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Use of Essential Oils Following Traumatic Burn Injury: A Case Study

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ABSTRACT

Hospital admissions related to burn injury reach 40,000 annually. Patients who experience extensive burns require longer hospital stays and are at increased risk for infection and hospital acquired conditions. This comparative case study is a two patient matched case control design that follows the hospital course of two children who experienced burn injuries. For one of these patients, with the consent of the child's parents, the grandmother treated her granddaughter with essential oils. Essential oils have the potential to inhibit microbial growth, support treatment of wounds, and facilitate healing. However, there have been no large scale studies on essential oils. Data for the two cases were retrieved from the electronic medical record at a Midwestern Pediatric Hospital. Retrieved data included burn site description, treatment for burns, number of days on the ventilator, white blood cell count, length of hospital stay, number of ICU days, infections diagnosed by positive culture and pain ratings. While the goals for treatment were the same for both children, the child who received only standard care was diagnosed with two blood stream infections and four hospital acquired conditions while the child who received supplemental treatment with essential oils did not develop any blood stream infections, was diagnosed with one hospital acquired condition, was in the PICU one day less, and had a four day shorter length of hospital stay. While these case findings are intriguing, research is needed to expand understanding of the role of essential oils in the treatment of burns.

Introduction

Hospital admissions related to burn injury reach 40,000 annually (American Burn Association NBR Advisory Committee, 2012, 2013). Patients who experience extensive burns (greater than 30% total body surface area [TBSA]) requiring longer hospital stays are at increased risk for infection and hospital acquired conditions (American Burn Association NBR Advisory Committee, 2012, 2013). While treatment of children with burns is complex, often family members supplement the care the child receives with alternative approaches. One alternative approach we review is the use of essential oils which have the potential to inhibit microbial growth, support treatment of wounds, and facilitate healing and recovery (Allard & Katseres, 2016). However, there have been no large scale studies on essential oils (Allard & Katseres, 2016) and little research on children or with burn patients is reported in the literature. The first author of this case study was the primary nurse for both patients presented. The observations made were only during the Pediatric Intensive Care (PICU) stay.

Purpose of the Case Study

The purpose of this case study is to present treatment, incidence of infection, length of hospital stay, and health outcomes of two children with similar histories of extensive burns (40% TBSA and consisting of partial and full thickness burns). One child's care was augmented with essential oils while the second child received standard care. This case study was submitted for IRB approval but was determined it did not meet the definition of research therefore IRB approval was not required. Corporate Compliance review indicated that approval from the parents was not required as we were not indicating patient names and both patients were well known to two of the authors. The children's names have been altered to protect their identity. For one of these patients, with the consent of the child's parents, the grandmother supplemented her granddaughter with essential oils because she believed they could inhibit infection. The grandmother used lavender and a blend of essential oils thought to have immune-supportive properties. She diffused the oils into the air and applied them to intact skin on the soles of her feet and forehead. Two means of administering lavender oil are recommended - topically and by inhalation (Buckle, 2003; Ozata, 2006).

Types of Burns

In 2013, the American Burn Association reported 3400 fire/burn/smoke inhalation deaths (American Burn Association NBR Advisory Committee, 2012, 2013). Residential fires accounted for 2550 of these deaths, 300 deaths were from vehicle crash fires, and 550 from other sources (Wolf, Phelan, & Arnoldo, 2014). Of the 550 deaths, 400 occurred as a result of contact with electricity, liquids, or hot objects. The primary cause of death in burn victims is multi-organ failure with sepsis

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being the primary trigger. Seventy-three percent of burns occur in the home (American Burn Association NBR Advisory Committee, 2012, 2013). Of 191,848 reported burn cases, 19% were children under five years of age (American Burn Association NBR Advisory Committee, 2012, 2013). Scald injuries are most prevalent in children under 5 years of age (American Burn Association NBR Advisory Committee, 2012, 2013).

Complications and Infection

Between 2003 and 2012, 96.6% of hospitalized burn patients survived (Wolf & Arnoldo, 2013). The majority of deaths occur within the first 72 h. Complications resulting from burn injury include wound pain, infection, inhalation injury, pneumonia, scarring, debriding and reconstructive procedures, pruritis, and mental health instability (increased tension, anxiety, stress, and post-traumatic stress) (Wolf et al., 2014). For all patient age groups admitted to the hospital, length of hospital stay averages 8–9 days (American Burn Association NBR Advisory Committee, 2012, 2013). Length of hospital stay can reach over 61 days when a patient incurs burns covering 70%–79% TBSA (American Burn Association NBR Advisory Committee, 2012, 2013).

The incidence of burn related complications increases with increased TBSA burns. Within the first ten days after hospital admission for severe burns, the prevalence for early infection is 50% and sepsis is 16% (Wolf et al., 2014). For this case study, we will consider severe burns to be greater than 40% TBSA. Factors contributing to infection include loss of skin barrier, arterial and venous access, mechanical ventilation, and compromised immune function.

The most prevalent complications following a burn injury include hypermetabolism, pneumonia, urinary tract infections (UTI), cellulitis, respiratory failure, septicemia, wound infections, renal failure, arrhythmia, central line associated bloodstream infection (CLABSI), and systemic infection (American Burn Association NBR Advisory Committee, 2012, 2013). Hypermetabolism is characterized by a profound increase in metabolic rate leading to slow wound healing, prolonged generalized weakness, loss of lean body mass, and increased morbidity (Lee, Norbury, & Herndon, 2012). Common bacteria include *Pseudomonas*, *Acinetobacter*, and *Staphylococcus aureus*.

Hospital Course and Treatment

Initial care management for severe burn patients often includes intravenous (IV) fluid resuscitation, Parkand Formula Resuscitation (Baxter, 1978; Fakhry, Alexander, Smith, Meyer, & Peterson, 1995) sedation, intubation, placement of a gastric tube, insertion of a urinary catheter, adequate analgesia, and central and arterial line insertion (Australian and New Zealand Burn Association & Education Committee, 2006; Enoch, Roshan, & Shah, 2009; Advanced Life Support Group, 2004). Patients may also receive routine wound care and daily dressing changes, bowel management, physical therapy (PT), occupational therapy (OT), speech therapy (ST), respiratory therapy (RT), hyperbaric oxygen therapy, skin grafts and titrated pain medications. Nutritional therapy is carefully managed. Due to the injury and the required care which often includes painful procedures and disfigurement, patients often experience increased anxiety, post-traumatic stress, and depressive symptoms (Backstrom, Ekselius, Gerdin, & Willebrand, 2013; Grigorovich, Gomez, Leach, & Fish, 2013). During healing, patients also experience pruritis (Kuipers et al., 2014).

In this particular ICU, the standard care for burns and wound care includes daily cleaning with a mild soap, debridement, and topical application of antimicrobial agents. Wounds are dressed with a non-adhering dressing and wrapped (non-circumferentially) with a dry gauze wrap dressing. Hypothermia is avoided by treating the patient in a warm environment and giving warmed IV fluids (Kim, Martin, & Holland, 2012). Patients are treated in the Operating Room (OR) for an initial debridement to prepare the skin bed for grafting. When needed, skin grafting is conducted in the OR and requires anesthesia and intubation. Several types of grafts may be used depending on the patient's TBSA.

Essential Oils

In many health care settings, including post-surgery, patients and families are supplementing care with essential oils (Stea, Beraudi, & De Pasquale, 2014). Aromatic plants had been used since ancient times for the preservative and medicinal properties (e.g. immune support) and to impart aroma and flavor to food (Edris, 2007). Essential oils are mainly used topically and through air (diffusion). Oils are steam distilled or cold pressed for extraction. All essential oils are extracted from different parts of the plant. For citrus, it comes from the rind. Other oils come from the bark, the stem, the flower, or the root. There are many different types of essential oils and they are used for different therapeutic purposes, e.g. analgesia, antiseptic, antimicrobial, and antidepressant properties. In Table 1, we present a summary of the chemical compounds and therapeutic actions of lavender essential oil (Cavanagh & Wilkinson, 2002; Daferera, Ziogas, & Polissiou, 2000; Denner, 2009; Koulivand, Khaleghi Ghadiri, & Gorji, 2013; Price & Price, 2007; Roller, Ernest, & Buckle, 2009), and the oil blend of wild orange (Aroma Tools, 2014; Geraci, Di Stefano, Di Martino, Schillaci, & Schicchi, 2016; Schelz, Molnar, & Hohmann, 2006; Wu et al., 2010), cinnamon (Aroma Tools, 2014; Barceloux, 2009; Liakos et al., 2014; Starliper et al., 2015; Wu et al., 2010), clove (Aroma Tools, 2014; Halder, Mehta, Mediratta, & Sharma, 2011; Wu et al., 2010), eucalyptus (Aroma Tools, 2014; Liakos et al., 2014; Schelz et al., 2006; Serafino et al., 2008; Wu et al., 2010) and rosemary (Aroma Tools, 2014; Schelz et al., 2006; Wu et al., 2010) that were used by the grandmother. The level of evidence for the use of each of these oils is also presented in Table 1 according to the American Association of Critical Care Nurses (AACN) (Armola et al., 2009).

Data Collection

The case control was identified via the Virtual Patient System data set (VPS) and matched to the case of interest. The case of interest was identified by the PICU staff because the grandmother supplemented the standard care.

Data for these two cases were retrieved from the electronic medical record and Virtual Patient System data set (VPS) at a free-standing Midwestern Pediatric Hospital, which has 296 beds and 24 trauma ICU beds. Retrieved data included the child's age, sex, mechanism of injury (e.g. scalding verses housefire), percent of TBSA, daily highest temperature, white blood cell count (WBC $10^3/\mu L$), pain score, ICU days, infections diagnosed by positive culture and site. Additional data collected included antibiotic therapies, complications, supportive therapies (e.g., PT, OT, ST), and length of hospital stay. The PICU staff nurses used the FLACC pain scale to assess levels of pain (Merkel, Voepel-Lewis, Shayevitz, & Malviya, 1997).

Case Reports

Case Control (Case A)

Kesha was a 2 ½ year old female who was the victim of a house fire and sustained significant flame burns covering greater than 40% of her TBSA. This included partial and full thickness burns to the face, trunk (abdomen and chest), right shoulder, and all four extremities (including fingers and toes). She also suffered severe smoke inhalation and was intubated on arrival to the Emergency Department (ED) and remained intubated for 28 consecutive days. Unfortunately, Kesha's mother, a single parent, died in the fire. Kesha was cared for in the PICU for 41 days and hospitalized for a total of 82 days.

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