normalized ratio] was less than 1.5 seconds as per IRCU protocol .cvc insertions that were performed without coagulation profile as in an emergency were not included in the study .

Table no 1

Univariate analysis & demographic profile & CVP insertions characteristic between the pts in the two groups

Parameters	Total	IJV	SCV	Pvalue
Total cvc	241	121	120	0.135
Mean age [sd]	54.63[17.06]	55.70[18.03]	51.77[18.03]	0.234
Gender m/f	156/85	86/45	80/41	0.537
APACHE II Score	15.36	15.32	16.30	0.155
Comorbid conditions				
DM	91	50	41	0.680
HT	66	40	26	0.456
IHD	24	14	10	0.009
Others	11	5	6	0.620
Catheterization characteristic				
RT side	158	81	77	0.521
>2insertions attempts	48	26	22	0.190
Failed attempts	20	15	5	0.007

Other include patients with IHD, COPD, Dilated cardiomyopathy , c,arrhythmias HOCM, IJV, SCV, values in no [%]

Table no 2

Mechanical complications with cvc insertions

Complication	Total n-241	IJV n-121	SCV n-120	P value	Puncture 1 n-181	>2 punctures	P value
Bleeding							
Arterial puncture	14	10	4	0.0193	2	9	0.0032
Hematoma formation	10		2	0.0094	2	12	0.0005
Catheter related							
Guide wire kinking	6		2	0.1090	5	3	0.0087
Catheter tip malposition	7		4	0.2052	5	2	0.2514
Others	1		1	0.1640	0	1	0.0487
Pneumothorax	6	3	3	0.5171	2	4	0.0057

Table no 3

Mortality rates comparison developed catheter related immediate complications

Complications	Positive	Negative	pvalue
Bleeding	42.1%	38.201%	0.3566
Catheter related	41.67%	40.50%	0.9677
Pneumothorax	27.27%	40.94%	0.1707
Catheter tip infections	4.95%	41.30%	0.0002
CRBSI	0.00%	40.31%	0.1002

Volume : 4 | Issue : 6 | June 2015 • ISSN No 2277 - 8179

Conclusion

In present study rates of infectious ,mechanical complications associated with cvc are high .The IJV route is associated significantly more bleeding complications as compared to scv insertions cvc by IJV route are also at more risk of infections. complications like catheter tip colonization ,infections & CRBSIs. when cannulae are used for duration more than 7 days. Considering high incidence of complications of cvc in present study.Ultrasound guided cannulation must be considered preventive measure against the infection includes placement of cvc by skilled infusion therapy team, coating of catheters with aseptic agents use of silver impregnated cuffs & topical disinfectants .

The antimicrobial sensitivity pattern of microorganism provides guidelines to selective antibiotics

The strict aseptic ideal catheter care has to be reinforced.

All IRCU /ICU consultants /intensivist are required to follow standard protocol.

REFERENCE

1. Rello J, Ochagavia A, Sabanes E, Roque M, Mariscal D,Reynaga E, et al. Evaluation of outcome of intravenous catheter-related infections in critically ill patients. Am J Respir Crit Care Med 2000;162 (3 Pt 1):1027-30. | 2. Edwards JR, Peterson KD, Andrus ML, Tolson JS, Goulding JS,Dudeck MA, et al. National Healthcare Safety Network | | 3 Patil HV, Patil VC, Ramteerthkar MN, Kulkarni RD. CentralHSN) Report, data summary for 2006, issued June 2007.Am J Infect Control 2007;35:290-301. venous catheter-related bloodstream infections in the intensive care unit. Indian J Crit Care Med 2011;15:213-23. | | 4 Rosenthal VD. Central line-associated bloodstream infections in limited-resource countries: a review of the literature. Clin Infect Dis 2009;49:1899-907. | | 5 Merrer J, De Jonghe B, Golliot F, Lefrant JY, Raffy B, Barre E,et al. Complications of femoral and subclavian venous catheterization in critically ill patients. JAMA 2001;286:700-7. | 6. Denys BG, Uretsky BF, Reddy S. Ultrasound-assisted cannulation of the internal jugular vein. A prospective comparison to the external Landmark-Guided Technique. Circulation 1993;87:1557-62. | | 7. Mansfield PF, Hohn DC, Fornage BD, Gregurich MA, Ota DM Complications and failures of subclavian-vein catheterization. N Engl J Med 1994;331:1735-8. | | . 8 Ruesch S, Walder B, Tramer MR. Complications of central venous catheters: Internal jugular versus subclavian access-asystematic review. Crit Care Med 2002;30:454-60. | | 9. Schummer W, Schummer C, Rose N, Niesen WD, Sakka SG Mechanical complications and malpositions of central venous cannulations by experienced operators. A prospective study of 1794 catheterizations in critically ill patients. Intensive Care Med 2007;33:1055-9. | | 10. Kusminsky RE. Complications of central venous catheterization. J Am Coll Surg 2007;204:681-9624. | | 11. Tarpatizi A, Avlamis A, Papaparaskevas J, Daikos GL,Stefanou I, Katsandri A, et al. Incidence and risk factors for central vascular catheter-related blood stream infections in tertiary care hospital. New Microbiol 2012;35:429-37. | | 12. Polderman KH, Girbes AJ. Central venous catheter use. Part 1:Mechanical complications. Intensive Care Med 2002;28:1-17. | | 13. Maecken T, Grau T. Ultrasound imaging in vascular access.Crit Care Med 2007;35:178-85. | | 14. Rosenthal VD, Maki DG, Salomao R, Moreno CA, Mehta Y,Higuera F, et al. For the international nosocomial infection control consortium (INICC). Device-associated nosocomial infections in 55 intensive care units of 8 developing Countries.Ann Intern Med 2006;145:582-91. | | 15.. Cuellar LE, Fernandez-Maldonado E, Rosenthal VD, Castaneda-Sabogal A, Rosales R, Mayorga-Espichan MJ,et al. Device-associated infection rates and mortality inintensive care units of Peruvian hospitals: findings of theInternational Nosocomial Infection Control Consortium. Rev Panam Salud Publica 2008;24:16- | | 16. Goede MR, Coopersmith CM. Catheter-related bloodstream infection. Surg Clin North Am 2009;89:463-74. | | 17. Lorente L, Henry C, Martín MM, Jiménez A, Mora ML.Central venous catheter-related infection in a prospective and observational study of 2,595 catheters. Crit Care 2005;9:631-5. | | 18 . Peng S, Lu Y. Clinical epidemiology of central venous catheter-related bloodstream infections in an intensive care unit in China. J Crit Care 2013;28:277-83 | | 19 Crnich CJ, Maki DG. Infections caused by intravascular devices: Epidemiology, pathogenesis, diagnosis, prevention,and treatment. In: APIC Text of Infection Control and Epidemiology. Vol. 1. 2nd ed. Washington, DC: Association for Professionals in Infection Control and Epidemiology, Inc;2005. p. 24.21-24.26. | | 20. Wittekamp BH, Chalabi M, Van Mook WNKA, Winkens B, Verbon A, et al. Catheter-related bloodstream infections: aprospective observational study of central venous and arterial catheter. Scand J Infect Dis 2013;45:738-45. | | 21. Tokarczyk AJ, Greenberg SB, Vender JS. Death, dollars and diligence: Prevention of catheter-related bloodstream infections must persis! Crit Care Med 2009;37:2320-1. | | 22. Jayaram R, Ramakrishnan N. Cost of intensive care in India.Indian J Crit Care Med 2008;12:55-61. | | 23Randolph AG, Cook DJ, Gonzales CA, Pribble CG. Ultrasound guidance for placement central venous catheters: A metaanalysis of the literature.Crit Care Med 1996;24:2053-8. |