Int J Burn Trauma 2013;3(1):30-36
www.IJBT.org /ISSN:2160-2026/IJBT1212002

Original Article

Management of severe burn injuries with topical heparin: the first evidence-based study in Ghana

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Received December 12, 2012; Accepted January 8, 2013; Epub January 24, 2013; Published January 30, 2013

Abstract: Conventional therapy for burns has always produced a nightmarish illness for patients. The lack of the ability to prevent contractures often produces dysfunctional limbs and the ugly scars resulting from severe burns are an ongoing reminder of this lengthy painful illness. This study is to determine the effectiveness of topical heparin in burns management among some patients at the Burns Intensive Care Unit (BICU) of the Komfo Anokye Teaching Hospital (KATH), Kumasi, Ghana. Patients for this prospective study were burns victims who were transported to the Accident and Emergency Center of KATH. Complete clerking of the patients and related information were taken. Six patients with ages ranging from 5-35 years, TBSA 5-42% and a combination of 2° and 3° burns were enrolled in the case study. Anatomical locations of the burns included: face, neck, trunk and limbs. Using topical heparin produced smooth skin in two patients: Patients 3 and 5 who reported on Post-burn Day 85 and 116 at the BICU. Five out of the six patients assessed the degree of pain; before treatment with heparin, all five patients stated they were experiencing severe pains, however, three (60.0%) of the patients stated they experienced no pain at all while two (40.0%) were experiencing mild pain after topical heparin application. Heparin was observed to be very effective in the management of burn injuries in the patients studied. It was effective in reduction of pain and prevention of scars and contractures. However, due to the small number of patients and lack of control for the wound healing, a firm recommendation for the use of heparin therapy in burns cannot be made and further studies would be required to establish its use especially in the African population.

Keywords: Burns, topical heparin, pain, hospital stay, cost-effective

Introduction

Current treatment for second and third degree burns is complex, uncomfortable for the patient and expensive for the health systems [1-3]. There are approximately 1500 severe burns cases in Ghana each year, and a sizeable fraction of these burns occur in large-scale disasters caused by petrol related fires. Petrol-related fires, such as those instigated by an overturned fuel tanker, are particularly common in developing countries [4]. In the Burns Intensive Care Unit (BICU) of specialized and teaching hospitals in Ghana, severe burns treatment complication is very common. The lack of the ability to prevent contractures often produces dysfunctional limbs and the ugly scars resulting from severe burns are an ongoing reminder of this lengthy painful illness.

Even though heparin had been reported by many burn studies [5-11] in humans and animals that tested large doses of heparin topically and parenterally producing significant therapeutic results, BICUs in Ghana had not been able to utilize it. Findings in heparin treatment included: relieved pain, enhanced healing, and smooth skin. Fewer resuscitation fluids, fewer lung and intestinal complications, and fewer infections were reported [5-11]. These burn studies and additional ones revealed, and other non-burn studies confirmed, that heparin had anti-inflammatory, neoangiogenic, collagen-restoring and epithelializing effects in addition to its anticoagulating effects [12-19]. Smoke inhalation studies in sheep and a burn study in children found heparin used parenterally or by inhalation significantly reduced lung pathology [20].

Earlier in 2011, the BICU of Komfo Anokye Teaching Hospital (KATH), to alleviate contractures and ugly scars of burn patients, it was decided to have a case study in the management of burns using topical heparin. The study aimed at determining the effectiveness of topical heparin in burns management in terms of pain relief, time of healing, and nature of skin.

Materials and methods

Study setting

KATH in Kumasi is the second-largest hospital in Ghana and the only tertiary health institution in the middle belt of the country. It is the main referral hospital for the Ashanti, Brong-Ahafo, Northern, Upper East and Upper West Regions. The BICU is well equipped with modern instruments; three plastic surgeons and other health personnel manage the burns victims.

Patient management

The patients for this case study were burns victims who were transported to the Accident and Emergency Center of KATH and referred to the plastic team-on-duty who then admitted the patients to the BICU. Complete clerking of patients and standard burn therapy was initiated immediately; thus establish a clear airway and intravenous lines, take blood for laboratory tests and a blood coagulation panel, obtain vital signs, insert a urinary catheter, and do urinalysis, take a brief history, perform a quick physical examination, evaluate the burn and its size, and determine if heparin use is contraindicated. If heparin use is not contraindicated, then topical heparin therapy is commenced as soon as possible.

Patients or relatives of the patients gave their consent and were enrolled in the study. The study commenced in June 2011 after Ethical approval was obtained from the Committee on Human Research, Publications and Ethics of the School of Medical Sciences, Kwame Nkrumah University of Science and Technology and Komfo Anokye Teaching Hospital.

Topical heparin protocol

Protocol for topical heparin preparation and administration for the study was adopted from the protocol used by the Saliba Burns Institute [8–10, 21]. On Post-burn Day 1 total topical heparin dose is approximately 100,000 IU per 15% body surface area (BSA) burn size in three divided doses *(with a modification),* for 5 days at 9am, 3pm and 9pm each day. In this modification the same dosage is given for the first 2 days; Day 3 and Day 4 are also the same with 75% of that of Day 1 whilst Day 5 (the last day) is reduced to 50%. Each time administering is done in 3 cycles with 5-10 minutes interval, sprinkling the heparin on the burned surface from a gauge "#29" needle. For burns blisters the needle of a syringe filled with 5000 IU/ml heparin solution is inserted into the blister and a small hole made that allows the burn fluid to drain. Then slowly the heparin solution from the syringe is inserted into the blister. After the blister is filled and the solution begins to run out, injecting the heparin solution is continued. This creates a rinsing action. The blister is filled up and rinsed out approximately 3 times. This cycle is repeated two to three times at 5 to 10 minutes intervals. Heparin solution is left within the blister before removing the needle for the final time.

Case presentations

Patient #1

A 5 year-old boy collided with an adult who was holding a pot of hot soup, which accidently poured on him. He sustained second degree burns injuries on the right back torso, buttocks and posterior right thigh region; TBSA was 12%; average body temperature was 36-38°C; was treated with topical heparin and discharged within 7days (**Figure 1**).

Patient #2

A 26 year-old galamsey (local manual) miner was involved in a blast (explosion) at a mining site at Dunkwa-Offin in the Central Region of Ghana and was referred to KATH. He sustained a mixture of second and third degree extensive burns on the face, neck and anterior chest wall. Total BSA was 16%; average temperature was 37-39°C; was treated and transferred out to the normal burns ward within 14 days (**Figure 2**).

Patient # 3

A 24 year-old sales woman was burning rubbish when accidentally there was a sudden blast

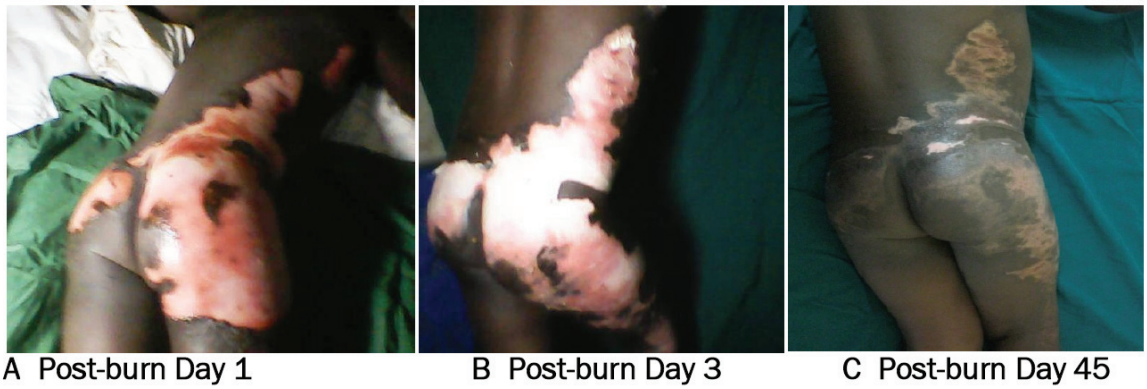

Figure 1. Scald burns in a 5 year-old boy.

Figure 2. Second and third degree burns in a 26 year-old man.

Figure 3. Facial burns in a 24 year-old woman.

from the burning rubbish which led to her sustaining superficial partial thickness burns on the face, left anterior knee and right anterior arm. TBSA was 8%; average temperature 36.5-37.5°C. She was treated with topical heparin and discharged home within 3 days. For the next 2 days she came to the BICU for the rest of heparin therapy which was given in one dose only (**Figure 3**).

Patient #4

A 44 year old man engaged in trading sustained superficial partial thickness gunpowder burns when he lighted a match to the gun powder to destroy it. The gunpowder got exploded burning his face, left forearm and hand. He then applied cooking oil and eggs on the burnt areas and later came to KATH for further medical atten-

Figure 4. Superficial burns in a 44 year-old man.

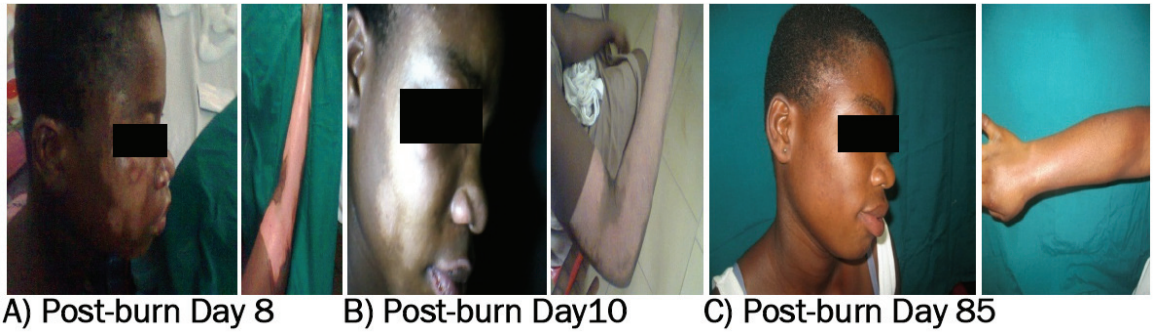

Figure 5. Flame burns in 17 year-old student.

Figure 6. Flame burns in a 35 year-old man.

tion. TBSA was 10% and the estimated TBSA for topical heparin (face) was 4%. He was treated with topical heparin for 5 days on OPD bases (**Figure 4**).

Patient # 5

A 17 year-old Senior High School female student pursuing Home Economics as a course of study incurred gas burn injuries in the face and the right upper limb, TBSA totaling about 10% while baking during her practical session. She was rushed to a nearby clinic where she began the usual treatment for burns. Two days later she was referred to our hospital on the request of her father. She began topical heparin treatment the following day (**Figure 5**).

Patient # 6

A 35 year-old cocoa farmer who sustained second and third degree burns to his face, arms,

Table 1. Results for Pain Grading

Patient	Pre-heparin application	Post- heparin application
#2	1	3
#3	1	4
#4	1	4
#5	1	4
#6	1	3

neck and upper anterior torso after he was caught in a petrol fire. TBSA was 42%. He had topical heparin therapy to the face (**Figure 6**).

Pain scale

Patients were made to grade the degree of pain they felt on a scale of 1-4, before and after the treatment with heparin by means of questionnaire: 1- Severe, 2- Moderate, 3- Mild, 4- No pain (**Table 1**). Before treatment with heparin, all five patients stated they were experiencing severe pains. However, three (60.0%) of the patients experienced no pain at all while two (40.0%) stated they experienced mild pain after topical heparin application.

Due to the age of Patient # 1 (5 years old), he was not made to answer the questionnaire because of his inability to understand the objective of the questionnaire.

Discussion

Burns are painful maladies. The known suffering and sequelae of burn victims in a thermal disaster defies description. Burn sequels affect life quality and produce longstanding emotional and social impacts in the patients. The development of new treatment resources could modify this picture. In this study, a new treatment approach using topical heparin was used to relieve pain, enhance healing, and produce smooth skin in the BICU of KATH.

Patients in the study were brought in the BICU in severe pains and in poor conditions. Conventional treatment of burns would have taken longer period to manage the pain, initiate healing (re-epithelization) and alleviate the formation of scars. Pain conditions in the patients were quickly alleviated with each passing day, hence patients in this topical heparin study reported less pain while consuming less analgesic medication as compare to patients in similar conditions who were treated with the conventional approach (high dosage of analgesic medication), with the normal management routine in the BICU. A number of studies in different parts of the world had also confirmed the effect of heparin in terms of pain relief [22-24].

According to the reports of Peplow and Wang et al., a persistent inflammation with the accumulation of large numbers of neutrophils is characteristic of chronic wounds. Secretory products released from these cells, such as elastase, cathepsin G and proteinases, are detrimental to wound healing because they degrade the extracellular matrix and growth factors and further recruit neutrophils to the wound area. Heparin and related molecules are thought to inhibit the action of these secretory products via electrostatic interactions [25, 26]. Even, skin pigmentation started as early as Day 7 for some of the patients coupled with a well smooth skin. In the BICU of KATH, elevated body temperature and chill are common symptoms associated with the patients; however making a conclusion based on only 6 cases reports would not be valid.

The comparative study of topical heparin and conventional treatment of Barretto et al., conducted at Hospital de Restauração in Brazil confirmed the similar findings of this study, stating that, “fever was less in the topical heparin group, while, the incidence of local septicemia infection was equal in both groups” [22]. This indicates that topical heparin system did not result in increasing the incidence of local or systemic infections, despite lesions being left uncovered (especially the facial part).

Heparin is affordable and may be economically advantageous for the health system and more comfortable to the patient. Finally, due to characteristics of sprayed topical heparin treatment system (simplicity and comfort), its incorporation to burn treatment centers’ routine may be advantageous for the patient.

Conclusion

Topical heparin was observed to be very effective in the management of burns injuries. It was effective in the alleviation of pains. Also time spent by patients during admission reduced

making it less costly for the patients. The patients involved in this case reports significantly benefited from the topical application of heparin. However, due to the small number of patients and lack of control for the wound healing, a firm recommendation for the use of heparin therapy in burns cannot be made and further studies would be required to establish its use especially in the African population.

Acknowledgement

We wish to thank Miss Elizabeth Anthony for helping in collecting the data. We also sincerely thank the KATH BICU nurses under the leadership of PNO Alice Aluwah-Blay for administering the topical heparin to the patients; likewise we sincerely thank Dr. Michael Saliba for his encouragement and advice on the heparin therapy.

Conflict of interest statement

All authors have declared no conflicts of interest.

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References

[1] Piccolo NS, Correa MD, Amaral CR, Leonardi DF, Novaes FN, Prestes MA. Sociedade Brasileira de Cirurgia Plástica. In: Projeto Diretrizes. Associação Médica Brasileira. Conselho Federal de Medicina. [citado 2 mar 2009]. Disponívelem: http://www.projetodiretrizes.org.br/projeto_diretrizes/083.pdf.

[2] Klein MB, Hollingworth W, Rivara FP, Kramer CB, Askay SW, Heimbach DM, Gibran NS. Hospital costs associated with pediatric burn injury. J Burn Care Res 2008; 29: 632-7.

[3] Sanchez JL, Bastida JL, Martínez MM, Moreno JM, Chamorro JJ. Socioeconomic cost and health related quality of life of burn victims in Spain. Burns 2008; 34: 975-81.

[4] Agbenorku P. In: Morbidity and mortality data-Kumasi: 1st Ghana Burn Conference 2008/ launch of Ghana Burn Association. Theme: prevention and management of burns in Ghana: are we doing it right; 2008.

[5] Saliba MJ Jr. Heparin in the treatment of burns. JAMA 1967; 200: 650.

[6] Saliba MJ Jr, Griner LA. Heparin efficacy in burns. I. Significant early modification of experimental third degree guinea pig thermal burn. Aerospace Med 1970; 41: 179-87.

[7] Saliba MJ Jr. Heparin efficacy in burns II. Human thermal burn treatment with large doses of topical and parenteral heparin. Aerospace Medicine 1970; 41: 1302-6.

[8] Saliba MJ Jr, Dempsey WC, Kruggel JL. Large burns in humans, treatment with heparin. JAMA 1973; 225: 261-9.

[9] Saliba MJ Jr. Heparin, nature's own burn remedy? Emergency Medicine 1973; 106: 111.

[10] Saliba MJ Jr, Saliba JR. Heparin in burns: dose related and dose dependent effects. Thromb Diath Haemorrh 1975 Feb 28; 33: 113-23.

[11] Mangus DJ, Falces E, Gilchrist DR. Heparinization and the use of culture-specific antibiotic liquids in the treatment of large burns. In: Proceedings 2000; 8: 127-146.

[12] Saliba MJ. Proceedings, Effects of heparin in the treatment of burns: International meeting. Edited by Dr Saliba, Saliba MJ Jr. San Diego, CA, USA, 1994, pp. 3-8, 15-68.

[13] Saliba MJ Jr. The effects and uses of heparin in the care of burns that improves treatment and enhances the quality of life. Acta Chir Plast 1997; 39: 13-6.

[14] Zapata-Sirvant RL, Hansbrough JF, Greenleaf GE. Reduction of bacterial translocation and intestinal structure alterations by heparin in a murine burn injury model. J Trauma 1994; 36: 1-6.

[15] Azizkhlan RG, Azizkhkan JC, Zetter BR, Folkman J. Mast cell heparin stimulates migration of capillary endothelial cells in vitro. J Exp Med 1980; 152: 931-44.

[16] Folkman J, Shing Y. Control of angiogenesis by heparin and other sulfated polysaccharides. Adv Exp Med Biol 1992; 313: 355-64.

[17] Hiebert LM, Lui JM. Heparin protects cultured arterial endothelial cells from damage by toxic oxygen metabolites. Arteriosclerosis 1990; 83: 37-51.

[18] Lantz M, Thysell H, Nilsson E, Olsson I. On the binding of tumor-necrosis-factor (TNF) to heparin and the release in vivo of the TNF-binding protein I by heparin. J Clin Invest 1991; 88: 2026-31.

[19] Griffin MP, Gore DC, Zwischenberger JB. Does heparin improve survival in experimental porcine gram-negative shock? Circ Shock 1990; 31: 343-49.

[20] Wright JP, Massop DW, Furst JG, Durham JR, Smead WL. Pre-ischemic heparinization decreases rat skeletal muscle reperfusion injury. J Cardiovasc Surg 1991; 32: 2-5.

[21] Saliba MJ Jr. Heparin in the treatment of burns. 2011. http://www.salibaburnsinstitute.org/PROTOCOL.html.
[22] Barretto MGP, Costa MGN, Serra MCF, Afiune JB, Praxedes HEP, Pagani E. Comparative study of conventional and topical heparin treatments for burns analgesia. Rev Assoc Med Bras 2010; 56: 51-5.
[23] Bonilla A, Saravia M, Zayas G. The introduction of a new method of treatment in burns in El Salvador. Rev Assoc Med Bras 2000; 11: 41-5.
[24] Troshev K. Application of heparin in the treatment of burns in Bulgaria. Rev Assoc Med Bras 2000; 11: 46-50.
[25] Peplow PV. Glycosaminoglycan: a candidate to stimulate the repair of chronic wounds. Thromb Haemost 2005; 94: 4-16.
[26] Wang J, Zheng H, Qiu X. Modulation of the intestinal response to ionizing radiation by anticoagulant and non-anticoagulant heparins. Thromb Haemost 2005; 94: 1054-9.