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Bacterial contamination of enteral nutrition in a paediatric hospital

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Summary A prospective study was performed in a paediatric hospital to evaluate the incidence of bacterial contamination in enteral nutrition bags and to determine the critical points of process. During two separate one-month periods, all children receiving pump-assisted enteral nutrition were enrolled in the study. Samples for microbiological analysis were collected from enteral nutrition bags after administration in the first and second study period (sample T_2). In the second study period, two additional samples were made at the end of the feed preparation process. One was refrigerated immediately (sample T_0) and the other was sealed in a tube that followed the enteral nutrition solution until the end of its administration (sample T_1). Bacterial contamination was detectable above 10^2 cfu/mL. Twenty-six out of 40 patients were included in the first study period and 14 out of 44 in the second study period. Contamination ($>10^2$ cfu/mL) occurred in nine of 26 samples (35%) and seven of 14 samples (50%) in the first and second study periods, respectively. Of these, five (20%) and three (21%) contained significant contamination ($\geq 10^4$ cfu/mL). Bacteria of low pathogenicity were found in T_0 samples. Bacteria present in T_2 samples were pathogenic and multiple in 50% of cases. These results suggest that manipulation of the enteral nutrition bags at the bedside is critical for bacterial safety.

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Introduction

Enteral nutrition (EN) is a safe method for the provision of nutrients to patients who are unable to take foods orally but who have a functional gut.[1] A few ready-to-use EN solutions are available for children. Paediatricians have to consider the needs of children requiring EN (age-specific requirements, excessive water and mineral losses, mild-to-medium intestinal impairment or immuno-allergic status). Therefore, paediatric EN solutions are often tailored and prepared in dietetic units from raw materials (powder, packaged solutions and additives).

Robert Debré hospital is a mother and child institution. Technicians prepare EN solutions under the control of dieticians. The solutions are prepared daily in the dietetic unit from powder and mineral water or ready-to-use solutes, and conditioned in sterile baby bottles. Thereafter, the baby bottles are sent in refrigerated containers to the units and stored in the units' refrigerators until use. EN solutions are decanted as often as needed up to the total volume prescribed to avoid bacterial proliferation at room temperature (usually two to three times). This complex process includes many manipulations that are critical points for bacterial contamination.[2] Bacterial contamination of EN solutions may cause diarrhoea or even septicaemia.[3,4]

The aim of this prospective study was to evaluate the contamination of EN solutions and to determine its origin.

Patients and methods

Patients

The first study was conducted from 1 to 30 July 2000 and the second study from 19 March to 24 April 2001. In the first study period, all patients undergoing pump-assisted EN were eligible to participate. In the second study period, only patients receiving EN solutions requiring additions, i.e. prepared in the dietetic unit, were included. All medical and surgical units participated in the study.

Exclusion criteria were: (1) insufficient samples (i.e. EN stopped too late); (2) EN without pump-assisted administration; and (3) absence of additions in the second study.

Sampling for microbial examination

All samples (1 mL of enteral feed) were collected in sterile containers and kept at 4 °C until microbiological analysis. Each sample site was decontaminated with alcohol before collection. In the first and second study periods, residual enteral solutions were sampled at the end of administration by aseptic puncturing of EN bags under laminar airflow in the bacteriology unit (sample T_2). In the second study period, two additional samples were collected after feed preparation in the dietetic unit. One sample was refrigerated immediately until analysis (sample T_0), and the other sample was taped to the feeding bottle before administration and to the EN bag during administration in order to follow the same circuit (sample T_1). This latter sample remained closed until analysis. The three samples were processed at the same time (Figure 1).

Samples were diluted to 10^{-2} and 10^{-3} using peptone water. One millilitre of each dilution and 0.1 mL of 10^{-3} diluted solution were poured into culture media for facultative aerobic mesophilic counts (Plate Account Agar®, Bio-Rad, Marne la Coquette, France). Inoculated plates were incubated at 30 °C for 72 h. Contamination was detectable above 10^2 colony forming units (cfu)/mL. Significant contamination was defined as a bacterial count $\geq 10^4$ cfu/mL. This limit was defined arbitrarily according to previous studies.[2,5-7] Bacterial identification was carried out using API® gallery (API, La Balme les Grottes, France).

Statistical analysis

Proportions were compared using Chi-squared test. Differences were considered to be significant when $P < 0.05$.

Results

Patients

Forty patients underwent EN during the first study period. Twenty-six EN bags were analysed (92% from medical departments and 8% from surgical departments). Fourteen patients were excluded from the study due to insufficient samples ($N=13$) or non-pump-assisted administration ($N=1$). The median age of patients was 6 years (range 3 days–17 years). EN indications were: newborn ($N=1$); nephrotic syndrome ($N=2$); infections ($N=3$); postoperative ($N=3$); metabolic disorders ($N=3$); anorexia ($N=3$); digestive pathologies ($N=6$); and others ($N=5$). Fifteen of 26 studied solutions had additions (58%), all of which were made in the dietetic unit by technicians. Up to seven additions