CE 2.5 Contact Hours

Silver Sulfadiazine or Biobrane Dressings

Which is the Best Treatment for Partial Thickness Burns in Pediatrics?

Carly W. Hodnett, MS, CRNP-AC

Background: In the treatment of partial thickness burns in pediatrics, silver sulfadiazine (SSD) has been widely used. Biobrane, a biosynthetic dressing, has gained popularity for treatment as well for its promotion of epithelial growth. Nonetheless, there is limited information on the comparison of SSD and Biobrane for the treatment of partial-thickness burns in children. This literature review aimed to provide objective data on increased epithelial growth and decreased infection risk of SSD and Biobrane.

Purpose: The aim of this study was to conduct a literature review to examine the use of Biobrane dressings in comparison with SSD for the treatment of partial-thickness burns in children to improve epithelial growth and decrease risk of infection as compared with SSD.

Results: Seven systemic reviews were included in the literature review. Evidence showed that there was limited high-quality evidence to confirm the effectiveness of Biobrane compared with SSD in the pediatric population with partial thickness burns in regard to fewer dressing changes, improved healing time, and reduced wound infections. Some evidence exists showing Biobrane's ease in use and improved healing time when compared with SSD.

Recommendations for Practice: Future research is necessary to investigate Biobrane and SSD within large pediatric burn populations to establish its effectiveness and provide high-quality evidence for the treatment of pediatric partial-thickness burns.

KEY WORDS: Biobrane, burns, partial-thickness burns, pediatric, silver sulfadiazine

INTRODUCTION

Burn injuries in children account for more than 60,000 deaths per year (Safe Kids, 2014). Partial-thickness burns are the most common burn in children and can be a difficult wound to treat because of the process of trying to preserve the unburned dermal and epidermal tissues (Lesher et al., 2011). Silver sulfadiazine (SSD) is a well-known and widely used antimicrobial cream that requires daily dressing changes for burn wounds. However, daily dressing changes can cause a wound to dry out, which promotes the invasion of bacteria. In the past decade, Biobrane, a biosynthetic dressing, has grown in popularity because of its limited need for daily dressing changes and promotion of tissue growth (Mandal, 2007).

Acute care pediatric nurse practitioners (AC-PNPs) have a vital role within specialty departments, such as burn centers. AC-PNPs are able to diagnose and treat patients with burn while considering the patient's family, culture, and environment. They also work closely with burn surgeons to provide a collaborative approach for resolution and stabilization of a patient with pediatric burn.

PROBLEM SIGNIFICANCE

In the United States, fire- and/or burn-related injuries account for 5% of unintentional injury deaths among children (Borse et al., 2008). There are significant differences between the skin of children and adults. The stratum corneum and suprapapillary epidermis layers can be 20%–30% thinner in children than in adults (Rashaan et al., 2014). This causes a child to be more vulnerable to burn injury and bacterial colonization because of the underdevelopment of their skin (Rashaan et al., 2014). In addition, children have a larger body-surface-area-to-weight ratio compared with adults. As a result, the absorption of applied products to burn wounds is greater for children than it is for adults (Rashaan et al., 2014).

Partial-thickness burns involve areas below the epidermal layer that include blood vessels, nerves, and hair follicles. These burns can be very painful and are typically managed without surgical intervention. However, a partial-thickness burn can progress to a full-thickness burn if the wound dries out and/or becomes infected, so maintaining a moist wound environment and decreasing the number of dressing changes can prevent this (Vloemans, Hermans, van der Wal, Liebregts, & Middelkoop, 2014).

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Table 1: Characteristics of Included Studies

Study	Type of Study	Study Objective	Population Size	Outcomes	Results	Limitations	Quality of Evidence
ABLS Provider Manual (2001)	Clinical practice guidelines	Broad overview of burn care	N/A	N/A	Within the first 24 hours: transfer to burn center. No wet dressings—only apply thermal blanket. Delayed transfer beyond 24 hours: clean with soap and water with silver sulfadiazine cream	Focuses on the first 24 hours after burn—no supportive evidence about SSD or biosynthetic dressings. More than 10 years with updated guidelines. Hard to generalize to pediatric population	IVA
Willis et al. (2013), United States	Case study with review of literature	Evaluated increase in lactate from chronic use of SSD because of propylene glycol (PG; found in SSD)	3-year-old male child with second- and third-degree burns—60% total burn surface area (TBSA)	PG in SSD, PG metabolism and toxicity, laboratory testing and trends	Rare discovery; may be related to worsening kidney function—PG is converted to lactic acid, excreted through the kidneys; PG toxicity should be considered with hyperosmolality, lactic acidosis, or a picture of sepsis. Need to remove the medication to reverse toxicity. Laboratory work before discontinuing SSD showed PG toxicity: metabolic acidosis, high lactate (avg. = 5.7), hyperosmolality (355 mOsm/kg)	Cannot be generalized to all pediatric patients, rare side effect of SSD—not commonly seen	VB
Lesher et al. (2011), United States	Retrospective cohort	Comparison of Biobrane and beta-glucan collagen (BGC)	235 pediatric patients with superficial and deep partial-thickness burns	Healing time and length of stay	Biobrane had more rapid healing and shorter length of stay compared with BGC. Biobrane provided effective primary wound care for 90% of patients.	Historical control group	IIIB
Whitaker et al. (2008), United Kingdom	Systemic review	Critical evaluation of using Biobrane for plastic and reconstructive surgery	Not specified	N/A	Decreases pain and hospitalization time. Effective treatment for full-thickness burn in adults, especially large burns involving joints and hands. Biobrane glove for hand; Biobrane jacket to dress the torso	Focused specifically on Biobrane without discussion of SSD. No specification on population or number of patients. Cannot generalize to pediatrics. U.K. research may not be applicable to U.S. standards.	IB
Rahmanian-Schwartz et al. (2011), Germany	Quasi-experimental	Long-term outcome of Biobrane versus Suprathel in acute burns	34 adults with TBSA < 20%, mostly on the hands and face	Wound healing	Biobrane and Suprathel have proven to be equally effective and reliable; no statistical significant difference in wound healing times (Biobrane healed 1.8 days earlier). In the clinical setting, may consider the most cost-effective treatment	Cannot generalize to pediatrics because of adult samples. Cross-comparison of two biosynthetic dressings. Germany-based research, so it may not be applicable to U.S. standards.	IIB

(continues)

Table 1: Characteristics of Included Studies, Continued

Study	Type of Study	Study Objective	Population Size	Outcomes	Results	Limitations	Quality of Evidence
Ahmadi and Williams (2009), United Kingdom	Case report	Second case study report of permanent scarring with Biobrane	18-year-old with superficial and partial-thickness burns, TBSA 16% on the abdomen, chest, and right upper arm	Scarring	Biobrane is trimmed as the wound heals, typically left on 7–14 days. This case was left on for a maximum of 14 days. Scars were present on Day 14 and were still present 3 years after the initial burn. Scars correlate with pores in the Biobrane dressing.	An 18-year-old patient with trauma would typically be treated in the adult population.	VB
Wasiak et al. (2013)	Cochrane systemic review	Assess effects of burn wound dressings on superficial and partial thickness burns	All randomized controlled trials (RCTs)—all ages; biosynthetic versus SSD: all ages, 10 trials with 434 people	Wound healing time, number of dressing changes	Consistent evidence that biosynthetic dressings are more effective than SSD. Six reported significant shorter wound healing times with biosynthetic dressings (9.7 days) versus SSD (16.1 days). Dressings changes: biosynthetic (1.5–2.4) versus SSD (9.2)	Mixed population (adults and pediatrics)—hard to generalize to pediatrics.	IB
Rashaan et al. (2014), Netherlands	Systemic review and meta-analysis	Cross-compare nonsilver versus SSD in partial-thickness burns in children in relation to wound healing, grafting, infection rate, number of dressing changes, length of hospital stay, and scarring	Seven RCTs: two studies, mean TBSA < 5%; 5 studies, mean TBSA < 15%. 0–18 years old with partial thickness burns	Wound healing time, number of dressing changes, and infection rate	Nonsilver treatment preferred over SSD for wound healing, dressing changes; no difference between infection rates. Six studies reported wound healing time (419 patients) found that SSD had significant longer healing time versus nonsilver dressings (amniotic membrane, Biobrane, Transcyte, or Mepitel). On average, 3.43 days longer. Dressing change: four studies reported reduced number of dressing changes with nonsilver versus SSD (on average, 19.89 less dressings). Infection rate: no significant difference.	Discussion included adult subjects, so it was not entirely applicable to the pediatric population. Netherlands research, so it may not be applicable to U.S. standards.	IB
Pham et al. (2007), Australia	Systemic review	Assess the safety and efficacy of bioengineered skin substitutes in comparison with biological skin replacements and/or standard dressing methods for burns.	5 RCTs; total = 233 patients, pediatric and adult	Wound healing, wound infection, number of dressing changes	Biobrane required few dressing changes than SSD. Biobrane, Transcyte, and SSD had similar results for wound infection and healing time. Transcyte had better healing time and wound closure than SSD.	Small sample sizes; some adult patients were included in one RCT. Cannot be generalized to pediatrics. Australian research, cannot say if it meets U.S. standards.	IB

(continues)

Table 1: Characteristics of Included Studies, Continued

Study	Type of Study	Study Objective	Population Size	Outcomes	Results	Limitations	Quality of Evidence
Vloemans et al. (2014), Netherlands and United States	Systemic review	Best treatment option for pediatric burns for wound management and dressing materials	2 RCTs with 121 patients. Age range = 3–180 months with partial-thickness burns; two retrospective studies on a biosynthetic dressing (Biobrane) with 190 patients, age range = 35–38 months with partial thickness burns	Wound healing time	RCTs: Biobrane (biosynthetic dressings) had improved wound healing time compared with SSD. Retrospective: Biobrane was effective for partial-thickness burns, less traumatic on superficial burns	No discussion of wound i nfection and number of dressing changes, which plays in hand with wound healing time.	IB
Aziz et al. (2012), Malaysia	Systemic review meta-analysis	Evaluate effectiveness of silver-containing dressings and topical silver for preventing infection and promoting healing in burn wounds	78 patients of all ages with involving 84 superficial and partial-thickness burns	Healing time, wound infection, and adverse effects	No significant difference b/t topical Ag agents versus non-Ag on wound infection; Nonsilver had a significant faster healing time; AE showed bleeding, itching, allergy, burning sensation, and necrosis.	No specification on topical Ag. Nonspecific age population	IB
Storm-Versloot, Vos, Ubbink, and Vermeulen (2010)	Cochrane systemic review	Effects of silver-containing dressings and topical agents for preventing wound infection and wound healing	Men and women 18 years old and older; Main: 26 RCTs—2,066 patients; SSD versus biosynthetic dressings: (a) 43 patients with partial-thickness burns, (b) 52 patients with partial-thickness burns	Infection rate and wound healing rate	Infection rate: no statistical difference; wound healing rate: Biosynthetic dressings were statistically favored (SSD = 21.3 days vs. dressing = 13.7 days; SSD = 15 days vs. dressing 10.6 days)	No pediatric studies, so it cannot be generalized to the pediatric population. No reports on the number of dressing changes.	IB

SSD has been a standard burn care treatment since the late 1960s and is still frequently used today. It has bactericidal properties against gram-positive and gram-negative organisms, so it has been used judiciously to prevent wound infections. However, this treatment has received criticism as it requires frequent dressing changes, which places the wound at risk for destroying new epithelial growth and exposure to bacteria (Wasiak, Cleland, Campbell, & Spinks, 2013). In addition, repeated use of this ointment has been shown to be toxic to keratinocytes, which delays wound healing as well (Wasiak et al., 2013).

Biosynthetic dressings, such as Biobrane are composed of biological and/or synthetic materials, such as polymers. This component allows the dressing to adhere to the wound while providing a moist wound environment and a mechanical barrier to prevent bacterial invasion (Mandal, 2007). Biobrane is widely used for pediatric partial-thickness burns for its ease in use and expected benefits with decreased dressing changes.

Traditionally, the treatment of partial thickness burns in children requires daily cleaning and application of antimicrobial cream to burn wounds. As a result, the wound is allowed increased exposure to the environment, which causes the wound to lose a significant amount of fluid from exudation and evaporation (Mandal, 2007). A partial-thickness burn that becomes dry can lead to a deeper wound that could require surgical intervention. In addition, a dry burn wound environment can lead to an increased risk of infection, which would inhibit epithelial cell growth (Mandal, 2007). A burn wound dressing can help influence and inhibit this process. The most ideal treatment for partial-thickness burns in children is a product that adheres to the wound as a mechanical barrier, provides a moist wound environment to prevent deepening of the wound, promotes granulation, and limits dressing changes to once or twice weekly to promote epithelial growth; these are all expected benefits of biosynthetic dressings (Vloemans et al., 2014).

PURPOSE

Many organizations have changed from the traditional SSD standard of care to treat partial-thickness burns to the use of biosynthetic dressings, such as Biobrane. Although biosynthetic dressings are easier to use, it is unclear whether they are more efficacious than SSD treatment, especially in the pediatric population. The most recent practice guidelines for burn care were published in 2001 and lack recommendations for wound care management including pediatric burn management (Ahrenhlz et al., 2001). There is a need to evaluate the evidence regarding pediatric wound care and investigate the comparative effectiveness of SSD and Biobrane in treating partial-thickness burns to develop evidence-based guidelines for pediatric burn care. This literature review examined the question "Does the use of Biobrane improve epithelial growth and decrease the risk of infection compared with SSD among partial-thickness burns in children?"

Search Strategy

Database Search	Search Terms	Articles Considered	Types of Articles Reviewed	Articles Excluded	Articles Considered
PubMed, CINAHL, EMBASE	"Partial thickness burns," "pediatrics," "children," "Biobrane," "silver sulfadiazine," "dressings"	Articles dated 2006–2014 that discussed Biobrane and/or SSD in adult and pediatric populations with partial-thickness burns	Systemic review of randomized controlled trials (RCTs), single RCTs, nonrandomized studies	Use of Biobrane or SSD for donor sites and articles older than 2006	6,178 found, only 51 left for review

REVIEW OF LITERATURE

The Cochrane Collaboration investigated superficial and partial-thickness burn dressings to determine optimal management (Wasiak et al., 2013). Six RCTs specifically looked at the comparison of a biosynthetic dressing with SSD (Table 1). Five studies compared Biobrane with SSD, whereas one study compared two biosynthetic dressings (Biobrane and Transcyte) and SSD in a three-way comparison. All six studies resulted in Biobrane having shorter wound healing time than SSD. Age groups were not specified in these trials, except one that noted patients aged 3–17 years. This trial reported that the use of Biobrane healed burn wounds, on average, in 1 day compared with SSD in 2.4 days. In the three-way comparison, the authors reported that the biosynthetic dressings had a shorter wound healing time than SSD. One of the six studies examined the number of dressing changes and reported that biosynthetic dressings required fewer dressing changes than SSD. Three studies investigated wound infection, which did not describe the treatment protocol clearly. There were no reports of infection with biosynthetic dressings, and there was one report of mild cellulitis with SSD. The Cochrane Collaboration concluded that there is consistent evidence that biosynthetic dressings are more effective than SSD; however, there were a limited

number of studies, small sample sizes, and an unclear age population.

Another Cochrane Collaboration (Storm-Verslott, Vos, Ubbink, & Vermeulen, 2010) investigated topical silver for preventing wound infection in children with partial-thickness burns Storm-Verslott et al., 2010). Two of 26 total RCTs looked into the comparison of SSD and Biobrane, which included 95 adult patients with partial-thickness burns collectively. There was not a significant difference in infection rate, but there was a significant difference in wound healing rate. Both studies reported that Biobrane had a shorter wound healing rate than SSD by a difference of 5–7 days. This systematic review concluded that Biobrane is more effective than SSD in regard to wound healing; however, results were concluded from a small, adult population group.

A systematic review and meta-analysis of RCTs examined nonsilver treatment compared with SSD in children with partial-thickness burns (Rashann et al., 2014). Two studies individually looked at the comparison of Biobrane and SSD, whereas one study compared two biosynthetic dressings (Biobrane and Transcyte) and SSD in a three-way comparison. One hundred thirty-two children with less than 15% total burn surface area of partial-thickness burn were evaluated collectively in all three studies. The mean age was 3.3 years for two of the studies; one study did not report the age population. Collectively, the studies reported that Biobrane had shorter wound healing and a reduced number of dressing changes compared with SSD. Infection rates were similar, but the results did not report what defined infection. These were based solely on clinical judgment.

Vloemans et al. (2014) investigated optimal treatment for partial-thickness burns in children in a systematic review. Two RCTs of Biobrane versus SSD were found and included 58 patients with an average age of 3.3 months. The investigators discovered that Biobrane had shorter healing time and fewer dressing changes compared with SSD. However, no infection rates were reported. This review also included two noncomparative studies evaluating Biobrane to SSD that were mostly descriptive in nature and concluded that Biobrane was effective and suitable for partial-thickness burns in children. The investigators concluded that there is consistent evidence that Biobrane is superior in regard to shorter healing time and fewer dressing changes. Limitations of this review include the small sample sizes and that research was conducted in the Netherlands, potentially limiting the relevance to the standard of practice in the United States.

A similar systematic review specifically examined bioengineered dressings for the management of burns (Pham, Greenwood, Cleland, Woodruff, & Maddern, 2007). Three of 20 RCTs studied Biobrane compared with SSD in 161 patients, with most of the sample being children. Another RCT of 58 pediatric patients compared Biobrane, Transcyte, and SSD for the treatment of partial thickness burns. Collectively, these RCTs found Biobrane more efficacious than SSD with significantly fewer dressing changes. Healing time and infection rates were not reported. These studies suggest that the use of Biobrane is superior than that of SSD because of ease and safety of use; however, this evidence is based on small sample sizes and international research.

Another systematic review examined the use of topical silver agents for treating burn wounds (Aziz, Abu, & Chong, 2012). Two RCTs studied SSD and Biobrane. These included 78 patients in Malaysia with partial-thickness burns. The mean age was 21.3 years. Both studies favored Biobrane for wound healing time; however, there was no statistical significance in infection between the groups. Biobrane proved to be more effective than SSD in wound healing time in adults; this may not be generalizable to the pediatric population. In addition, the study was based out of Malaysia, so the findings may not be applicable for U.S.'s burn treatment standards of care.

Biobrane has been praised for its tolerability and its ability to mimic human dermal skin by providing a barrier, moisture, and elasticity (Rahmanian-Schwarz et al., 2011). A quasi-experimental study of 34 adult patients with partial-thickness burns to their hands or face reported that Biobrane correlated more with a patient's skin (Rahmanian-Schwarz et al., 2011). A retrospective study highlighted Biobrane's ease of use for its excellent elasticity, especially burned skin involving joints (Lesher et al., 2011). It also noted its ability to detect early infection and burn wound assessment because of its transparency (Lesher et al., 2011).

There have been two case reports of permanent scarring from the use of Biobrane dressings. These included an 18-year-old man and a three-year-old child who experienced 16% and 25% total burn surface area of a partial-thickness burn, respectively (Ahmadi & Williams, 2009; Whitaker, Prowse, & Potokar, 2008). Each was noted to have punctate scarring that corresponded with the pores of the Biobrane dressing that were still present at a 10-month follow-up. Another case study discussed a 3-year-old with 60% partial-thickness burns that were treated daily with SSD who developed propylene toxicity (Willis et al., 2013). Prolonged exposure to SSD can cause metabolic acidosis, which may lead to renal failure.

EVALUATION/OUTCOME

This literature review highlights good evidence in the adult population but limited high-quality evidence in

the pediatric population to confirm the effectiveness of Biobrane compared with SSD in partial-thickness burns in regard to fewer dressing changes, improved healing time, and reduced wound infections. However, the evidence does show consistent findings despite small sample sizes. Some evidence exists showing Biobrane's ease of use and improved healing time when compared with SSD. There is some evidence from small, poor-quality trials that SSD and Biobrane were comparable in infection rates, but most of the studies lacked guidelines in defining an infected burn wound. The differences in children's dermal layer as compared with adults limit the applicability of the current findings, which have shown the superiority of Biobrane to SSD because many of the trials had a mixed population of pediatrics and adults. Most of the research was conducted outside the United States, so the results may not be suitable for U.S.'s burn guidelines. Further research is needed to evaluate the use of Biobrane versus SSD in children to clearly define wound infections and expected time to epithelial growth and update burn care guidelines.

ROLE OF THE Advanced Practice Nurse

AC-PNPs are becoming vital providers in the inpatient and specialty department clinics. The role of the AC-PNP continues to evolve and expand, allowing the AC-PNP to treat critical complex pediatric patients, such as burn victims. Patients with pediatric burn are typically followed by a surgical team for the treatment of their burns. AC-PNPs work alongside surgeons in assessing, diagnosing, and treating children. The AC-PNP provides family-centered care; they may afford more time to address anticipatory guidance, educational support, and patient and family teaching. In fact, Kline, Reider, Rodriquez, and Van Roeyen (2007) reported that 90% of surgeons believed the NP role helped improve communication between the surgical team and their patients. The surgical AC-PNP must remain current on the evidence-based management for pediatric burns to ensure the provision of superior quality care to promote optimal patient outcomes. As the treatment for pediatric burns continues to improve, the surgical AC-PNP should maintain expertise in wound management including understanding options, appropriate use, technique, and side effects and developing evidence-based standards of practice to guide staff and educational tools for families. Burn management can be complex and requires meticulous care to ensure optimal patient outcomes. With advances in burn treatment, the surgical AC-PNP is instrumental in providing high-quality, cost-effective care to acute and critically ill children, which has served a vital role in the multidisciplinary team caring for children.

CONCLUSION

This review provides evidence that the use of Biobrane required fewer dressing changes, improved healing time, and reduced wound infection compared with SSD; however, most of the studies were conducted with small pediatric populations. The presence of the surgical AC-PNP provides comprehensive medical and burn management and promotes continuity of care to children and their families. The expansion of the AC-PNP is a vital participant in the care of the pediatric burn victim. Future research is necessary to investigate Biobrane and SSD with larger pediatric sample sizes to establish its effectiveness and provide high-quality evidence for the treatment of pediatric partial-thickness burns.

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