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Dressed for success? Silver impregnated nanocrystalline dressing for initial treatment of giant omphalocele☆

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ABSTRACT

Objective: The purpose of this study was to describe outcomes and resource utilization in patients treated with twice-weekly silver impregnated (SI) nanocrystalline dressings for initial non-operative management of giant omphalocele (GO).
Methods: A retrospective review of patients with GO treated with SI dressings was undertaken. Clinical parameters, cost, and complications were recorded.
Results: Five patients with GO were treated with SI dressings between 2014 and 2016. Clinical characteristic (mean ± SD) included gestational age 36 ± 4 weeks, birth weight 2.6 ± 0.63 kg, GO size 10.2 ± 4.7 cm, ventilator days 7.5 ± 8.7 d, days in NICU 41 ± 20 d, days to full feeds, 30 ± 15 d, and LOS 62 ± 41 d. The average in-hospital cost of SI dressings was $110 CAD/week. This is comparable to daily silver sulfadiazine dressings ($109CAD/week) which were used historically. All patients were discharged with once- or twice-weekly dressing changes. No ruptures occurred. There was one mortality secondary to pulmonary sepsis.
Conclusions: For initial non-operative management of GO, twice weekly SI nanocrystalline dressings is safe and effective. Use of SI dressings results in decreased handling of infants, reduced physician and nursing resource utilization, and favourable outcomes.
Level of evidence: IV (Retrospective Case Series).

Omphalocele is a congenital anomaly of the abdominal wall that occurs in 1 in 4000 to 6000 live births [1]. They can be classified as small, giant, or ruptured, and have a high rate of associated congenital abnormalities. Mortality is related to the size of the omphalocele as well as associated anomalies and can occur in up to13–25% of patients [1]. Giant omphalocele (GO) lacks a strict clinical definition, but is commonly described as a fascial defect > 5 cm or those containing liver [2]. GO presents a difficult clinical entity with abdominal-visceral disproportion, pulmonary hypoplasia, and the potential for associated congenital anomalies. Management strategies include both initial operative closure and delayed non-operative treatment. The latter aims to achieve escharization and may be combined with compression for gradual visceral reduction. However, no consensus exists on optimal management for GO [1,3]. Although there is no current standard of care, there is evidence to show that delayed non-operative management may lower mortality, decrease hospital stay, decrease time to full feeding, and avoid operative complications associated with early surgical closure [1,2,4–7].

A common non-operative strategy involves the application of topical silver sulfadiazine (SS) which has been shown to be inexpensive and effective [4,8,9]. The major disadvantage of this technique is the need for daily dressing changes. This is both resource intensive and can risk frequent disruption and damage to the underlying neoepithelium [3]. Recently, Oquendo et al. reported using silver impregnated (SI) dressings to treat GO, with the advantages of decreased frequency of dressing changes, ease of application, and broad-spectrum antimicrobial coverage [3]. Here we present our initial experience with use of SI nanocrystalline dressings to treat GO. The purpose of this study was to describe outcomes in GO patients treated with SI dressings.

1. Materials and methods

A retrospective study identified infants with GO who underwent delayed non-operative management with SI dressings at our institution between 2014 and 2016. Exclusion criteria were ruptured omphalocele

Abbreviations: GO, giant omphalocele; SI, silver impregnated; SS, silver sulfadiazine; LOS, length of stay.

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and patients treated with primary or initial staged surgical closure. Demographics included infant gender, gestational age, birth weight, maximal GO diameter and associated comorbidities. Data were also collected for ventilator days, days in neonatal intensive care unit (NICU), time to full feeds, LOS, type and timing of surgical closure, as well as dressing cost per patient.

1.1. Omphalocele management: silver impregnated nanocrystalline dressing protocol

The current technique being examined used a standardized protocol for initial dressing application and subsequent changes that was performed by an enterostomal therapist, the surgical team, bedside nursing, and eventually patient caregivers. The omphalocele and surrounding skin were first washed with sterile water. A protective barrier was applied (No-Sting barrier, 3 M, MN USA) to the skin around the wound. A SI nanocrystalline dressing (Acticoat Flex, Smith & Nephew, UK) was then saturated with amorphous hydrogel (Intrasite gel, Smith & Nephew, UK). The dressing was placed over the entire omphalocele defect. This was followed by the addition of sterile water-moistened gauze dressings which then was covered with a transparent film (Tegaderm, 3 M, MN, USA) dressing to maintain a moist wound environment. A self-adherent two-layer compression dressing (Coban 2 Lite 10 cm, 3 M, MN, USA) was then wrapped around the omphalocele, and the patient's waist and back to provide a moderate amount of circumferential compression to the wound with the goal of establishing and/or maintaining abdominal domain. When the patients were small, the inner layer of the Coban was replaced with soft-roll or cotton [Fig. 1]. The degree of compression was adjusted to prevent respiratory compromise, feed intolerance, or patient discomfort. Dressings were initially changed two to three times per week and ultimately decreased to weekly based on patient parameters, including wound size and drainage. Once dressing changes had decreased to twice per week or less and the patient was medically stable, they were discharged. Wounds were carefully monitored for infection in the outpatient setting. Dressing changes were performed by caregivers at home or in our outpatient clinic, depending on family comfort and complexity of the wound. Once neoepithelialization was complete and the wound stable, nanocrystalline dressings were discontinued. The two-layered compression dressing was continued until the time of surgical fascial closure. The stages of wound healing are shown in Fig. 2.

1.2. Delayed surgical closure

Surgical fascial closure was ultimately undertaken at the discretion of the treating surgeon. The standard practice at our institution is to wait until the patient is at least one year of age. Typically, the surgical goal is to achieve primary fascial closure, however repair with synthetic or biologic mesh is sometimes required. Typically, some of the redundant neoepithelial layer is excised and an effort may be made to use this to create a 'pseudo-umbilical' scar in the approximate position of a normal umbilicus.

2. Results

Five patients with GO were treated with SI dressings between 2014 and 2016. Patient characteristics are listed in Table 1. All patients were born by Caesarian. No omphalocele ruptures occurred. Comorbidities included patent ductus arteriosis ($n = 2$), ventricular septal defect ($n = 1$), transient pulmonary hypertension ($n = 1$), respiratory distress syndrome ($n = 1$), pulmonary hypoplasia ($n = 1$) and pulmonary interstitial emphysema ($n = 1$). In 2 patients, serum silver levels were measured after at least 2 weeks of SI treatment and found to be normal. There was one mortality secondary to pneumosepsis. By discharge all patients were receiving twice weekly dressing changes. The average in-hospital cost of SI dressings was $110 CAD/week, compared to $109CAD/week with our traditional standard of daily SS dressings. At present, two patients have had surgical fascial closure at 546 and 441 days, and the other two surviving patients are awaiting OR.

3. Discussion

There is increasing evidence to show that initial non-operative management of GO is safe and effective. A recent systematic review by Bauman et al. concluded that non-operative management with delayed closure should be considered the surgical standard for management of GO due to improved time to full feeds as well as reduced surgical morbidity compared to upfront primary surgical closure [1]. Initial

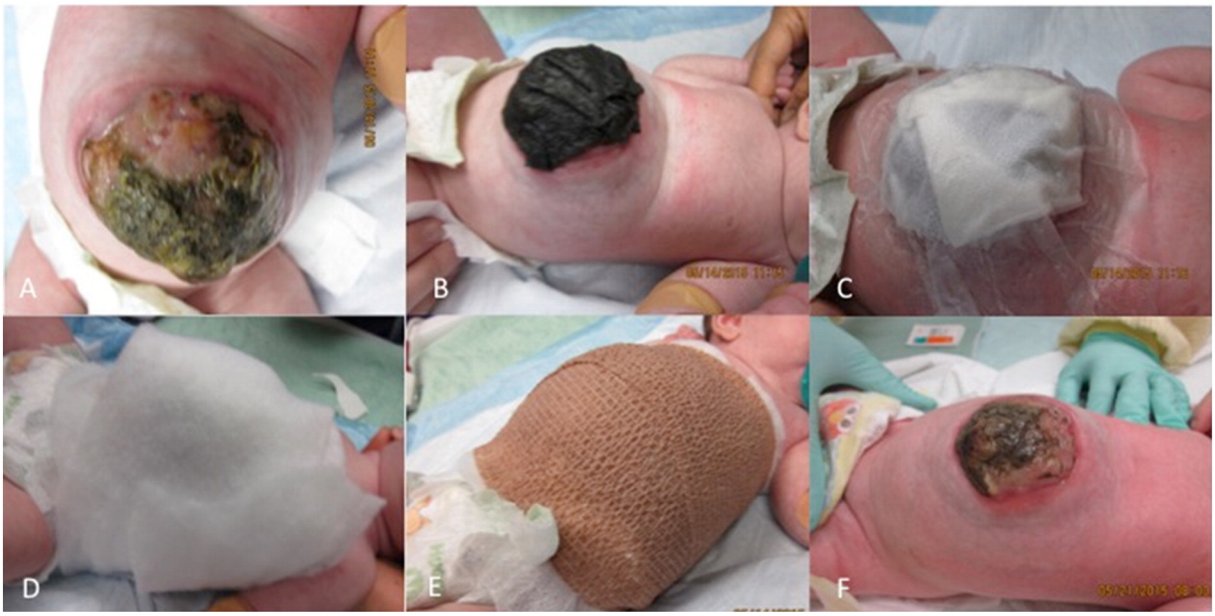

Fig. 1. Application of silver nanocrystalline dressing. The wound is cleaned with sterile saline or sterile water (A). It is important to rinse with sterile water as the nanocrystalline dressing can react with saline to form salt crystals. The silver nanocrystalline dressing is saturated with amorphous hydrogel, placed over the defect (B), and covered with water moistened gauze (C) and transparent wrap. A 2-layer compression wrap (D, E) is then applied. Within 1 week (F) the defect has already decreased considerably.