MOH NURSING CLINICAL PRACTICE GUIDELINES 1/2008

Prevention of Central Venous Device-Related Infection in Children

Ministry of Health

NMRC National Medical Research Council

SingHealth

National Healthcare Group

Singapore Private Hospitals Nursing Administrators Group

Nanyang Polytechnic

Institute of Technical Education

Singapore Nurses Association 1957

Clinical Trials & Epidemiology Research Unit

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Levels of Evidence and Grades of Recommendation

Level	Type of Evidence
1^{++}	High quality meta-analyses, systematic reviews of RCTs, or RCTs with a very low risk of bias.
1^{+}	Well conducted meta-analyses, systematic reviews, or RCTs with a low risk of bias.
1^{-}	Meta analyses, systematic reviews, or RCTs with a high risk of bias.
2^{++}	High quality systematic reviews of case-control or cohort or studies; High quality case-control or cohort studies with a very low risk of confounding or bias and a high probability that the relationship is causal.
2^{+}	Well conducted case-control or cohort studies with a low risk of confounding or bias and a moderate probability that the relationship is causal.
2^{-}	Case-control or cohort studies with a high risk of confounding or bias and a significant risk that the relationship is not causal.
3	Non-analytic studies e.g. case reports, case series.
4	Expert opinion.

Grade	Recommendation
A	At least one meta-analysis, systematic review, or RCT rated as 1^{++}, and directly applicable to the target population; or A body of evidence, consisting principally of studies rated as 1^{+}, directly applicable to the target population, and demonstrating overall consistency of results.
B	A body of evidence, including studies rated as 2^{++}, directly applicable to the target population, and demonstrating overall consistency of results; or Extrapolated evidence from studies rated as 1^{++} or 1^{+}.
C	A body of evidence including studies rated as 2^{+}, directly applicable to the target population and demonstrating overall consistency or results; or Extrapolated evidence from studies rated as 2^{++}.
D	Evidence level 3 or 4; or Extrapolated evidence from studies rated as 2^{+}.

Key References

Pearson, M.L. (1996). Guideline for prevention of intravascular device-related infection. Part 1. Intravascular device-related infections: An overview. The Hospital Infection Control Practices Advisory Committee. *American Journal of Infection Control, 24*(4): 262-293.

Acknowledgments

Singapore Ministry of Health Nursing Clinical Practice Guidelines Workgroup on Prevention of Central Venous Device-Related Infection in Children.

MOH Nursing Clinical Practice Guidelines 01/2008

PREVENTION OF CENTRAL VENOUS DEVICE-RELATED INFECTION IN CHILDREN

Scope of the Guidelines

The main aim of this guideline is to reduce the incidence of central venous device-related infections in children 16 years and below. The recommendations are applicable to the management of the paediatric population receiving central venous therapy, and may not be appropriate for the management of premature neonates, and children with arterial or haemodialysis catheters.

Summary of Recommendations

Health Care Worker Education and Training

A/1+ Conduct continuous education and training of health care professionals regarding indications and procedures for the insertion, maintenance of central venous devices (CVD) and appropriate infection control measures to prevent CVD infections.

Hand washing

A/1+ Wash hands before and after palpating, inserting, replacing or dressing any central venous access devices.

Barrier Precautions during Catheter Insertion and Care

B/2++ Use sterile technique, including a sterile gown, sterile latex gloves, large drapes and mask when inserting a central venous device.

Selection and Replacement of Intravascular Catheters

B/1+ Select the catheter, insertion technique, and insertion site with the lowest risk for complications.

B/1+ Do not routinely replace central venous catheters solely for the purposes of reducing the incidence of infection.

Skin Cleansing

B/1+ Before CVD insertion, cleanse the skin site with an appropriate antiseptic solution. Although a 2% Chlorhexidine-based preparation is preferred, Chlorhexidine 0.5% with alcohol 70%, or 10% Providone Iodine can be used.

Catheter Site Dressing

B/1+ Use transparent, semi-permeable, polyurethane dressings to cover the central venous dressing site.

B/2++ Replace catheter site dressing when the catheter device is removed, or when the dressing becomes damp, loosened, or soiled.

B/2++ Avoid touching the catheter site when changing the dressing.

Catheter Care

C/2+ Do not use single-lumen parenteral nutrition catheters for purposes other than hyper-alimentation (e.g. administration of fluids, blood or blood products).

C/2+ Designate one port for hyper-alimentation when a multi-lumen catheter is used to administer parenteral nutrition. It should not be used for other purposes (e.g. administration of fluids, blood or blood products).

D/4 Clean the catheter / extension line hub using chlorhexidine 0.5% with alcohol 70%.

D/4 Routinely flush indwelling central venous catheters (except peripherally inserted central catheters) with 2 mls of 10 units per ml of heparinised saline when not in use.

Replacement of Administration Sets and Intravenous (IV) Fluids

B/1+ Replace IV tubing including three-way adaptor, stopcock and extension tubings (closed system), no more frequently than 72-hour intervals, unless clinically indicated.

D/4 Replace IV tubing used for intermittent infusions every 24 hours.

B/2+ Replace tubing used to administer blood and blood products immediately after transfusion.

C/2+ Replace tubing set used for administration of lipids and TPN fluids within 24 hours of initiating the infusion.

D/4 Replace IV fluid including non-lipid containing parenteral nutrition every 72 hours.

D/4 Complete infusions of lipid-containing parenteral nutrition fluids within 24 hours of hanging the fluid.

D/4 Complete infusions of blood and blood products within four hours of hanging of the blood/blood products.

Intravenous Three-Way Injection Port / Needleless Injection Port

D/4 Clean three-way injection port using Chlorhexidine 0.5% with spirit 70% before accessing the system. Replace a new stopper after each disconnection.

D/4 Clean needleless injection port with alcohol 70% before accessing the system. Replace needleless IV devices and cap at least as frequently as the administration set. Ensure that all components of the system are compatible to minimise leaks and breaks in the system.

Preparation and Quality Control of Intravenous Admixtures

C/1+ Prepare all parenteral fluids in the pharmacy in a laminar-flow hood using aseptic technique.

B/1+ Check all containers of parenteral fluid for visible turbidity, leaks, cracks, particulate matter, and the manufacturer's expiration date before use.

D/4 Use single-dose vials for parental additives or medications whenever possible.

B/2+ If multi-dose vials are used:

- Refrigerate multi-dose vials after they are opened, following manufacturer's recommendations.

B/1+

- Cleanse the rubber diaphragm of multi-dose vials with alcohol 70% before inserting a device into the vial.

B/1+

- Use a sterile device each time a multi-dose vial is accessed, and avoid touch contamination of the device before penetrating the rubber diaphragm.

B/2+

- Discard multi-dose vials when suspected or visible contamination occurs, or when the manufacturer's stated expiration date is reached.

In-Line Filters

B/1+ Do not use filters routinely for infection control purposes.

Surveillance for Catheter-Related Infection

B/1+ Perform surveillance for central venous device-related infections to determine device-specific infection rates, to observe trends in those rates, and to assist in pinning down lapses in infection control practices within the institution.

D/4 Observe and palpate catheter insertion site eight hourly to assess for tenderness and infection.

D/4 In children who have a bulky dressing at the catheter site, remove the dressing and visually inspect hourly for bleeding, redness, swelling and security of catheter and palpate catheter site eight hourly. Apply new dressing, after inspection.

D/4 Record the date of catheter insertion on the transparent dressing site.

B/1+ Do not routinely perform surveillance blood cultures of patients or of central venous devices.

Ministry of Health · NMRC National Medical Research Council · SingHealth · National Healthcare Group · Singapore Private Hospitals Nursing Administrators Group · Nanyang Polytechnic · Institute of Technical Education · Singapore Nurses Association · Clinical Trials & Epidemiology Research Unit

MOH NURSING CLINICAL PRACTICE GUIDELINES 01/2008

Prevention of Central Venous Device-Related Infection in Children

February 2008

STATEMENT OF INTENT

This set of guidelines is intended for use by personnel who are responsible for surveillance and control of infections in caring for children with central venous devices. The recommendations are based on the available research findings. However, there are certain aspects in which insufficient published research is available and, therefore, experts' opinions and consensus been utilized to provide guidelines.

The recommendations are applicable to the management of the paediatric population receiving central venous therapy, and may not be appropriate for the management of premature neonates, and children with arterial or haemodialysis catheters.

Every personnel is accountable and responsible for the prevention of infection associated with central venous devices. It is recommended that individual personnel assess the appropriateness of the recommendations with regards to patient condition, availability of resources, institutional policies, treatment goals and options available before adopting any recommendation.

FOREWORD

Central venous catheter-related blood stream infection, which can be potentially life- threatening, is a significant morbidity in the paediatric intensive care unit. It is, however, preventable by adherence to strict practice guidelines.

A nursing workgroup was initiated by the Ministry of Health to establish evidence-based clinical guidelines on the prevention of this morbidity. Through rigorous literature review, we have put in place this set of guidelines to guide healthcare workers involved in the care of central venous catheters for paediatric patients. This is a low cost, evidence- based initiative that has a positive impact on patient outcome which serves to reduce central venous catheter-related blood stream infection to the minimum.

PAULINE TAN C J
CHIEF NURSING OFFICER

CONTENTS

1 INTRODUCTION

1.1 Background

The use of central venous catheters (e.g. Hickmans and total inplanted devices, peripheral inserted central catheters) in children has become increasingly important over the past decade for the treatment of children with chronic medical conditions, especially malignancies. They are also used to administer intravenous fluids, medications, blood products, parental nutrition and to monitor the haemodynamic status of critically ill patients.

During the use of central venous devices, micro-organisms may enter the bloodstream and a variety of local or systemic infectious complications including septic thrombophlebitis, endocarditis, and bloodstream infections may occur (Pearson, 1996). Catheter related infections, particularly catheter-related bloodstream infections (CR-BSIs) are associated with increased morbidity, mortality rates of 10 to 20%, prolonged hospitalization and increased medical costs. (Smith *et al*, 1991; Pittet *et al*, 1994; Arnow, 1993)

As many as 18% of all chronic venous access devices are removed due to infection (Wiener *et al,* 1992) however the use of these devices in children have a low rate of infection (Darbyshire *et al*, 1985 Shulman *et al*, 1988 McDowel *et al,* 1986). Many factors are associated with an increase risk of infection among children with central venous access devices, including younger children less than 2 years old, malabsorption syndrome, and those receiving total parental nutrition (Mulloy *et al*, 1991)

There are no published results or studies examining frequency of dressing change, administration sets, catheter site care, use of in-line filters, needleless intravascular devices in reducing catheter-related infection in children. (Pearson, 1996)

1.2 Definitions

Colonised catheter – Growth of ≥15 colony-forming units (semi-quantitative culture) or $>10^3$ (quantitative culture) from a proximal or distal catheter segment in the absence of accompanying clinical symptoms.

(Pearson, 1996)

Exit-site infection – Erythema, tenderness, induration, or purulence within 2 cm of the skin at the exit site of the catheter.

(Pearson, 1996)

Pocket infection – Erythema and necrosis of the skin over the reservoir of a totally implantable device, or purulent exudates in the subcutaneous pocket containing the reservoir.

(Pearson, 1996)

Tunnel Infection – Erythema, tenderness, and induration in the tissues overlying the catheter and >2 cm from the exit site.

(Pearson, 1996)

Catheter-related blood stream infection (CR-BSI) – Isolation of the same organism (i.e. identical species, antibiogram) from a semi-quantitative or quantitative culture of a catheter segment and from the blood (preferably drawn from a peripheral vein) of a patient with accompanying clinical symptoms of BSI and no other apparent source of infection. In the absence of laboratory confirmation, defervescence after removal of an implicated catheter from a patient with BSI may be considered indirect evidence of CR-BSI.

(Pearson, 1996)

Infusate-related blood stream infection – Isolation of the same organism from infusate and from separate percutaneous blood cultures, with no other identifiable source of infection.

(Pearson, 1996)

1.3 Types of Central Venous Devices

In this guideline, the types of Central Venous Devices covered are:

- Non-tunneled central venous catheters (CVC)
- Peripherally inserted central venous catheters (PICC)
- Tunneled central venous catheters
- Totally implantable central venous devices (TIDS)

Non-tunneled CVCs are the most commonly used central venous catheters. Maki (1992) showed that central venous catheters account for an estimated 90% of all CR-BSI.

Peripherally inserted central venous catheters provide an alternative to subclavian or jugular vein catheterization and are inserted into the superior vena cava via the cephalic, basilar and scalp veins of the antecubital space, and into inferior vena cava via lower limb veins.

PICC appears to be associated with a lower rate of infection as compared to other non-tunneled CVCs. (Ryder 1995; Raad *et al*, 1993)

Tunneled central venous catheters are surgically implanted central catheters, such as Hickman, Broviac and Groshong, and are commonly used to provide long term central vascular access. Most studies reported that the rate of infection with the use of tunneled catheters had been significantly lower than those reported with the use of non-tunneled CVCs. (Abraham, 1982; Shulman *et al,* 1988; Schuman *et al*, 1985) However, two recent studies, one randomised, found no significant difference in the rates of infection among tunneled and non-tunneled catheters. (Raad *et al*, 1993; Andrivet *et al*, 1994)

Totally implantable central intravascular devices also are tunneled beneath the skin, but have a subcutaneous port or reservoir with a self-sealing septum that is accessed by a needle puncture through the intact skin. Among the long-term vascular access devices, TIDs have the lowest rates of CR-BSI. (McDowel *et al*, 1986; Wurzel *et al*, 1988; Pegues *et al*, 1992; Groeger *et al*, 1993)

1.4 Scope of the Guidelines

The main aim of this guideline is to reduce the incidence of central venous device-related infections in children 16 years and below. The recommendations are applicable to the management of the paediatric population receiving central venous therapy, and may not be appropriate for the management of premature neonates, and children with arterial or haemodialysis catheters.

The guidelines include recommendation on hand washing, aseptic technique, use of barrier precaution during catheter insertion and care, use of administrative sets and infusate, catheter site care, use of inline filters; three-way injection ports and needleless intravascular devices, and preparation and quality control of intravenous admixture.

2 DEVELOPMENT OF GUIDELINES

2.1 Training and Guidance

Members of the workgroup attended a two-day interactive training workshop to learn about and discuss the theory and practical issues of developing an evidence-based guideline. This was conducted under the guidance of Dr Edwin Chan & Dr Miny Samuel of the National Medical Research Council Clinical Trials & Epidemiology Research Unit. The practical training revolved around topic selection and the development of a “mock” evidence-based guideline which developed into this present one.

2.2 Literature Review

This set of guideline is adapted from the Guideline for Prevention of Intravascular Device-Related Infections by the Centres for Disease Control (CDC) of the United States of America (Pearson *et al*, 1996, Gerberding *et al*, 2002). Searches on MEDLINE, CINAHL, Cochrane library between 1995 and 2007 found no other new evidence except two RCTs on the type of dressing for central venous devices.

A review of prevailing clinical practice in Singapore was made by studying the guidelines and documentation used by various local hospitals and institutions.

For areas where available evidence was inconsistent or inconclusive, recommendations were made based on the clinical experience and judgment of the workgroup or expert committee reports.

2.3 Evaluation of Evidence and Grading of Recommendations

We adopted the revised Scottish Intercollegiate Guidelines Network (SIGN) system which gives clear guidance on how to evaluate the design of individual studies and how to grade each study’s level of evidence (see 2.3.1 and 2.3.2); and how to assign a grade to the recommendation after taking into account external validity, result consistency, local constraints and expert opinion (see 2.3.3). The extensive reliance on the CDC guidelines is acknowledged and treated as a very special case of published expert opinion.

2.3.1 Individual Study Validity Rating

All primary studies and reviews addressing a particular topic e.g. measurement of wound size, were appraised using a SIGN checklist appropriate to the study's design and individually rated for internal validity using the system below:

Rating	Description
++	**All or most** of the criteria have been fulfilled. Where they have not been fulfilled the conclusions of the study or review are thought **very unlikely** to alter the conclusions.
+	**Some** of the criteria have been fulfilled. Those criteria that have not been fulfilled or not adequately described are thought **unlikely** to alter the conclusions.
–	**Few or no** criteria fulfilled. The conclusions of the study are thought **likely or very likely** to alter the conclusions.

2.3.2 Levels of Evidence

Each study is assigned a level of evidence by combining the design designation and its validity rating using the system below:

Level	Type of Evidence
1^{++}	High quality meta-analyses, systematic reviews of RCTs, or RCTs with a very low risk of bias.
1^{+}	Well conducted meta-analyses, systematic reviews, or RCTs with a low risk of bias.
1^{-}	Meta analyses, systematic reviews, or RCTs with a high risk of bias.
2^{++}	High quality systematic reviews of case-control or cohort or studies. High quality case-control or cohort studies with a very low risk of confounding or bias and a high probability that the relationship is causal.
2^{+}	Well conducted case-control or cohort studies with a low risk of confounding or bias and a moderate probability that the relationship is causal.
2^{-}	Case-control or cohort studies with a high risk of confounding or bias and a significant risk that the relationship is not causal.
3	Non-analytic studies e.g. case reports, case series.
4	Expert opinion.

2.3.3 Grade of Recommendation

The detailed results of each study and mitigating local circumstances were considered in formulation of each recommendation which was then graded using the system below:

Grade	Recommendation
A	At least one meta-analysis, systematic review, or RCT rated as 1^{++}, and directly applicable to the target population; or A body of evidence, consisting principally of studies rated as 1^{+}, directly applicable to the target population, and demonstrating overall consistency of results.
B	A body of evidence, including studies rated as 2^{++}, directly applicable to the target population, and demonstrating overall consistency of results; or Extrapolated evidence from studies rated as 1^{++} or 1^{+}
C	A body of evidence including studies rated as 2^{+}, directly applicable to the target population and demonstrating overall consistency or results; Or Extrapolated evidence from studies rated as 2^{++}
D	Evidence level 3 or 4; or Extrapolated evidence from studies rated as 2^{+}

2.3.4 Interpretation of the D/4 Grading

The grading system emphasizes the quality of the experimental support underpinning each recommendation. The grading D/4 was assigned in cases where:

- it would be unreasonable to conduct a RCT because the correct practice is logically obvious.

- recommendations derived from existing high quality evidence-based guidelines in which it would be impossible to obtain and review all the primary evidence or to reconcile their grading system with the current one. These recommendations have been accepted based on the scientific reputation of their sources, and they are classified as 'Expert opinion' (level 4 evidence), e.g. (D/4)

2.4 Guidelines Review and Revision

Drafts of the guidelines were circulated to various stakeholders in health-care institutions for peer review and evaluation of the validity, reliability and practicality of the recommendations.

This guideline will be reviewed and revised periodically to incorporate the latest relevant evidence and expert clinical opinion.

2.5 Limitations

This guideline offers recommendations which are based on current scientific evidence and professional judgment. It is not intended as a legal standard of care and does not guarantee or ensure safe and effective patient care.

Users of this guideline should determine what are safe and appropriate patient care practices, based on the assessment of the circumstances of the particular patient, their own clinical experience and knowledge of the most recent research findings.

3 GUIDELINES AND RECOMMENDATIONS

3.1 Health Care Worker Education and Training

- Conduct continuous education and training of health care professionals regarding indications and procedures for the insertion, maintenance of central venous devices (CVD) and appropriate infection control measures to prevent CVD infections.

(A/1+)

Rationale:

Every institution should ensure that all health care providers, including nurses and physicians, maintain a high level of skill and knowledge. This could be achieved through regular training and compliance to policies and procedures relating to central venous access devices. (Sherertz *et al*, 2000; Davis *et al*, 1999, BeVier *et al*, 1994; Conly *et al*, 1989; East,1994; Kyle *et al*, 1990; Vanherweghen *et al*, 1986).

3.2 Hand washing

- Wash hands before and after palnating, inserting, replacing or dressing any central venous access devices.

(A/1+)

Rationale:

Handwashing is the single most important routine in preventing the spread of infection as many types of these infections may be caused by organisms transmitted on the hands of personnel. (Boyce *et al*, 2002; Eggimann *et al*, 2000; Simmons *et al*, 1990; Steere and Mallison, 1975)

3.3 Barrier Precautions during Catheter Insertion and Care

- Use sterile technique, including a sterile gown, sterile latex gloves, large drapes and mask when inserting a central venous device.

(B/2++)

Rationale:

Adopting maximum barrier precautions can minimize catheter contamination and subsequent CVC-related infections. (Capdevila, 1998; Raad *et al*, 1994; CDC, 1988)

3.4 Selection and Replacement of Intravascular Catheters

- Select the catheter, insertion technique, and insertion site with the lowest risk for complications.

(B/1+)

- Do not routinely replace central venous catheters solely for the purposes of reducing the incidence of infection.

(B/1+)

Rationale:

Studies have shown that the use of femoral catheters has an equivalent infection rate to that of non-femoral catheters. (Venkataraman *et al*, 1997, Stenzel *et al*, 1989) Fewer infectious complications have been associated with the use of teflon or polyurethane catheters than catheters made of polyvinyl chloride or polyethylene. (Sheth *et al*, 1983)

3.5 Catheter Site Care

3.5.1 Skin Cleansing

- Before CVD insertion, cleanse the skin site with an appropriate antiseptic solution. Although a 2% Chlorhexidine-based preparation is preferred, Chlorhexidine 0.5% with alcohol 70%, or 10% Providone Iodine can be used.

(B/1+)

Rationale:

Insertion sites should be prepared with an antiseptic of proven efficacy such as Chlorhexidine 2%, however, Chlorhexidine 0.5% in 70% alcohol or 10% Providone Iodine can be used. (Mimoz *et al*, 1996; Maki *et al*, 1991; Garland *et al*, 1995; Rannem *et al*, 1990; Strand *et al*, 1993)

3.5.2 Catheter Site Dressing

- Use transparent, semi-permeable, polyurethane dressings to cover the central venous dressing site.

(B/1+)

- Replace catheter site dressing when the catheter device is removed, or when the dressing becomes damp, loosened, or soiled.

(B/2++)

- Avoid touching the catheter site when changing the dressing.

(B/2++)

Rationale:

There is no evidence to suggest that transparent semi-permeable dressings reduce the risk of infection. (Bijma *et al*, 1999; Nikoletti *et al*, 1999; Madeo *et al*, 1998; Maki *et al*, 1994) Several benefits have been reported in the use of transparent dressing such as securing of the device, allowing continuous visual inspection of the catheter site, allowing patients to bathe and shower, thus saving personnel time. (CDC, 1998)

3.5.3 Catheter Care

- Do not use single-lumen parenteral nutrition catheters for purposes other than hyper-alimentation (e.g. administration of fluids, blood or blood products).

(C/2+)

- Designate one port for hyper-alimentation when a multi-lumen catheter is used to administer parenteral nutrition. It should not be used for other purposes (e.g. administration of fluids, blood or blood products).

(C/2+)

- Clean the catheter / extension line hub using chlorhexidine 0.5% with alcohol 70%.

(D/4)

- Routinely flush indwelling central venous catheters (except peripherally inserted central catheters) with 2 mls of 10 units per ml of heparinised saline when not in use.

(D/4)

Rationale:

Thrombi and fibrin deposits on the catheters may serve as a focus for microbial colonization. (Snydman *et al*, 1982; Stillman *et al*, 1977)

Catheter thrombosis appears to be one of the most important factors associated with infection of long-term catheters. Therefore, the use of anti-coagulants or thrombotic agents may be used in the prevention of CR-BSI. However, clinical trials are needed to assess further the relative efficacy, risks and benefits of the routine use of various anti-coagulants in preventing catheter-related infection. (Press *et al*, 1984; Raad *et al*, 1994)

3.6 Replacement of Administration Sets and Intravenous (IV) Fluids

- Replace IV tubing including three-way adaptor, stopcock and extension tubings (closed system), no more frequently than 72-hour intervals, unless clinically indicated.

  (B/1+)

- Replace IV tubing used for intermittent infusions every 24 hours.

  (D/4)

- Replace tubing used to administer blood and blood products immediately after transfusion.

  (B/2+)

- Replace tubing set used for administration of lipids and TPN fluids within 24 hours of initiating the infusion.

  (C/2+)

- Replace IV fluid including non-lipid containing parenteral nutrition every 72 hours.

  (D/4)

- Complete infusions of lipid-containing parenteral nutrition fluids within 24 hours of hanging the fluid.

  (D/4)

- Complete infusions of blood and blood products within four hours of hanging of the blood/blood products.

  (D/4)

Rationale:

Replacing administration sets 72 hours or more after the initiation of use have shown to be safe and cost beneficial. (Snydman *et al*, 1987; Maki *et al*, 1987)

However, certain fluid such as blood, blood products, TPN fluids and lipids are more likely to support microbial growth if contaminated. Therefore, more frequent replacement of administration sets is required (Didier *et al*, 1998; Maki *et al*, 1975; Melly *et al*, 1975)

3.7 Intravenous Three-Way Injection Port / Needleless Injection Port

- Clean three-way injection port using Chlorhexidine 0.5% with spirit 70% before accessing the system. Replace a new stopper after each disconnection.

  (D/4)

- Clean needleless injection port with alcohol 70% before accessing the system. Replace needleless IV devices and cap at least as frequently as the administration set. Ensure that all components of the system are compatible to minimise leaks and breaks in the system.

  (D/4)

Rationale:

The three-way injection port (stopcock) which is commonly used for the administration of medication / intravenous fluids and collection of blood samples may be another portal of entry for microorganisms. Although stopcock contamination is common, few studies have been able to demonstrate that the organisms colonising the stopcock is the same organism responsible for CRI. (McArthur *et al*, 1975; Walrath *et al*, 1979)

Needleless devices were introduced as an attempt to reduce needlestick injuries and the risk of transmission of blood borne infections to health care workers. However, data to assess the potential risk of contamination of the catheter and infusate that may be associated with the use of these devices are limited. (Arduino *et*

al, 1997; Brown *et al*, 1997; Luebke *et al*, 1998; McDonald *et al*, 1998)

3.8 Preparation and Quality Control of Intravenous Admixtures

- Prepare all parenteral fluids in the pharmacy in a laminar-flow hood using aseptic technique.

  (C/1+)

- Check all containers of parenteral fluid for visible turbidity, leaks, cracks, particulate matter, and the manufacturer's expiration date before use.

  (B/1+)

- Use single-dose vials for parental additives or medications whenever possible.

  (D/4)

- If multi-dose vials are used:

  - Refrigerate multi-dose vials after they are opened, following manufacturer's recommendations.

    (B/2+)

  - Cleanse the rubber diaphragm of multi-dose vials with alcohol 70% before inserting a device into the vial.

    (B/1+)

  - Use a sterile device each time a multi-dose vial is accessed, and avoid touch contamination of the device before penetrating the rubber diaphragm.

    (B/1+)

  - Discard multi-dose vials when suspected or visible contamination occurs, or when the manufacturer's stated expiration date is reached.

    (B/2+)

Rationale:

Multi-dose parenteral medication vials (MDVs) are commonly used in preparation of parenteral medications. These MDVs may be used for prolonged periods, and for more than one patient. Therefore, contamination of MDVs due to a break of aseptic technique during preparation may result in nosocomial infection. (Longfield *et al*, 1985) reported that the overall risk for extrinsic contamination of MDVs appear to be small (0.5 per 1000 vials), but the consequences may be serious. (Henry *et al*, 2001; Grohskopf *et al,* 2001; Plott *et al*, 1990) Single-dose vials are preferred but they are frequently preservative-free and might pose a risk of contamination if they are punctured several times. (ASPH, 2000)

3.9 In-Line Filters

- Do not use filters routinely for infection control purposes.

  (B/1+)

Rationale:

Rusho and Batt (1979), Allcutt *et al* (1983), Falchuk *et al* (1985), and Maddox *et al* (1983) state that in-line filters reduce the incidence of infusion-related phlebitis. However, there is no evidence to support their efficacy in the prevention of infection associated with CVDs and the infusion system. Some of the potential benefits derived from in-line filters are:

- reduction in the risk of infection from contaminated infusate
- removal of particulate matter that may contaminate IV fluids
- removal of endotoxin produced by gram negative organisms in contaminated infusate

The above potential benefits from the use of in-line filters may reduce the incidence of catheter-related infection, however, infusate related BSI rarely occurs. It is more practical and less costly to remove most particulates from the infusate with the use of pre-use filtration in the pharmacy. Furthermore, in-line filters may clog, especially with certain solutions (lipid, mannitol, etc) and subsequently decrease the availability of administered drugs. Apart

from these unfavorable effects, the routine use of in-line filters may increase cost, personnel time and possible infections. (Butler *et al*, 1980; Newall *et al*, 1998)

3.10 Surveillance for Catheter-Related Infection

- Perform surveillance for central venous device-related infections to determine device-specific infection rates, to observe trends in those rates, and to assist in pinning down lapses in infection control practices within the institution.

  (B/1+)

- Observe and palpate catheter insertion site eight hourly to assess for tenderness and infection.

  (D/4)

- In children who have a bulky dressing at the catheter site, remove the dressing and visually inspect hourly for bleeding, redness, swelling and security of catheter and palpate catheter site eight hourly. Apply new dressing, after inspection.

  (D/4)

- Record the date of catheter insertion on the transparent dressing site.

  (D/4)

- Do not routinely perform surveillance blood cultures of patients or of central venous devices.

  (B/1+)

Rationale:

Each organization should ensure that an effective surveillance system is in place to identify central venous access device-related infection. Express data as the number of catheter-related infections or catheter-related bloodstream infections (CR-BSI) per 1000 catheter-days to facilitate comparisons with national trends. (Pearson, 1996; White *et al*, 1994; Pittet *et al*, 1994; Raad *et al,* 1995; Widmer, 1992; Haley *et al*, 1985; Josephson *et al*, 1991)

4 CLINICAL AUDIT

Hospital and institution administrators should consider these guidelines in their in-house quality assurance / improvement programmes. Nurses should critically review the implications of these guidelines for their routine care delivery, trainee teaching and patient education needs.

4.1 Outcome Indicators

The recommended key outcome indictors are CVDs related infection rate for the following:

- colonised catheter
- exit-site infection
- pocket infection
- tunnel infection
- catheter-related blood stream infection
- infusate related blood stream infection

The infection rate is calculated according to a standard formula recommended by the Hospital Control Unit.

The infection rate is expressed as the number of catheter-related infection or catheter-related blood stream infections (CR-BSI) per 1000 catheters-days to facilitate comparison with national or international trends.

The formula is as follows:

$$\frac{\text{Total no. of CRI or CR-BSI}}{\text{Total no. of Catheter Day}} \text{ X 1000 Catheter days = \% of CRI or CR-BSI}$$

4.2 Management Role

Hospital and institution administrators, together with the infection control unit and quality assurance / improvement teams, should ensure that outcome indicators are met. They may benchmark against hospitals or institutions that perform well.

5 IMPLEMENTATION OF GUIDELINES

It is expected that these guidelines be adopted after discussions involving clinical and management staff of the respective hospitals and institutions. They may review how these guidelines may complement, or be incorporated into, their existing institution protocols.

Feedback may be directed to the Ministry of Health for consideration in future reviews.

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APPENDIX 1 SELF ASSESSMENT

1. To prevent air embolism in central lines, one should use:
   a) luer lock connections
   b) push in connectors
   c) clear dressings on the insertion site
   d) tape on all connections
   e) three way taps

2. In order to prevent infection of the central venous line, what other measures, besides aseptic technique, should be adopted?
   a) Re-dress daily
   b) Re-dress twice daily
   c) Reduce catheter manipulation to a minimum
   d) Use only sterile dressings
   e) Take daily swabs from the insertion site

3. Central venous catheters are used for the following, except:
   a) hemodynamic monitoring
   b) hemodialysis
   c) nutrition administration
   d) arterial monitoring

4. The following are criterias used to determine central venous access related infections, except:
   a) colonization of 15 or more colony-forming units and sepsis
   b) purulent drainage at the catheter site
   c) hypertension, altered mental states
   d) symptoms of sepsis or bacteremia

5. Which topical dressing for a central venous access device is most effective against infection?
   a) Moisture permeable transparent dressing
   b) Cotton gauze
   c) Polyantibiotic ointment and cotton gauze
   d) Impermeable dressings

6. The following are the principles of management for central venous access catheter, except:
   a) prevent infection
   b) maintain an opened system
   c) maintain a patent system
   d) prevent damage to the device

7. All administration set - with 3-way adaptors for central venous line must be changed every:
   a) 24 hours
   b) 36 hours
   c) 48 hours
   d) 72 hours

8. When flushing a central venous catheter, which of the following you must observe?
   a) Maintain a positive pressure when clamping the catheter
   b) Maintain a negative pressure when clamping the catheter
   c) Maintain a neutral pressure when clamping the catheter
   d) None of the above

9. The recommended frequency in dressing change for central venous catheter is:
   a) 24 hours
   b) 48 hours
   c) 72 hours
   d) weekly or when necessary

10. The most common complication of central venous access devices is
    a) thrombotic obstruction
    b) mechanical obstruction
    c) catheter fracture
    d) infection

11. A catheter related blood stream infection is demonstrated by
    a) bacteria found in a blood culture
    b) bacteria found in a blood culture of a patient who has symptoms of systemic infection
    c) bacteria found in a catheter tip segment
    d) the same bacteria found in a blood culture, a catheter segment, the infusate, and the catheter hub.

12. When erythema, tenderness, induration, or purulence are observed within 2 cm of the skin at the exit site of the catheter, it is called:
    a) a tunnel infection
    b) an abscess
    c) a port pocket infection
    d) a systemic infection
    e) exit-site infection

13. A physician who has just inserted a central catheter in a patient orders a chest x-ray and IV fluids. The nurse should
    a) start IV fluids as ordered.
    b) wait until the x-ray is performed, and then start IV fluids.
    c) wait until tip placement is confirmed before starting IV fluids.
    d) draw back blood from the central catheter to assure patency, and then start IV fluids.

14. Which of the following can help to prevent clot formation inside the lumen of a central venous catheter?
    a) Decreasing the infusion rate
    b) Encouraging the patient to cough and take deep breaths periodically
    c) Flushing the catheter with normal saline after withdrawing blood
    d) Using needleless injection caps

15. Systemic infection is suspected when the patient with a central venous access device (CVAD) develops
    a) erythema at the insertion site
    b) drainage around the insertion site
    c) upper-extremity swelling
    d) fever

16. Which of the following solutions is most effective in cleansing the three-way port before accessing the central venous catheter?
    a) Chlorhexidine 0.5% with alcohol 75%
    b) Povidone – iodine 10%
    c) Alcohol 70%
    d) Polyantibiotic

Answers

Questions	Answer
1	(a)
2	(c)
3	(d)
4	(c)
5	(a)
6	(b)
7	(d)
8	(a)
9	(d)
10	(d)
11	(d)
12	(e)
13	(c)
14	(c)
15	(d)
16	(a)