Evaluating the Adherence to Central Venous Catheter Routines Results from a Pilot Study Focusing on the Insertion Site

Redéen Stefan[1,2]*, Anette Krepper Nurse[1], Anette Grahn[1], Schilling UM[1] and Hammarskjöld F[1]

[1]Institute of Medicine and Healthcare, University of Linköping; Clinical education and simulation center Clinicum, East Sweden, Region of East Sweden Linkoping, and Sweden

[2]Department of Surgery and Department of Clinical and Experimental Medicine, Linköping University, 58185 Linköping, Sweden

[3]Department of Anaesthesia and Intensive care, Ryhov County Hospital, Jönköping, Sweden

*Corresponding author: Stefan Redéen,
Email: Stefan.redeen@regionostergotland.se

Abstract

Hospital related infections are present in 10% of all in-hospital patients. Central venous catheter use is one contributing factor.

We studied 86 patients with central venous catheter regarding: indication, active use, vein, sex, single- or multi-lumen, dressing and the insertion site.

The median catheterization time was 4 days. Dressing was used in 84 (98%) patients of which 47 (55%) patients had acceptable securement of the dressings. The dressing had been changed in 62 (72%) patients prior to the schedule and in 15 patients the dressing had not been changed for the last three days.

We have found insufficient adherence in 39 (45%) of patients with central venous catheter. The skin at the insertion site showed redness, fluids and blood. The catheter was fully exposed to air in 9 patients. All these problems could be reasons for hospital related infections.

Keyword: Prospectively; Hospital related infections; Central venous catheter; Transparent dressing; Adherence; Education; Guidelines; Patients

Introduction

Health care related infections (HRI) are an important problem in modern medical care contributing to morbidity, mortality and substantial economic losses.

Central venous catheters (CVC) have been identified as one of the most common reasons for HRI [1,2]. Several studies have shown that adherence to evidence-based routines can reduce these infectious complications to very low levels, even over a sustained period of time and contribute to substantial economic savings [3-6]. The use of CVC is increasing, not only in intensive care units (ICU), but also in other wards and in-home care. Hence, more patients are at risk of CVC related infections (CRI) [5].

The repeated national point prevalence studies in Sweden, from year 2012 to 2013, have revealed a HRI rate in Sweden of 9.1 %. In the county council of Östergötland the incidence was 11. 6 % during the same period of time, according to data from the Swedish Association of Local Authorities and Regions (www.skl.se). Consequently, HRI seem to be common in the county of Östergötland and Sweden. Furthermore, CVC-use seems to contribute to a substantial part of all HRI in this evaluation.

With this background, we started an educational program to increase the knowledge and adherence to our routines based on the recommendations from SKL and The Scandinavian Society of Anesthesiology and Intensive care medicine (SFAI) [2]. These CVC-routines include adequate indications, sterile insertion, proper handling, recognition of complications, and removal of the CVC when it was no longer needed [1,2].

The aim of this study was to evaluate the daily use of CVC with focus on the insertion site, dressings and removal of CVC as indicators of the adherence to our routines.

Material and methods

Our current guidelines regarding CVC include: patient information, indications, insertion, CVC-use, removal, documentation, follow-up and quality control. These guidelines are updated on an annual basis, and ought to be well known at the three hospitals in our county. They are distributed and implemented by a team with instructional nurses and physicians with a specific educational mission on behalf on each head operation manager.

All patients in this observational study of non-tunneled CVC were taken care of at the three hospitals in the county of Östergötland.

The patients were selected and recruited both from planned and acute processes. To secure normal distribution of patients, the days for examination were selected randomly by the investigate nurse when it was available from her rostering and possible for the wards. All patients were asked to voluntarily participate in the study and were given written information about the study. All surveyed patients accepted participation. Three nurses with a specific responsibility for CVC-education and quality work at the three hospitals working at the Education and Simulation center, Clinicum at the county Council of Östergötland, performed the data collection.

The patients and dressings were evaluated with a standardized protocol, Table 1. The routines for dressings included use of a semipermeable polyurethane film and the dressing should be changed every 72 hours or earlier when the dressing was loose or soiled. Furthermore, the CVC should be removed when it was no longer needed, and not had been in use for 48 hours. Documentation was done with an unidentifiable photo from the insertion site. The data were collected during the year of 2015.

Table 1: Standardized protocol used in this study.

1.	Type of unit.
2.	Indication for CVC[1] use: surgery, nutrition or others (i.e. treatment with antibiotics, difficulties inserting peripheral catheter).
3.	Have the CVC have been used for the last 48 hours: yes, no or unclear.
4.	Placement of CVC: the subclavian vein, the jugular vein or other.
5.	Sex: women or man,
6.	Type of CVC: Single or multi-lumen.
7.	Type of dressing: Tegaderm®/transparent or other.
8.	Dressing function: Good, loosening, exposed catheter or others
9.	Skin assessment: Normal, normal and little blood, minor redness and minor blood, severe redness, blood/fluid, not gradable.
10.	Time since the dressing was changed: 0- 24h, 25-48 h, 49-72h or more.

[1]CVC: Central venous catheter

All patients were given written information about the study by a study nurse. All asked patients were informed that they could decline to participate in the study without giving any reason. Informed consent was included. Since this study originally was part of a quality program to reduce the number HRI in the region, no formal ethic application was sent from start. However, a future identical prospective study has been approved by the Local Ethic committee.

Results

We used descriptive statistics and percent for each group in this study.

In total there were 86 patients included, of which 34 were female. The median catheterization time was 4 (range: 1-49) days. The subclavian vein was used in 72 (84%) of the patients, and 38 (44%) were multi-lumen catheters.

From the University Hospital of Linköping were 50 patients recruited (wards of thoracic surgery, acute-care surgery, infection diseases, acute-medicine and hematology).

From the County Hospital of Vrinnevi in Norrköping 27 patients were recruited (wards of palliation, general surgery, medicine and intensive care unit). Finally, 9 patients were from the ward of medicine at the district Hospital in Motala. The distribution is given in Table 2.

Almost all patients, 84 (98%), had a transparent dressing, and the dressings were acceptably attached in 47 (55%). In 39 patients (45%), the insertion site was improperly dressed and in 9 of these patients, the catheter was fully exposed to air. The appearance of the skin at the insertion sites of the 86 catheters are shown in Table 3.

In 15 (18%) of the patients the dressing had not been changed for the last 72 hours and or more and in 62 (72%) cases the dressing had been changed prior to the scheduled 72-hour interval.

In 10 (11 %) patients the CVC had not been used for the last 48 hours.

Discussion

The main findings of this study were that in spite of local guidelines, daily care of the CVC insertion site was insufficient and the CVC were not removed to an acceptable extent when they were not in use.

Since CRI in general is one important and possible preventable reason for morbidity and mortality, the Clinical education and simulation center Clinicum, East Sweden, Region of East Sweden started this study as a baseline to evaluate the CVC situation in our county. At the same time, local guidelines were updated and implemented in the Region, with the aim of increasing the quality work regarding insertion and care of CVC.

Evaluation of CRI is a challenging task and several methods are suggested. The gold standard is continuous follow-up of all patients with a CVC to achieve the incidence of HRI [1,2,7]. However, this is very time-consuming. Therefore, alternative methods such as monitoring of central line associated bloodstream infections or CVC tip cultures are used [8]. This can be performed as continuous evaluations or as point-prevalence measurements. Since several studies have shown that adherence to basic routines for insertion and care of CVC will give low incidences of CRI, evaluation of adherence is a common way to evaluate local guidelines for CVC. In this pilot study we chose to evaluate dressings, insertion site and CVC removal since these are cornerstones in the daily care of the catheters.

Our results show that only 55% of the dressings had acceptable attachment and 72% of the dressings had to be changed prematurely. This is in accordance with other studies [9]. 18 of the dressings were changed after the 72-hour routine. Furthermore, 34% of the patients had visible erythema, small blood clots, fluids and hematomas at the insertion site. All these findings indicate an increased risk for CRI. These indicate the need for intensified education concerning applying technique of the dressings and care of insertion site. Furthermore, new technical solutions for the insertion site are desirable.

Only one CVC was used for more than 28 days. Our guidelines recommend other central venous systems (venous ports, tunneled-CVC or peripheral inserted central venous catheters) for catheterization time more than four weeks to reduce the risk of CVC related infections [2]. Hence, this routine seems to be well-functioning.

Removal of unnecessary central venous catheters is an important part in reducing CVC complications. We found that 11 % of the catheters were not used for the last 48 hours. We have not evaluated if the central venous catheters really should have been removed but it indicates that several central venous catheters could have been removed to decrease the risk for CRI.

There are several patient-related risk factors for CRI, i.e. acute insertion, immunosuppression, burns, parenteral nutrition, intensive care, transfusion therapy [2]. Traditionally, the opinion has been that incidences of HRI are higher in the ICU compared to units outside the ICU. Recent studies have found conflicting results on this matter [10]. Patients in this study are from a very broad spectrum of units and our results indicate that there are opportunities for improvement at almost at every department of our three hospitals.

The find optimal insertion site is a difficult task. Since the introduction of ultrasound for CVC insertion the jugular vein has become more popular [5]. This is in contrast to the results in our study where 84% of the catheters were inserted in the subclavian vein. On the other hand, central venous catheters inserted in the subclavian or axillary vein is more difficult in this point of view but the insertion site is easier to clean and dress. There is only one study evaluating the insertion site in a prospective randomized study [11]. This ICU study indicates fewer infections for central venous catheters inserted in the subclavian vein compared to the jugular vein but there was no difference in the overall complication rate. Hence, there is a need for more studies in this field since ultrasound should be used for CVC insertion. Furthermore, it is also a question about how the CVC is sutured. This should be done in a way that the insertion site could easily be cleaned and the connection hubs should be placed downward to the chest.

Transparent dressings are recommended for the insertion site in Sweden [2]. There are several studies also supporting the use of chlorhexidine sponges or dressings as a complement to reduce the number of CVC infections [2,12]. This technique has not been used in

Table 2: Units from where the patients were recruited.

Infection diseases	3
Hematology	8
Thoracic surgery	30
Palliative care	1
Internal medicine	13
Intensive care unit	5
Acute-care surgery	26
Total	N=86

Table 3: Appearance of the skin at the insertion site.

Normal	57
Normal and little blood	3
Minor redness and minor blood	16
Severe redness	0
Blood/fluids	8
Not gradable	2
Total	N=86

our three hospitals. We believe that we should consider this after proper use of standard dressings.

There could be several reasons for the lack of adherence to the routines for CVC insertion. The routines could have been insufficiently communicated to the units. During the last year there were a lowered number of experienced nurses at the wards. This, in combination with an increased staff turnover, could influence the knowledge of all routines. All these factors have to be evaluated.

Several studies have shown that CVC teams who are responsible for implementing routines and evaluating CVC care and complications reduce the number of CVC infections and are cost effective [1-3]. Hence the simulator and education center Clinicum should introduce education for the CVC team at all wards with the intention to decrease HRI in our county.

This study has some limitations. We have not consequently evaluated all inserted CVCs which could have influenced the result and the number of CVCs is limited. However, since this is a pilot study we think that it gives a quite clear view of a problem that has to be further evaluated.

In conclusion, we have found insufficient adherence to CVC routines regarding the insertion site and removal of catheters not in use. This could contribute to an increased incidence of CVC related infections. Studies on large scale having more samples will be required to confirm it further.

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