



Case report

Treatment of severe extravasation injury in a newborn by using tilapia fish skin: A case report

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ABSTRACT

Introduction and importance: Peripheral venous catheterizations in newborns are associated with complications such as infections, phlebitis, vessel rupture and drug leaks or serum. Extravasation injury refers to the leakage of injected drugs from blood vessels causing damage to the surrounding tissues, skin necrosis, and sometimes amputation. Using tilapia fish skin (TFS) is one of the new strategies that have been used in wound management. **Case presentation:** This case is a 36-week- and 4-day-old male fetus with a birth weight of 1600 g, height of 40 cm, and head circumference of 31 cm who was born to a 25-year-old mother by cesarean section at Mahzad Obstetrics and Gynecology Hospital, Urmia, Iran. On the third day of hospitalization at neonatal intensive care unit (NICU), an extravasation injury occurred in the infant's left hand in size approximately 1 × 1 cm by peripheral catheter. Despite extensive intravenous antibiotic therapy and rinsing with normal saline, wound healing was not achieved. The necrotic area was bandaged by using of the tilapia skin. For this purpose, the area was first washed with normal saline for 5 min and then the tilapia skin was placed on the damaged skin for 10 days. After a month, the newborn's wound had completely healed.

Clinical discussion: Infants are more prone to extravasation injury than adults due to being more sensitive and thinner peripheral vessel walls.

Conclusion: This case illustrates that tilapia fish skin may be a suitable alternative to other temporary skin cover dressings in premature newborns suffering from extravasation injury.

1. Introduction

In the United States, approximately 400,000 newborns are admitted to the Neonatal Intensive Care Unit (NICU) each year [1]. A study has shown that 12% of newborns are hospitalized in NICUs and the survival rate of newborns is increased if they are hospitalized in these wards [2].

Infants, especially premature newborns, need an environment that is equipped with advanced medical technology and specialized nursing care in order to survive, but unfortunately, this environment inadvertently endangers the baby's organs [3]. In the NICU, the insertion of an intravenous catheter is a common procedure for venipuncture, blood pressure measurement, and administering intravenous fluids, or intravenous nutrition and medication [4]. Approximately 95% of peripheral venous catheters are removed due to complications such as infections,

phlebitis, vessel rupture and drug leaks or serum. Extravasation injury is one of the most important complications of peripheral catheter insertion [5]. Extravasation injury refers to the leakage of injected drugs from blood vessels causing damage to the surrounding tissues, skin necrosis, and sometimes amputation [5]. Treatment is performed according to the appearance and symptoms of the surrounding tissue and skin, and the degree of extravasation [6].

Innovative treatment methods are needed for wound management [7–8]. Using tilapia fish skin (TFS) is one of the new strategies that have been used in wound management [9]. The researchers found that TFS provides all of the ingredients the skin needs to heal: moisture, type 1 collagen, and some resistance to bacterial colonization [10]. In addition, tilapia skin reduces patients' pain and patients need less pain medication [6]. The combination of these features and previous reports led us to

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Fig. 1. Extravasation injury in the newborn.



Fig. 2. Using tilapia skin in the necrotic area.



Fig. 3. The necrotic area two weeks after dressing with tilapia skin.



Fig. 4. The necrotic area one month after dressing with tilapia skin.

trial TFS in a severe case of extravasation injury in a premature newborn. This case report was reported according to the SCARE 2020 Guidelines to ensure the quality of reporting [11].

2. Case presentation

This case is a 36-week- and 4-day-old male fetus with a birth weight of 1600 g, height of 40 cm, and head circumference of 31 cm who was born to a 25-year-old mother by cesarean section at Mahzad Obstetrics and Gynecology Hospital, Urmia, Iran. The newborn's vital signs at birth were as follows: Temperature (T): 36.7, heart rate (HR): 165 bpm, respiration rate (RR): 54 bpm, blood pressure (BP): 62/24 mm Hg, oxygen saturation: 97%. The mother had a history of a normal delivery at the age of 21. She also belongs to an extended family with moderate socioeconomic status. During this pregnancy, she had regularly visited a gynecologist for health examinations, during which the fetus was found to be in perfect health on the color Doppler ultrasound. She had no history of drug taking and denied a history of smoking, alcohol, and drug abuse. Moreover, she did not state any history of diseases. The newborn was hospitalized to the NICU ward and a peripheral intravenous (IV) catheter (a purple catheter in the newborn's left hand) was inserted to receive necessary fluids and electrolytes, intravenous nutrition, and medications. The newborn received intravenous antibiotics, including Gentamicin 4.5 mg BID, Ampicillin 120 mg BID, and Cefotaxime 100 mg BID. On the third day of the infant's hospitalization, the neonatal nurse notices necrosis of the IV line area and report the issue immediately. An extravasation injury occurred in the infant's left hand in size approximately 1×1 cm by peripheral catheter (Fig. 1). Despite extensive intravenous antibiotic therapy and rinsing with normal saline, wound healing was not achieved. After obtaining informed consent from the newborn's parents and coordination with the newborn's physician, our treatment team bandaged the wound using tilapia skin. For this purpose,

the skin of tilapia was obtained by sharp and blunt dissection from the underlying muscles and washed with a sterile normal saline solution to remove any trace of blood and other impurities. The skin sample was placed into a sterile normal saline solution. Sterilization procedure was carried out using 2% chlorhexidine gluconate. The area was first washed with normal saline for 5 min and then the tilapia skin was placed on the damaged skin for 10 days (Fig. 2). During this period, the newborn also received antibiotic therapy. After two weeks, the wound was relatively healed (Fig. 3). After a month, the newborn's wound had completely healed (Fig. 4).

3. Discussion

Since the immune system is not well developed in infants, the ability to fight microorganisms is not well formed. Therefore, infections in infants will be much more dangerous than in adults [12]. With the least damage, the integrity of the skin will be severely affected, and the germs that live naturally on human's skin can easily enter the bloodstream and cause septicemia [13]. Moreover, infants are more prone to extravasation injury than adults due to being more sensitive and thinner peripheral vessel walls [5].

TFS has non-infectious microbiota, large amounts of type I collagen, and a morphological structure similar to human skin. Therefore it is one of the new strategies that have been used in wound management [10]. The smell of tilapia fish is also removed. The considerable superiority is that tilapia, implemented as an occlusive dressing, is left in place for around 10 days under a bandage [6]. TFS has been suggested as an option of biological material "as a potential xenograft" for the management of burns wounds. TFS led to improvements in the healing process and no relevant changes in hematological and biochemical parameters [9–10].

Consistent with this study, Costa et al. in a case report had used

tilapia skin to dress a burn wound of a three-year-old boy who had suffered burns of his face, chest and abdomen by boiling water. They rinsed the burn area with normal saline before using the TFS and a total of 12 layers of skin were placed on it, after 10 days, the burn area was repaired completely [9]. In another study, tilapia skin was used for dressing to heal skin lesions, and the results showed that the burn area after dressing with tilapia skin was completely healed [14]. Moreover, Lima et al. in a clinical trial showed that dressing with tilapia skin can have a significant effect in treating skin integrity damage [15]. Most studies have shown that the age range of cases who have already been dressed with tilapia fish skin is above 3 years old [14,15]. This may be the youngest patient reported in the literature.

One of the advantages of this method is the great adhesion capacity of the tilapia skin. The fish skin is placed once on the surface of the burnt skin and removed at the end of the treatment period. The average duration of treatment is between 9 and 12 days and the burns are less in this method [16].

4. Conclusion

Repairing skin damage caused by extravasation injury in infants is one of the major challenges in many countries. As a result of the extraordinary effect of tilapia skin on the skin damage healing of the newborn as well as its ease of implementation and inexpensiveness, TFS may be a suitable alternative to other temporary skin cover dressings in premature newborns suffering from extravasation injury. However, further studies in a wide range of the population are needed over a longer period of time.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Provenance and peer review

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Ethical approval

All ethical principles were considered in conducting this case report. All patient information kept confidential.

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CRedit authorship contribution statement

NF, RA, MGH, BM and RG contributed in data collection, manuscript drafting and reviewing, and approval of final manuscript. RG and NF have contributed in case management, data collection, manuscript drafting and reviewing, and approval of final manuscript. RG performed the study supervision.

Declaration of competing interest

None.

References

- [1] T. Mendelson, C. McAfee, A.J. Damian, A. Brar, P. Donohue, E. Sibinga, A mindfulness intervention to reduce maternal distress in neonatal intensive care: a mixed methods pilot study, *Arch. Womens Ment. Health* 21 (6) (2018 Dec) 791–799, <https://doi.org/10.1007/s00737-018-0862-x>.
- [2] V.C. Smith, J. Stewart, in: S.A. Abrams (Ed.), *Discharge Planning for High-risk Newborns*. UpToDate, 2020 Jun 24.
- [3] K.G. Williams, K.T. Patel, J.M. Staumire, C. Bridges, M.W. Mathis, J.L. Barkin, The neonatal intensive care unit: environmental stressors and supports, *Int. J. Environ. Res. Public Health* 15 (1) (2018 Jan) 60, <https://doi.org/10.3390/ijerph15010060>.
- [4] R. Goli, S. Zafarmokhtarian, M. Ghalandari, N. Babakeshi-Sheythanabad, S. Rostami, H. Farajollahi, Pneumothorax as a rare complication of peripherally inserted central catheter (PICC) in neonates: a case report study, *Int. J. Surg. Case Rep.* 1 (88) (2021 Nov), 106472, <https://doi.org/10.1016/j.ijscr.2021.106472>.
- [5] S. Atay, S. Sen, D. Cukurlu, Incidence of infiltration/extravasation in newborns using peripheral venous catheter and affecting factors, *Rev. Escola Enfermagem USP* 4 (2018 Oct) 52, <https://doi.org/10.1590/S1980-220X2017040103360>.
- [6] V. Boyar, C. Galiczewski, Efficacy of dehydrated human amniotic membrane allograft for the treatment of severe extravasation injuries in preterm neonates, *Wounds* 30 (8) (2018 Aug 1) 224–228.
- [7] N. Parizad, K. Hajimohammadi, R. Goli, Surgical debridement, maggot therapy, negative pressure wound therapy, and silver foam dressing revive hope for patients with diabetic foot ulcer: a case report, *Int. J. Surg. Case Rep.* 1 (82) (2021 May), 105931, <https://doi.org/10.1016/j.ijscr.2021.105931>.
- [8] K. Hajimohammadi, N. Parizad, A. Hassanpour, R. Goli, Saving diabetic foot ulcers from amputation by surgical debridement and maggot therapy: a case report, *Int. J. Surg. Case Rep.* 1 (86) (2021 Sep), 106334, <https://doi.org/10.1016/j.ijscr.2021.106334>.
- [9] B.A. Costa, E.M. Lima Júnior, M.O. de Moraes Filho, F.V. Fachine, M.E. de Moraes, F.R. Silva Júnior, et al., Use of tilapia skin as a xenograft for pediatric burn treatment: a case report, *J. Burn Care Res.* 40 (5) (2019 Aug 14) 714–717, <https://doi.org/10.1093/jbcr/irz085>.
- [10] E.M. Lima Júnior, M.O. de Moraes Filho, B.A. Costa, F.V. Fachine, M.L. Vale, A. K. Diógenes, K.R. Neves, et al., Nile tilapia fish skin-based wound dressing improves pain and treatment-related costs of superficial partial-thickness burns: a phase III randomized controlled trial, *Plast. Reconstr. Surg.* 147 (5) (2021 Apr 27) 1189–1198, <https://doi.org/10.1097/PRS.00000000000007895>.
- [11] R.A. Agha, T. Franchi, C. Sohrabi, G. Mathew, A. Kerwan, A. Thoma, et al., The SCARE 2020 guideline: updating consensus surgical CAse REport (SCARE) guidelines, *Int. J. Surg.* 1 (84) (2020 Dec) 226–230, <https://doi.org/10.1016/j.ij-su.2020.10.034>.
- [12] N. Parizad, N. Faraji, A. Hassanpour, R. Goli, S. Rostami, A. Amanollahzadeh, Cyclopia, a newborn with a single eye, a rare but lethal congenital anomaly: a case report, *Int. J. Surg. Case Rep.* 1 (88) (2021 Nov), 106548, <https://doi.org/10.1016/j.ijscr.2021.106548>.
- [13] S. Thapa, L.B. Sapkota, Changing trend of neonatal septicemia and antibiotic susceptibility pattern of isolates in Nepal, *Int. J. Pediatr.* 6 (2019 Feb) 2019, <https://doi.org/10.1155/2019/3784529>.
- [14] E. Lima, M. Moraes, B. Costa, A. Uchôa, C. Martins, M. Moraes, et al., Treatment of deep second-degree burns on the abdomen, thighs, and genitalia: use of tilapia skin as a xenograft, *Rev. Bras. Cir. Plást.* 35 (2) (2001 Jan 1) 243–248.
- [15] E.M. Lima Júnior, M.O. De Moraes Filho, B.A. Costa, A.V. Rohleder, M.B. Sales Rocha, F.V. Fachine, A.J. Forte, et al., Innovative burn treatment using tilapia skin as a xenograft: a phase ii randomized controlled trial, *J. Burn Care Res.* 41 (3) (2020 May 2) 585–592, <https://doi.org/10.1093/jbcr/irz205>.
- [16] M. Osama, Use of Nile tilapia (*Oreochromis niloticus*) skin in the management of skin burns, *J. Pak. Med. Assoc.* 67 (12) (2017 Dec 1) 1955.