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More than just teddy bears: Unconventional transmission agents in the operating room

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ABSTRACT

Introduction: Surgical site infection (SSI) following orthopedic surgery can have a substantial impact on patients and families. The rate remains high, ranging from 0.5% to 8.5% in pediatric spine surgery. It is common to allow children to bring a teddy bear (or similar toy) to the surgical ward to help reduce the stress of surgery. We hypothesize that despite their known benefits for children, teddies would increase the bacterial load in the surgical room.

Methods: A blinded descriptive study was conducted from June 2015 to September 2016. The study included children entering the hospital through the emergency ward for a traumatic cause requiring surgery. Patients admitted for infectious problems and those who had been hospitalized less than 6 months before the inclusion date were excluded. A picture of the teddy was taken and stored in a blind fashion. The AFNOR (Association française de normalisation) standardized rules for bacteriological surface control and the ISO/DIS 14698 protocol were strictly followed. Two independent observers performed blind bacteriologic analyses of the teddy bears with bacteria identification and colony counts. Photos of the teddy bears were then analyzed by two blinded, independent observers: one doctor and one parent from outside the hospital. Cleanliness and fluffiness of the toy was evaluated using a numeric scale.

Results: Bacteria were identified on 100% of the 53 teddies included. The mean number of bacteria was 182.5 ± 49.8 CFU/25 cm². Eight teddies (15.1%) tested positive for potential pathogenic bacteria (two *staphylococcus aureus*, one *acinetobacter ursingii*, four *acinetobacter baumannii*, one *pseudomonas stutzeri*). Three teddies (5.7%) tested positive for fungi. The median cleanliness score was 2 (interquartile range (IQR) = 1) if rated by the doctor and 2 (IQR = 1) if rated by the parent. No statistical difference was found between these two values in the global teddy bear population. We found no any statistical link between the number of CFUs and the cleanliness scores given by the doctor. The median fluffiness score given by the parent was 2 (IQR = 1). Looking at the correlative CFUs, we found a statistically significant difference between each stage of fluffiness with a higher stage showing higher CFU ($P < 0.0001$).

Conclusion: Despite their documented benefits for the child, teddy bears are not appropriate in the surgical room.

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1. Introduction

Surgical site infection (SSI) following orthopedic surgery has a substantial medical, social, and financial impact on patients and families [1,2]. In pediatric departments, orthopedic surgeries may

be performed on vulnerable patients. For patients suffering from cerebral palsy or other neuromuscular conditions, the occurrence of SSI can be devastating, as these infections are difficult to treat and often require surgical debridement, long-term antibiotics, and hardware removal [3,4]. Therefore, it is important to clarify the risk factors for SSI development. Preoperative, intraoperative, and postoperative factors contribute to the overall bacterial load to which surgical patients are exposed. Some of these factors are modifiable and improve with aggressive surgical sterilization

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practices (e.g., surgeon hand preparation, antibiotic prophylaxis), whereas others are unavoidable (e.g., patient factors such as immunosuppression, neuromuscular conditions, diabetes) [5–7].

Because much of the success in SSI prevention depends on factors in the operating room, most providers believe that the majority of SSIs result from exposing an open wound to bacteria during surgery. Providers have developed preventive measures to ensure sterility and minimize infection risks. Massive efforts to implement these protocols have decreased—but not completely eliminated—occurrence of SSIs. For example, despite the use of multiple measures to reduce overall incidence of SSI after pediatric spine surgery, the rate remains high, ranging from 0.5% to 8.5%, depending on the population studied [8,9]. Other intraoperative factors that contribute to the overall bacterial load to which the patient is exposed include both the sterile items already in the operating room at the beginning of a procedure (e.g., gowns, drapes, implants, etc.) and nonsterile items that are brought into the operating room by caregivers and the patient.

As a nonpharmacological intervention, it is common to allow children to bring a teddy bear (or similar toy) to the surgical ward to help reduce the stress of surgery [10]. After surgery, access to teddy bears may be part of distraction techniques that help reduce postoperative pain and anxiety [11–13]. But is it appropriate to admit the child's best friend in a surgical room? We hypothesize that nonsterile items brought into the operating room to decrease children's anxiety (e.g., stuffed animals, toys, etc.) are a reservoir of bacteria that contribute to the overall bacterial load to which surgical wounds are exposed, thus increasing the risk of SSI. The goal of this study was to evaluate the level of colonization in these unconventional transmission agents admitted to the operating room and to look for specific potential pathogens among the bacteria identified. We also attempted to evaluate the effectiveness of a visual evaluation of the toy's cleanliness and fluffiness by either a doctor or a parent to predict the colonization level. We hypothesized that, despite their known benefits for children, teddies would increase the bacterial load in the surgical room.

2. Material and methods

From June 2015 to September 2016, this study included children entering the hospital through the emergency ward for a traumatic cause requiring surgery. Patients admitted for infectious problems and those who had been hospitalized less than 6 months before the inclusion date were excluded. This way, we attempted to ensure a homogenous cohort and focused on possible bacterial contamination of the teddy due to outside germs.

2.1. Bacteriological screening

When children had multiple teddies, we tested only their favorite one. We collected written consent from the parents (and possibly the child). Then we took a picture of the teddy and stored the photo in a blind fashion. The bacteriological screening and tests were performed during the interval between admission to the emergency room and access to the operating room to prevent any intrahospital contamination. AFNOR (Association française de normalisation) standardized rules for bacteriological surface control and the ISO/DIS 14698 protocol were strictly followed [14]. Both recommend applying pressure on the measurement area of $500 \text{ g} \pm 50 \text{ g}$ for 10 second on a 25-cm surface. A standardized applicator was used to ensure reproducible measurements, with the same amount of pressure and contact time between the plate and the teddy (Count-Tact Applicator[®], Biomerieux, 376 chemin de l'Orme, 69280 Marcy l'Étoile, France). As recommended, we used a 25-cm² trypticase soy agar. Measurements were taken at the center of the

teddy bear's belly. The three examiners (AH, VS, and OR) wore surgical gloves during sample collection to prevent contamination. The samples collected were incubated for 24 hour at 37 °C.

2.2. Analysis

Two independent observers performed blind bacteriologic analyses of the teddy bears. For each sample, the analysis identified individual bacteria and counted colonies, in addition to specifying pathogenic versus saprophytic bacteria. Photos of the teddy bears were then analyzed by two blinded, independent observers: one doctor and one parent from outside the hospital. They were asked to rate the appearance of each teddy bear subjectively. They first evaluated the cleanliness of the toy using a numeric scale from 1 to 5: 5 was the dirtiest possible teddy and 1 described an apparently immaculate teddy. Next, only the parent evaluated the fluffiness of the teddy, using the scale introduced by Davies et al. [15]: 1 = plastic, 2 = minimal fluffiness, 3 = moderate fluffiness, and 4 = very fluffy.

Data were collected in a computerized database and analyzed with SPSS V22.0 software (SPSS Inc., Chicago, IL, USA). To assess the correlation between the cleanliness/fluffiness ratings given by the observers and the colony-forming unit (CFU) count, a Kruskal-Wallis test was used. A *P*-value for *t*-tests was considered significant if less than 0.05.

3. Results

This study included the teddy bears of 53 children. The population consisted of 30 girls and 23 boys, aged 0–14 years (mean, 4.3 years). Bacteria were identified on 100% of the teddies. The mean number of bacteria was $182.5 \pm 49.8 \text{ CFU}/25 \text{ cm}^2$. The mean number of different isolates was 3.7/teddy (from two to six different bacteria). Fifty-two teddies (98.1%) tested positive for commensal flora bacteria. Coagulase-negative staphylococcus was identified on 49 teddies (92.5%), and 38 teddies (73.6%) tested positive for saprophytic bacteria. Eight teddies (15.1%) tested positive for potential pathogenic bacteria (two *staphylococcus aureus*, one *acinetobacter ursingii*, four *acinetobacter baumannii*, one *pseudomonas stutzeri*). Three teddies (5.7%) tested positive for fungi. All isolated bacteria are summarized in Table 1.

Photos of all the teddies are included in Fig. 1. The median cleanliness score was 2 (interquartile range (IQR) = 1) if rated by the doctor and 2 (IQR = 1) if rated by the parent. No statistical difference was found between these two values in the overall teddy bear population. We found no statistical link between the number of CFUs and the cleanliness scores given by the doctor.

The median (interquartile range) fluffiness score given by the parent was 2 (IQR = 1). Only one teddy was made of plastic and therefore ranked 1. Twenty-six teddies were ranked 2, 20 were ranked 3, and five ranked 4. Looking at the correlative CFUs, we found a statistically significant difference between each stage of fluffiness with the higher stage showing increased CFU ($P < 0.0001$). The details of the different groups are reported in Table 2.

4. Discussion

In a pediatric surgery department, we are privileged to have the presence of transitional objects close to our young patients. Stuffed animals, rag dolls, and teddy bears are abundantly present and harmoniously integrated into the team's daily work. Following Winnicott's studies [16] and according to the New York University Psychoanalytical Institute, "the transitional object may be conceived of in three ways: as typifying a phase in a child's development; as a defense against separation anxiety; and, lastly,

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