

# Effectiveness of S.T.I.C.K bundle for the prevention of IV Infiltration rate in the terms of practice among staff nurses working in tertiary care hospital Bhubaneswar, Odisha.

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## Abstract

**Intravenous (IV) fluid and medication infiltrations may result in serious complications such as tissue necrosis, ulcerations, and compartment syndromes. Objectives are to assess the existing and post-practice level skills of staff nurses about the S.T.I.C.K. Bundle and to find out the effectiveness of bundle in terms of improvement in posttest level of practice scores. Research approach was quantitative research approach and research design was pre experimental one group pretest-posttest design. Sample size was 30 and sampling technique was non probability consecutive sampling. Major finds were apparently higher in the post test group in comparison to the pre-test group. The paired 't' test value is found to be 2.16 at the degree of freedom 29 and the corresponding p value is <0.05. Hence, the research hypothesis can be accepted at 5% level of significance and can be inferred that there is significant difference between pre and post-practice level.**

**Keywords:** Effectiveness, Practice, Infiltration, S.T.I.C.K, Bundle.

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## Introduction

Intravenous (IV) fluid and medication infiltrations and/or extravasations may result in serious complications such as tissue necrosis, ulcerations, and compartment syndromes. These complications can require reconstructive surgery and cause long-term pain and suffering, longer hospital stays, and increased costs [1]. Frequent assessment of Peripheral-IV (PIV) sites can help identify infiltration and extravasations in their early stages [2]. A 2015 study showed a significantly lower incidence of pediatric IV infiltrations when patient guardians were educated and involved in frequent observation of IV sites [3]. Unit Nursing Practice Council (UNPC) members on a pediatric Orthopedic/Neurology unit noticed a rise in PIV infiltrations. Children are innately active and mobile which challenges proper maintenance of peripheral IV catheters. Continuous movement by the child can cause increased irritation of the vein by the catheter. Additionally, the short length of peripheral IV catheters may contribute to ease of catheter dislocation and subsequent infiltration of fluids and/or medications. This Quality Improvement (QI) project focused on prevention and early recognition of Peripheral-IV infiltrations in a pediatric orthopedic- neurology population.

The early identification of risk factors and intervention the proper IV care by maintaining protocol helps to prevent of potentially serious infiltration and adverse outcomes. Literature recommended development of well-established written protocols followed by close supervision for the prevention of infiltration. However, variable nursing practices and lack of written protocols in the indoor patients of hospital prompted the researcher to take up the study with the objectives to develop S.T.I.C.K. Bundle protocol and determine the effectiveness of two protocols to prevent the infiltration in indoor patients of a tertiary care hospital.

The insertions of these devices are associated with risks and complications that have impact on the clinical status of the patient. A variety of complications associated with the insertion and the utilization of venous access devices can be categorized as local complications such as thrombosis, thrombophlebitis, extravasations and infiltration or systemic complications like pulmonary embolism and blood infections that occur less frequently than local complications. Usually they are serious, may be life threatening and require immediate medical attention 1&2. Infiltration and extravasation are known complications of infusion therapy. The Infusion Nurses Society (INS) and Oncology Nursing Society were defined infiltration as the invader tent leakage of a non-vesicant solution or medication into the tissue surrounding the I/V catheter whereas extravasation is the inadvertent leakage of a vesicant medication or solution into the surrounding tissue whereas vesicant refers to any medication or fluid with the potential for causing blisters, severe tissue injury, or necrosis [3]. The incidence of peripheral vein extravasation has been reported to range from 0.1% to 6.5%. Infiltration and extravasation can occur due to mechanical causes such as placement of cannula in areas of joint flexion, large gauze cannula and improper stabilization or splinting of the joint; obstruction because of clot formation following multiple vein punctures and due to inflammatory processes associated with the drugs such as cytotoxic agents that promote venous inflammation by the release of biochemical substances such as histamine, serotonin, leukotrienes, prostaglandins, and bradykinins.

The early identification of risk factors and intervention upon the first signs and symptoms of infiltrations and phlebitis is critical to the prevention of potentially serious adverse outcomes. Literature recommended development of well-

established written protocols followed by close supervision for the prevention of infiltration.

## Background of the Study

Peripheral Intravenous Catheter (PIVC) insertion is one of the most common invasive procedures performed in a hospital, but most nurses receive little formal training in this area. Blended PIVC insertion training programs that incorporate deliberate simulated practice have the potential to improve clinical practice and patient care.

It is estimated that more than 300 million short (<3 in) Peripheral Intravenous Catheters (PIVCs) are sold annually in the United States with at least 80% of all hospitalized patients receiving some form of infusion therapy. Even though it is a prevalent, technically difficult, and invasive procedure, most health care practitioners, who have not been trained as vascular access experts, receive little substantive peripheral vascular access education, training, or opportunities to practice skills until competent.

Peripheral venous cannulation is the insertion of a vascular access device into a peripheral vein. This procedure needs manual skills, professional competency, knowledge about the anatomy and physiology of vascular system. Intravenous cannulas are small hollow advance device over a needle which penetrates into vein and it is used more frequently for administration of different drugs, fluids, blood, nutrition, for sampling and other purposes

Peripheral intravenous cannulation is the most common source of infection due to the migration of skin flora on the site of insertion into the cutaneous tract of cannula with outer surface of catheter. Due to high risk of infection and embolism, superficial veins of the lower limbs are avoided. If the cannula is placed in the lower limbs it may resisted soon. Blood stream infections are also associated with peripheral or intravenous catheters through contamination of microorganisms on the venous puncture site. Organisms include staphylococcus epidermidis, staphylococcus aureus, candida species and enterococci which introduced within contaminated infusion fluids.

The incidences of local or blood stream infections are related to IV therapy. A considerable number of deaths occur due to blood stream infections like every 10th person is suffering from one type of hepatitis which is life threatening. This problem occurs due to the poor practices of intravenous cannulation or therapy. Moreover, may cause the universal infection which can be mechanical or infectious like Occlusion, thrombosis, dislodgment, infiltration, leakage, phlebitis and scar formation are the mechanical complication while fungal and bacterial sepsis are included in infectious complication.

Peripheral Intravenous cannulation is a procedure in which the patient's skin is punctured with a needle to allow insertion of a temporary plastic tube into a vein. The Peripheral IV Cannula (PIC) is usually inserted into a metacarpal vein on the back of the hand or a vein in the lower arm; either the cephalic or

basilic vein. Femoral veins should be avoided because of the higher density of skin flora in this area, which would put the patient at increased risk of infection. It is estimated that approximately 60% of hospital inpatients annually undergo peripheral IV cannulation in order to receive therapeutic IV medication. Since the procedure involves breaching the skin and leaving a foreign body in the vein, patients are exposed to a number of risks, one of which is infection.

## IV Infiltration

IV infiltration and extravasation (*i.e.* infusion leaking out of the blood vessel), are frequently observed in the clinical setting as complications related to intravenous injection. IV infiltration can lead to problems like discomfort, the need for reinsertion of the intravenous catheters, or compartment syndrome, which can increase not only the period of hospitalization and medical expenses for treatment, but also permanent damage in children. Considering these negative consequences of IV infiltration, it is important to prevent these outcomes. IV infiltration related factors must, therefore, be identified to determine high-risk groups and come up with appropriate management strategies.

Although intravenous therapy is one of the most commonly performed procedures in hospitalized patients, it remains susceptible to infections and noninfectious complications. Previous studies investigated Peripheral Intravenous Catheter (PIVC) complications mainly in pediatrics, but apparently none were investigated among Saudi adult populations. Thrombophlebitis and infection are common complications of peripheral venous catheter and their use should be discontinued because of occlusion or leakage. Insertion, monitoring and assessing peripheral venous catheter site is a common nursing activity. The guidelines recommend that peripheral intravenous catheter should be removed or replaced every 12-72 hours to avoid complication such as thrombophlebitis. Furthermore the smallest necessary peripheral venous catheter should be well documented with date, time, size and location in the can be used to administer the prescribed therapy reliably and safely.

The Nosocomial Infection National Surveillance Service (NINSS, 2002) postulates to 6.2% of hospital-acquired bacteraemias may be directly attributable to peripheral IV cannulation. Some might argue that this is a small percentage, but for the patient who develops a bacteraemia any percentage is going to be significant. Infection may be localized or systemic; however, peripheral intravenous cannulations are more commonly associated with localized than systemic infection. Nevertheless, because of the high number of PICs inserted annually, serious infections have resulted in significant annual morbidity [4]. The majority of patients who undergo peripheral IV cannulation will not experience serious ill effects. However, individuals who do develop complications, the temporary/long-term loss or use of a limb may affect an individual's choice of occupation causing economic impact. Loss of working days increased nursing time and the costs of treating PIC complications will contribute to the economic burden felt by both the patient and the healthcare organization [5].

## Need of the Study

Infiltration injuries occur when fluids or medications penetrate the tissue surrounding an Intravenous (IV) catheter site and are a well-known complication of Peripheral Intra Venous use. Extravasations are defined as the inadvertent administration of a vesicant solution or medication, while infiltration is defined as a non-vesicant solution or medication. Both injuries result from damage to vessel endothelium, which allows the fluid to penetrate tissues surrounding an IV site. As infiltration and extravasations are often used interchangeably in the literature, infiltration will be used to describe both events for the purpose of this report. In one study there is 17.4% infiltrate rate in one month. Park et al. developed an IV infiltration prevention and early detection program [6].

The program consisted of a poster, documentation of catheter insertion, parent education, completion of an infiltration report, vein assessment before catheter insertion, appropriate site selection, and assessment of the insertion site every shift. Implementation of the program resulted in a decrease in infiltration rates and increased catheter maintenance. It is included in unit based nursing orientation for RNs. Nursing assistants are instructed to notify the RN if they have concerns about the IV site including if the patient complains of pain at the site. It is also recommended nursing assistants seek RN assistance when untangling IV lines or tubing's. After doing this program the infiltration rate was reduced about 11.2% in next month and after few months it is reduced about 1.55% [6]. But in the previous literatures there is only study on the IV infiltration rate which is reduced after giving teaching to the staff nurses. So I want to include the improvement of the staff nurses' practical skill in my study.

## Objectives of the study

- To assess the existing practice level skills of staff nurses about the S.T.I.C.K. Bundle.
- To assess the post-practice level skills of staff nurses about the S.T.I.C.K. Bundle.
- To find out the effectiveness of bundle in terms of improvement in posttest level of practice scores.

## Operational definition

**Effectiveness:** In this study, the effectiveness denotes the behavioral (practice) changes observed by the nurse after receiving the demonstration on S.T.I.C.K. Bundle.

**S.T.I.C.K. Bundle:** S-Securement (A standardized step by step approach to securing the IV)

T-Touch, Look, Compare (TLC) Irritants

C-Catheter selection (type, size, location)

K-Keep it? Daily Review of necessity

**Practice:** In this study, practice refers to the ability to perform and adopt S.T.I.C.K. Protocol correctly in clinical settings as measured by checklist.

**Infiltration:** Infiltration is the diffusion or accumulation (in a tissue or cells) of foreign substances or in amounts in excess of the normal. It will be assessed by the Infiltration Scale adapted with permission from Infusion Nurses Society.

## Hypothesis

There will be significant difference between pretest and post-test practice score regarding S.T.I.C.K. Bundle Protocol among the staff nurses.

## Methodology

### Research approach

In view of nature of the problem selected and objectives to be accomplished quantitative research approach was considered appropriate for present study [7].

### Research design

The research design selected for the present study pre experimental one group pretest-posttest design.

Group	Pre-test (q1)	Intervention (x)	Post-test (q2)
Staff Nurses who are working in pediatric unit, KIMS, BBSR.	Pre Test Practice of staff nurses of S.T.I.C.K. Bundle during IV care.	Demonstration on IV care maintaining S.T.I.C.K Bundle.	Post Test Practice of staff nurses of S.T.I.C.K. Bundle during IV care.

**Table 1.** Schematic presentation of the research design. Q1: Pre-test practice of staff nurses of S.T.I.C.K. Bundle during IV care (before intervention); X: Demonstration on IV care maintaining S.T.I.C.K Bundle; Q2: Post-test practice of staff nurses of S.T.I.C.K. Bundle during IV care (after intervention); Pre-Test: Assess the practice of staff nurses on S.T.I.C.K. Bundle during IV care.

## Intervention

Demonstration on S.T.I.C.K Bundle during IV care. Only the staff nurses who are coming under the inclusion criteria.

**Post-test:** Assess the practice of staff nurses on S.T.I.C.K. Bundle during IV care.

**Variables under study:** A variable is an attribute of a person on an object that varies and takes on different values. In quantitative research an activity is aimed at trying to understand how and why things vary and to learn how difference in one variable is related to the difference in another.

Three types of variables are identified in this study.

- Dependent variable
- Independent variable
- Demographic variable

**Dependent variable:** In this study the dependent variable is the level of practice of staff nurses regarding prevention of IV infiltration.

**Independent variable:** In this study the independent variable is S.T.I.C.K. Bundle Protocol to prevent IV infiltration rate.

### **Demographic variable**

In this study the demographic variables are age, religion, Educational qualification of staff nurses, total years of clinical experience, years of clinical experience in pediatric, Source of Knowledge, attend any CNE program on IV infiltration [8].

**Research Setting:** The study was conducted at pediatric ward of a tertiary care hospital, Odisha.

**Population:** In this present study target population: Staff nurses of Pediatric unit.

Accessible population: Staff nurses of Pediatric unit, who will present at the time of data collection.

**Sample and sample size:** In this study the sample consists of 30 staff nurses who meet the inclusion criteria.

**Sampling technique:** In the study Consecutive Sampling (nonprobability sampling) technique has been used for selecting the sample.

### **Sampling Criteria**

#### **Inclusion criteria**

- Staff nurses who are willing to participate in the study
- Staff nurses who are present during the study.
- Those who have licensed or registered to work as a staff (GNM, B.Sc Nursing and Post Basic B.Sc)

#### **Exclusion criteria**

- Staff nurses who are on supervisory duty.
- Staff nurses who are absent during the time of data collection.

#### **Selection and development of tools**

The tools are based on the objectives of the study. The following steps were adopted prior to the development of the tools.

- Review of literature (text books, journals, published or unpublished dissertation, internet) pertaining to oral cancer and its prevention.
- Discussion with subject expert, nursing personnel.
- Development of first draft of tool was prepared
- Establishment of content validity.
- Development of second draft of tool was prepared
- Establishment of content validity again.
- Establishment of reliability.
- Development of final draft of tool.

#### **Description of the tool**

**Description of the final tool:** The final tools are used in the study were:

**Section-A:** Socio-Demographic Data: Staff nurses profile consisted of 7 items such as age, religion, Educational qualification of staff nurses, total years of clinical experience, years of clinical experience in pediatric, Source of Knowledge, attend any CNE program on IV infiltration.

**Section-B:** Questionnaire for assessing the practice of staff nurses regarding S.T.I.C.K. Bundle.

A structured questionnaire (check list) used to assess the practice on S.T.I.C.K. Bundle among staff nurses. It contains 24 points on practice aspects of S.T.I.C.K. Bundle. The questions are divided to the different part which are securing of IV cannula, Touch, Look, Compare, Irritants, and Catheter Selection and Keep it.

### **Score Interpretation**

The total score is 24. Each Correct answer will awarded with one score while incorrect answer will awarded Zero score.

1 mark-Correct answer

0 mark-Wrong answer

Score	Levels of practice
66%-100 % (16-24 marks)	Good
33%-66% (8-16 marks)	Average
Below 33% (0-8 marks)	Poor

**Table 2.** Scoring keys.

**Validity:** Content of tools was validated by seven experts.

The prepared tool along with a request letter, validation certificate and answer keys were submitted to one expert from medical field, two experts from the fields of medical-surgical nursing and four experts from the fields of Child Health Nursing for establishing the content validity. According to their suggestion the tool was modified.

**Reliability:** It is than concerned with consistency, accuracy, precision, stability, equivalence and homogeneity. The structured questionnaire was conducted to 5 staffs. The reliability of tool was established by testing the internal consistency. The internal consistency was assessed by using test pre-test technique. The reliability structured questionnaire was  $r=0.82$ . It was reliable.

**Pilot study:** The pilot study was conducted from 04.03.2019 to 09.03.2019 at Pediatric Intensive Care Unit (PICU) to find the feasibility of the study on 5 staff nurses. The subjects for the pilot study possessed the same characteristics as that of the sample for the main study. The participants were informed about the purpose of the study and consent was taken from the participants and the investigator did not face any kind of problem. Data analysis was done by using descriptive and inferential statistics. No further changes were made in tools after the pilot study and the investigator proceed for the main study.

### **Data collection procedure**

To conduct the study following steps were maintained:

- Permission was taken from Nursing Supervisor of pediatric, tertiary care hospital, Odisha
- The data collection period was from 05.04.2019 to 20.04.2019.
- The researcher met each staff nurse and explained the purpose of the study.
- Consecutive sampling technique was used to select the sample from the population as per the inclusion criteria.
- Inform consent was given to the sample.
- The questionnaires on demographic profile were given and practice was assessed according to the checklist.
- After the pre-test the demonstration was given to the staff nurses on S.T.I.C.K. Bundle.
- After 3 days of giving demonstration post-test practice was assessed according to the check list.
- All the staff nurses/ sample respondents cooperated well with the investigator during the data collection.

### **Plan for data analysis**

Analysis is the systematic organization and synthesis research data and testing of the research hypothesis using the data.

- The data obtained will be analyzed using both descriptive and inferential statistics based on the objectives and hypothesis of the study.
- Baseline Performa containing sample characteristics will be analyzed by descriptive statistics.
- Organizing the data on a master sheet.
- Frequency and percentage distribution of staff nurses to describe sample characteristics.
- Frequency, percentage, mean and standard deviation of the pre-test and post-test of demonstration on S.T.I.C.K. Bundle.
- 't'-value to evaluate the effectiveness of bundle in terms of improvement in posttest level of practice scores.

## **Major Findings**

### **Demographic profile of staff nurses**

The characteristics of the demographic variables described in terms of their frequency and percentage distribution which picturizes that

- Maximum subjects (60%) were in the age group of 21-25 years.
- Maximum subjects (70%) were having Total years of Clinical experience of 1-5 years.
- Maximum subjects (53.3%) were having Total year of clinical experience in pediatric of 1-5 years.
- Highest source of knowledge was Teacher (56.7%).
- Maximum subjects (60%) have not attended any CNE program on IV infiltration.

### **The first objective of the study was to assess existing practice level of pediatric staff nurses regarding IV infiltration prevention**

Out of 30 subjects' assessment of practice regarding existing practice assessment of S.T.I.C.K. Bundle for prevention of IV infiltration revealed that majority 20 (66.7%) of them had average practice, minority 9 (30%) had good practice and remaining 1 (3.3%) had poor practice. The mean for overall practice of staff nurses was 15.4 (SD=2.314). Distribution of pretest practice scores according to At and Above Median is 20 (66.7%) and Below median is 10 (33.3%). The pretest median is 15. This decrease in total practice indicates that the staff nurses need more motivation and reinforcement on IV care practices.

### **The second objective of the study was to assess post practice level of pediatric staff nurses regarding IV infiltration prevention**

Out of 30 subjects' assessment of practice regarding post practice assessment of prevention of IV infiltration revealed that majority 20 (66.7%) of them had good practice, minority 10 (33.3%) had average practice and no one had poor practice. The mean for overall practice of staff nurses was 16.7 (SD=3.21). Distribution of posttest practice scores according to At and Above Median is 19 (63.3%) and Below median is 11 (36.7%).

### **The third objective was to effectiveness of S.T.I.C.K. Bundle for prevention of IV infiltration in terms of practice**

Analysis of mean practice score is apparently higher in post-test group in comparison to the pre-test group. The paired 't' value is found to be 2.16 at degrees of freedom 29 and the corresponding p value is 0.000 (<0.05). This indicates that there is statistically significant difference between the practice scores in post-test and pre-test group. Hence the research hypothesis can be accepted at 5% level of significance and can be inferred that there is significant difference between pre and post-practice level regarding S.T.I.C.K. Bundle for prevention of IV infiltration. Improvement in the total level of performance which done among studied group regarding IV infiltration prevention pre and post-practice there was significant improvement the level of total performance.

## **Conclusion**

The present study assessed the effectiveness of S.T.I.C.K. Bundle for prevention of IV infiltration among staff nurses working in pediatric ward.

### **On the basis of the findings of the study the following conclusions are made**

The result revealed that majority 67% of the staff nurses had good practice regarding S.T.I.C.K. Bundle and maximum subjects (60%) were in the age group of 21-25 years. There

was a positive relationship between the practice of S.T.I.C.K. Bundle and total years of clinical experience.

### **Implications**

The investigator has drawn the following implications from the findings of her study, which are of vital concern to the field of nursing practice, nursing education, nursing administration and nursing research.

### **Nursing Education**

The health care delivery system at present is giving more emphasis on preventive rather than curative aspects even though the people come to hospital after getting the illness. So the health personnel must adhere to the protocols while caring for their patients during their stay in hospital. The effectiveness of demonstration program if established can be used as an illustrative informational aid to the nurses. Nurses should be gained to acquire the skill and knowledge in assessing the health needs of the patients and provide effective care to them. The quality of nursing care depends to a large extent on the knowledge, skills, attitude and activities of the practicing nursing staff.

### **Nursing Practice**

Optimal care of the pediatric patients requires distinctive multidisciplinary approach. Positive patient outcomes are dependent on the composition of the health care team and close collaboration among its members. At the center of this team is the nurse, the coordinator of all patient care activities. The nurse is responsible for providing a clean and safe environment to detect early signs of IV infiltration. IV infiltration control in pediatric ward may be challenging and rewarding experience. It may be stressful because of many skills, procedures and responsibility demanded by the nurses. Nurse must not only continue to learn about the new advances but should also participate actively in learning skills for developing their inner knowledge, intuition, wisdom as well as the discipline to integrate such skills into daily practice.

### **Nursing Administration**

Nursing administration should take an initiative in creating policies or plans in providing continuing education to their employees in the organization. They should plan for man power, money, materials, methods and time to conduct various successful educational programs. Health administrators should make the education department aware about the prevailing health problems and must make their staffs competent enough to deal with various healths related issues.

### **Nursing Research**

The essence of research is to build a body of knowledge in nursing as it is an evolving profession. Nurses are in a key position to continue the research as they are the one observing human responses. The effectiveness of the study in the research

field is verified by the utility of protocols in the pediatric ward for the hospitalized children to prevent IV infiltration.

### **Recommendations**

On the basis of the findings of the study, following recommendations could be made for the further study:

- The study can be replicated on a large sample to draw generalization.
- A comparative study may be conducted to find out the effectiveness between existing protocols on prevention IV infiltration and S.T.I.C.K. Bundle for prevention of IV infiltration.
- A similar study can be replicated with random sampling technique.
- Similar study can be conducted on the all staffs of a tertiary care hospital.
- Similar type of study could be conducted on the staff nurses on other aspects like knowledge, attitude, compliance etc.

### **Limitations**

The limitations of the study are:

- As observation checklist was used for the data collection, it may restrict the amount of information that can be obtained from the respondents.
- Small no of subjects and the study was restricted to one setting, hence the generalization is limited to the group of 30.
- The study was limited to staff nurses who were already working in pediatric ward setting.

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