Original Research Paper

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DOES CHLORHEXIDINE WIPE HELP IN REDUCING HOSPITAL ACQUIRED INFECTIONS (HAIS) AMONG CRITICALLY ILL CHILDREN ADMITTED TO A PAEDIATRIC INTENSIVE CARE UNIT?

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ABSTRACT

OBJECTIVE: To determine the effect of chlorhexidine wipes in reducing the incidence of hospital acquired infections (HAIs) among critically ill children admitted in Paediatric Intensive Care Unit (PICU).

METHODS: An interventional study, wherein enrolled children were wiped with chlorhexidine after routine bath. The incidence of HAIs were noted and compared with data from historical controls of previous year during the same period (pre-intervention).

RESULTS: One hundred and ninety nine children in the intervention period were compared with 271 children from pre-intervention period. The numbers of ventilator-days were 777 and 696 respectively for the intervention period and pre-intervention periods. Incidence of ventilator associated pneumonia (VAP) reduced from 12.9/1000 ventilator-days in the pre-intervention period to 6.4/1000 ventilator-days in the intervention period (p=0.1). VAP prevalence was 3.3% in the pre-intervention period as compared to 2.5% in the intervention period (p=0.6).
The incidence of CLABSI was 3.6/1000 catheter-days (catheter days: 1377) with prevalence of 2.5% in the intervention period, whereas among the historic controls of the previous year it was 4.2/1000 days (catheter days 1432) with a prevalence of 2.2% (p= 0.8). No untoward effect was reported.

CONCLUSION: The use of chlorhexidine wipes in ICU was feasible but did not significantly decrease HAIs.

KEYWORDS : Chlorhexidine wipes, Hospital Acquired Infections (HAI's), Central Line Associated Blood Stream Infection (CLABSI), Ventilator Associated Pneumonia (VAP).

INTRODUCTION:

Hospital acquired infections (HAI's) are a significant problem among children admitted to hospitals, especially Intensive Care Units (ICU). WHO states that HAI is the most frequent adverse event of healthcare delivery worldwide. At any point of time over 1.4 million people suffer from HAIs. The duration of hospital stay is 2.5 times more among patients who acquire HAIs when compared to those who do not have HAIs with the excess mortality in critically ill adults affected by VAP being 27.5% (1). Furthermore, HAIs are often caused by multidrug resistant organisms which are difficult to treat, associated with poor outcomes and high treatment costs.

The burden of HAIs is reported to be 19 times higher in developing countries when compared to developed countries (2). The Global Antibiotic Resistance Partnership (GARP) and Centre for Disease Dynamics, Economics and Policy (CDDEP) state the incidence of HAI in India to vary widely from 11 to 83% owing to the poor health infrastructure (3). Paediatric data on HAIs from developing countries is limited.

It has been demonstrated that 10-70% of HAI's can be prevented by implementing measures such as: education and training of staff, adherence to hand hygiene, aseptic techniques during catheter insertion, site care, cleaning of injection ports and surveillance strategies (4, 5).

Chlorhexidine is effective against gram positive, gram negative bacteria, fungi and protozoa. Use of chlorhexidine impregnated wash cloths in hospitalized patients is shown to decrease HAIs significantly when compared to the routine care that was being provided. Surface wiping of the skin with chlorhexidine wash cloths seems to be a simple, cost-effective strategy with chlorhexidine wipes being available commercially and yet there is paucity of Indian studies evaluating the efficacy and safety of chlorhexidine wipes in reducing HAIs. This study was therefore undertaken to determine if use of chlorhexidine wipes reduces hospital acquired infections in our setting.

Patients and methods: This was an interventional study done among children admitted in PICU of Christian Medical College, Vellore, India from June to September 2013 (intervention period). The controls were those children who were admitted to the PICU during the same months in the previous year i.e., 2012 (pre-intervention period).

During the intervention period all consecutive children admitted to PICU were recruited excepting those with raw skin areas, burns, poor skin integrity and known hypersensitivity to chlorhexidine. Neonates (<28 days), infants weighing < 3 kg and those children whose parents did not consent were also not included. Children with ICU stay < 2 days in the PICU were excluded from the analysis.

The Hospital Infection Control Committee (HICC) of our institution carries out a computer assisted, active and targeted surveillance of the three major device associated infections - Ventilator Associated Pneumonia (VAP), Central Line Associated Blood Stream Infection (CLABSI) and Catheter Associated Urinary Tract Infection (CAUTI).

CDC definitions (6) were used to determine the rates of such infections. CLABSI was defined as: a. patient with indwelling central catheter for 48 hours, b. Fever >100.4º F or hypothermia <97.7 F, c. single positive blood culture (2 or more cultures in case of commensals) and d. No other source evident. Ventilator Associated Pneumonia (VAP) was defined as: a. Patient mechanically ventilated and b. Abnormal chest X ray, two or more serial CXR with at least one of the following – i. New or progressive and persistent infiltrate/ consolidation/ cavitations ii.pneumatoceles in infants less than 1 year old and c. Systemic features: i. Fever >100.4º F or hypothermia <97.7º F with no other recognized cause ii. Leucopoenia (total WBC <4000/mm^3) or leukocytosis (total WBC>12000/mm^3) and d. Respiratory findings: i. Purulent ET aspirate or increased respiratory secretions or increased suctioning requirements. ii. Worsening gas exchange (PaO2/FiO2 <240), increased oxygen requirements or increased ventilator demand, e. If only one of the two findings mentioned in "d" are present diagnosis needs to be supported by

positive culture (ET aspirate/ BAL/ blood/ pleural fluid), f. In an immuno-compromised patient, any one of the findings mentioned in "c" and "d" with a positive culture and abnormal CXR to diagnose pneumonia is sufficient.

Sample size:
A sample size of 480 children (240 in each arm) was found to be sufficient to detect a clinically important difference of 6% in the prevalence of HAI between groups using a two-sided Z – test of the difference between proportions with 80% power at 5% significance level.

Intervention:
After obtaining consent, children under the study were wiped with chlorhexidine in addition to their regular sponge bath with soap and water. We used 2% Comfrey chlorhexidine gluconate wipes, which was commercially available. The nurses were trained regarding the method of use. The chlorhexidine wipes were applied from chin to toes as toxic effects on eyes and ears have been reported. The wipes were folded twice to get 4 sides; each side was gently rubbed in a back and forth motion on the skin in different areas. Separate sides were used for trunk, back and limbs; separate sheet was used to wipe the perineum. The skin was then allowed to dry for at least 30 seconds.

Pre Intervention:
The clinical data for the pre-intervention period was obtained from in-patient charts on the structured proforma which was used during the intervention period. Those patients whose chart was missing or major details were not available were excluded. The HAI data was obtained from HICC data base and this data was compared with those who received chlorhexidine wipes.

The following formulae were used to calculate the incidence and prevalence: Prevalence = Number of infected person/Number of patients observed at the same time x 100. Incidence = Number of new nosocomial infection acquired in a period/Number of patient days x 1000. HAI rates were expressed as incidence per 1000 ventilator-days or catheter-days and prevalence in percentage.

Data entry and statistical analysis:
The data was analyzed using the SPSS program. Frequency and percentages were used to present categorical data and continuous data were expressed by mean with standard deviation. To compare the incidence and prevalence among the two groups proportion test was used. The study was reviewed and approved by the institutional ethical committee (IRB No., 8362 dated 26.06.2013).

RESULTS:
Of the 246 patients who were admitted to PICU during the intervention period, 199 participated in our study whereas in the pre intervention period 271 out of 322 patients were recruited (Fig-1).

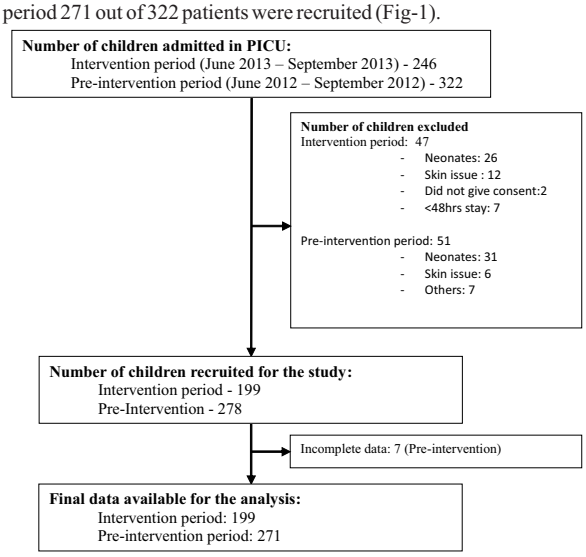

Table-1 shows the baseline demographic and clinical characteristics of the children.

Except for the mean age all other demographic variables were comparable between the groups. Mean age of the children in the intervention period was 55.8 months (range: 33 days to 15 years) as against 61.2 months (range: 29 days to 15 years) in the pre-intervention period. 14% of the patients had surgical procedure either before or after admission (Intervention group).

Table 1: Baseline characteristics of study population

Parameter	Intervention (n=199)	Pre-intervention (n=271)
Age (Mean age in months)	55.8	61.2
Male: Female	1.8:1	1.6:1
Final Diagnosis Acute Febrile Illness Pneumonia/ARDS Post-operative Others	 84 54 28 33	 129 73 42 27
Percentage of Intubated children	134 (67.3%)	182 (67.1%)
Number of central lines	52	49
Final outcome (Number %) Died LAMA[#] Discharged	 25 (12.5%) 20 (10.1%) 154 (77.4%)	 47 (17.3%) 26 (9.6%) 198 (73.1%)

[#]LAMA - Leave against medical advice

The blood culture drawn at admission showed growth in 8% in the intervention and 13% in the pre-intervention group; none of them had HAI. In another 3 patients in the intervention period pus culture isolated Staphylococcus aureus; however blood cultures were sterile. Serological markers were positive in 17.5% (94% elevated CRP).

52 (26%) children in the intervention period had a central line inserted, of which, 38 (73%) were femoral, 7 (13.5%) venous cut-down long line, whereas among the children in the pre-intervention period 49 (18%) children had a central line placed. 67% were intubated for their primary condition in both the groups (Table. 2).

Table 2: Hospital acquired infections (HAIs) in the intervention and pre-intervention groups

	Pre-Intervention	Intervention
Total number of VAPs	9	5
Total number of CLABSIs	6	5
Blood stream infection	Klebsiella-1 Acinetobacter- 1 CONS[2]- 1 NFGNB[1]:-2	Klebsiella- 1 Acinetobacter- 1 NFGNB[1]- 1 Candida- 2
VAP	Acinetobacter- 4 Candida- 2 CONS[2]- 2 Pseudomonas- 1	NFGNB- 1 CONS[2]- 1
Number of catheter-days	1432	1377
Number of ventilator-days	696	777
Incidence of VAP	12.9	6.4
Prevalence of VAP	3.3	2.5
Incidence of CLABSI	4.2	3.6
Prevalence of CLABSI	2.2	2.5

[1]NFGNB – Non-fermenting gram negative bacilli and [2]CONS – Coagulase Negative staphylococcus

Data from pre-intervention period showed that among 271 patients the ventilator-days was 696 and catheter-days was 1432. The incidence of VAP was 12.9/1000 ventilator–days. In comparison the number of ventilator-days was 777 and catheter-days were 1377 among the 199 children in the Intervention period. The incidence of VAP was 6.4/1000 ventilator-days (p= 0.1). The incidence of CLABSI in the pre-intervention period was 4.2/1000 catheter-days whereas in the intervention group it was 3.6/1000 line-days (p= 0.8). The prevalence of VAP was 3.3% and 2.5% in the pre-intervention group and intervention group respectively (p= 0.6). The prevalence of CLABSI in the intervention period was 2.5% with a non-significantly lower prevalence of 2.2% in the pre-intervention period.

There was no surgical site infection in the intervention period. Chlorhexidine wipes was used for an average of 6.3 days (range 2 – 70). All children were observed for itching sensation and/or redness and no adverse reaction to chlorhexidine was reported.

Out of the 9 patients in the intervention group who had hospital acquired infection 5 (55.5%) had either died or left against medical advice. The overall outcome for both groups is tabulated in table I.

DISCUSSION:

This was a prospective interventional study that attempted to determine the effect of chlorhexidine wipes in reducing hospital acquired infections among critically ill children.

Although there was a reduction of VAP incidence from 12.9/1000 ventilator days in the pre-intervention period to 6.4/1000 ventilator-days in the intervention period it did not achieve statistical significance. Likewise there was no significant change in the incidence of CLABSI among the children who were given chlorhexidine wipes. No significant reduction was demonstrated in the prevalence of both VAP and CLABSI.

Our study result is in contrast to the other studies where they showed a reduction in HAI's (7, 8), however Dicks et al did notice that children with MRSA sepsis did not have any reduction in infection, suggesting the resistant pattern of our organisms resulted in non-significant reduction in HAIs with chlorhexidine wipes (9). Farber et al had shown that using chlorhexidine impregnated wipes did not reduce surgical site infections (10) however we did not encounter any urinary tract or surgical site infection during both periods. Our results are similar to other reports in the literature which have variable results (11)

We had a good sample size of varied ages and disease conditions in both the groups. Our admissions peak during the months from June to September due to seasonal illnesses. The case–mix (Table-1) had both surgical and medical patients with conditions that are typically seen in developing countries. Two thirds of the children were intubated. Invasive lines were placed in about a quarter of them. This was a good environment to study if an intervention would further reduce HAI's. Another, strength of this study is the active, targeted surveillance that was independently conducted by our HICC and continued during the intervention period as was in the previous year.

The intervention in this study was simple, practical, economical and nurse's friendly. The included children were wiped with 2% Chlorhexidine in addition to and soon after their regular sponge bath with soap and water. No adverse reaction to chlorhexidine was reported as in most other studies.

The limitation of our study however was that it was not a randomised trial. Lack of availability of placebo wipes prompted us to use historic controls. A temporal reduction in the VAP incidence due to improvement in the quality of the intensive care delivered to our patients could have operated.

The overall HAI rates of all intensive care units of the hospital for the year 2012 were: VAP 3.88/1000 ventilator days (Benchmark* 5.1/1000 ventilator days) and CLABSI 0.66/1000 central line days (Benchmark* 3.2/1000 central line days). We noted that our VAP as well as CLABSI incidence were higher than that of the overall incidence rate of all other ICUs and the Bench mark rates. We need simple strategies that may reduce the infection rates among critically ill children and hence trials with larger sample size and better study design perhaps have to be conducted.

CONCLUSION:

We observed a non-significant reduction in VAP and CLABSI rates with the use of chlorhexidine wipes following routine care to these children. Chlorhexidine wipes was well tolerated with no adverse events.

Declaration:
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Competing interest: None stated.
Ethical approval: Obtained

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