Journal of Infection and Public Health xxx (2017) xxx–xxx

Contents lists available at ScienceDirect

Journal of Infection and Public Health

journal homepage: http://www.elsevier.com/locate/jiph

Central line associated sepsis in children receiving parenteral nutrition in Oman

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ARTICLE INFO

Article history:
Received 22 September 2016
Received in revised form 25 January 2017
Accepted 28 January 2017

Keywords:
Parenteral Nutrition
Sepsis
Central Line Associated Blood Stream Infection
Children
Oman

ABSTRACT

Parenteral Nutrition (PN) is used when gut fails to provide complete nutrition. Central line Associate Blood Stream Infection (CLABSI) a major complication of this therapy. The objective of the study was to report the incidence of CLABSI and associated mortality in children receiving PN in the Royal Hospital and study the indication and duration of PN use. All children from the age of 0–48 months who received TPN outside NICU from the period between 1/1/2011 till 31/12/2014 were included. Data were retrieved from the hospital electronic data base. There were 42 children 27 males and 15 females who used PN through a central line for a total duration of 569 days. The incidence of CLABSI was 14 days per 1000 days catheter and mortality of 556 per 10 000. The average duration of TPN was 14.5 days. Most of the patient had CLABSI in the PICU and cardiac related illness or surgery was the most common indication of PN use. The average duration of use was 14 days. Inspite of that short duration use of PN, there is a very high incidence of CLABSI and its related mortality. Bundle policy for central line care is not used in the Royal Hospital and this study calls for urgent implementation of central line care bundle policy in the Royal Hospital.

Introduction

Parental nutrition (PN) is a form of pharmaceutical nutrition that offers complete nutrition and fluids to patients who cannot use their gut for their nutritional needs. PN was first used in children in 1944 and has since been widely used in a variety of medical and surgical conditions including congenital diarrhea and short gut syndrome following intestinal resection [1,2]. Based on the underlying medical condition, the use of PN has varied form few days in critically ill children to lifelong home PN for children with intestinal resection or other forms of intestinal failure.

Administration of PN is mainly through a central line. Central line as defined by the CDC as any intravenous catheter where the tip terminates in one of the great vessels at or close to the heart [3,4].

PN through a central line, although could be lifesaving, the most dreadful risk of central line is death secondary to Central Line Associated Sepsis (CLABSI). This is particularly pertinent in patients with malignancies or gastrointestinal disease [5]. Patients with malignancies are immune-compromised and patients with gastrointestinal disease are usually PN dependent for many years.

Central Line Associated Bacterial Infection (CLABSI) is defined based on growth of the same organism from both the central line as well as a peripheral vessel blood sample simultaneously [6]. CLABSI is caused by nosocomial bacteria with predominantly *Staphylcoccus aureus* and *Staphylococcus epidermidis* [7].

The prevalence of central catheter related sepsis ranged from 7.1/1000 catheter days in to 5.3/1000 catheter days in a multicenter PICU study in the USA prior to establishing central line policies. Introduction of central line care polices dropped significantly CLABSI to as low as 1.7/1000 catheter days [8].

The incidence of CLABSI could be further dropped to as low as 0.94/1000 if patients were moved to home care from hospital care [9]. The ultimate aim of CLABSI rate is zero occurrence.

From the Arabic Gulf area in Kuwait, an incidence density of 14.9 CLABSIs per 1000 catheter-days was reported from a tertiary center [10]. Moreover, in Saudia Arabia a rate of 10/1000 catheter-days was reported in an adult intensive care unit [11].

The mortality from CLABSI has been reported in variable rates ranging from 25% [12], to 60 patients over 16 years as reported by Diamant et al. [13] and to a rate of 0.93/10 000 catheter days as reported by Hojsak [9] from a Croatian study.

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http://dx.doi.org/10.1016/j.jiph.2017.01.022

CLABSI in addition to mortality imposes a significant health economic burden as well. It has been estimated that every CLABSI incidence in paediatric unit in the USA costs an average of $US 55 646 and 19 days longer stay [14].

Recently the use of central line care bundles has been widely advocated with clear reduction in CLABSI [15]. Using central line care recommendations, Edwards et al. reported a reduction from an incidence of 5.8 per 1000 catheter days to 1.4/1000 catheter days [16]. Miller also reported a reduction of 56% in CLABSI over 3 months upon implementation of central line insertion and maintenance bundles [17].

The current study looks at the incidence of CLABSI and the characteristics of children using PN conducted in The Royal Hospital in Muscat, Oman. The Royal Hospital was founded in 1986 and has since been offering PN services for all children with surgical and medical conditions.

The Omani population is about 2.6 million persons as reported by MOH report in 2014 [18].

However, the pattern of use of PN and its outcomes particularly sepsis or death has not been studied.

As the highest medical institution in Oman, it was necessary to study CLABSI associated with PN in the Royal Hospital particularly that there are no studies from the Middle East or in the Gulf region describing such data.

Objective

The primary objective of the study was to determine the incidence of CLABSI in children utilizing PN in the Royal Hospital.

The secondary objective was to characterize patients who received PN and describe the indication of PN use.

Methods

This is a retrospective cohort study conducted in the Royal Hospital paediatric wards excluding children who had the PN started and stopped in Neonatal Intensive Care Unit (NICU). The NICU was excluded as there are different policies in NICU compared to the paediatric wards and PICU regarding central line care.

All children from the aged of 0–48 months who received PN outside NICU from the period between 1/1/2011 till 31/12/2014 were included. Data were retrieved form the electronic data base of the hospital. Data extracted from the records included age, sex, underlying medical condition that called for PN, duration of PN use, weight at starting and cessation of PN, wards at which PN was started and stopped, occurrence of sepsis, type of organism and their sensitivity, site of central line insertion and mortality in the patients.

Statistics

Microsoft Excel spread sheets software was used for data input and analysis. Data was described using number and percentage as well as mean, median and standard deviation. Values were calculated to the level of significance using 2 tailed student *t*-test assuming equal variance where appropriate.

Results

There were 42 children who received PN during the four years study period out of which there were 28 males and 15 females with a ratio of 1.9:1. The mean age of children at the commencement of PN was 94.7 days (SD of 95.6 days) with a median of 60 days. The mean duration period of PN use was 14.5 (SD 17.8) and the median of 9 days with a range of 1–90 days. Six patients had PN more than 28 days.

Table 1
Microorganisms identified in CLABSI.

Micro organism	Frequency of isolation
Staphelococcus epidermedis	5
Stenotrophomonas maltophilia	1
Enterococcal fecalis	1
Staphylococcus aureus	1
Staphylococcus haemolytics	1
Candida tropicalis	1

Table 2
Duration of PN in children with CLABSI.

Patient	Days
Patient 1	80
Patient 2	17
Patient 3	13
Patient 4	32
Patient 5	90
Patient 6	29
Patient 7	10
Patient 8	10

The total duration of central line catheter use was 569 days. Six children were excluded from central line catheter days calculation as they received PN through peripheral lines.

There were 23 (63%) children who had central line through the jugular or sub-clavian veins, 12 children (33%) via the femoral veins and one child had an umbilical venous catheter. The most common indication of PN in the Royal Hospital was cardiac surgery or a cardiac disease related feed intolerance. This was followed by post gastrointestinal surgery. Table 1 demonstrates the indications of PN use in the Royal Hospital.

CLABSI was ascertained in 8 children out of the 36 children receiving PN through central line representing 22% of the total central line population. Two children with central line died as a direct result of CLABSI representing 25% of those acquired CLABSI and representing 5.6% of the whole group that had central line inserted.

The incidence of CLABSI was hence 14 episodes per 1000 days catheter with a mortality of 556 per 10 000 population.

The most frequent organism isolated was *S. epidermidis*. No methicillin resistant *Staphylococcus* (MRSA) was isolated either. Table 1 lists the microorganisms isolated from blood culture of the patients.

In relation to CLABSI, the study examined some factors including duration of use of PN, weight and age of commencement of the PN for their possible association.

With regards duration of use of PN, children who developed CLABSI had an average duration of 35.1 days (SD ± 32 days) while the non CLABSI group used PN for a shorter time of an average of 12.9 (SD 15.6 days). The difference of duration in the two groups we not statistically significant $P = 0.09$.

All children who developed CLABSI had PN use of more than 10 days with single child developed CLABSI under 10 days of use. Table 2 demonstrates the duration of PN with each patient who developed CLABSI.

The two children who died as direct result of central line sepsis, the first child had congenital secretory diarrhea and was on PN for 32 days while the other child had apple peal atresia and was on PN for 90 days. These two children had some the longest times of PN in the hospital throughout the three years of study.

Looking at the site of central line, the odds ratio of having sepsis if jugular/sub-clavian line was 1.3 compared to having a femoral line.

Please cite this article in press as: AL Lawati TT, et al. Central line associated sepsis in children receiving parenteral nutrition in Oman. J Infect Public Health (2017), http://dx.doi.org/10.1016/j.jiph.2017.01.022