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Role of high ligation in high tension electric burn

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Abstract: Electric burns constitute 4%-6.5% of all burn cases in the western world and 24.49% in India (1,2). High tension burns often requires limbs amputations, the amputation rate reported in high-tension electrical burn injuries ranges from 10% to 68% (2). Amputations of a limb in electric burn patients require special consideration of high ligation of vessels because of progressive necrosis due to vascular injury and prolonged production of thromboxane with electric burns. High ligation of vessels significantly decreases the secondary haemorrhage chances. We do routinely perform high ligation in all cases of high-tension electric burn requiring limb amputation.

Keywords: High ligation, Electric burn, Amputation.

Introduction: Electric burns constitute 4%-6.5% of all burn cases as per the American Burns association repository report 2011(4). Whereas in India it constitutes around 24.49% which is quite significant when compared to other parts of the world (3). It is classified as high-voltage (>1000kilowatt) or low-voltage (<1000kilowatt). High voltage electric burn results in more tissue damage than low tension electric burn, which often requires surgical interventions. Tissue destruction in the high-tension electric burn is severe and progressive in nature because of vascular injury and prolonged production of thromboxane induced by the electric current resulting in the requirement of serial debridement and even amputation of the affected limb (4). The most destructive indirect injury occurs when a victim becomes part of an electrical arc. An electrical arc is a current spark formed between two objects of differing potential that are not in contact with each other, usually a highly charged source and a ground. In arcing circumstances, burns may be caused by the heat of the arc itself, electro thermal heating due to current flow, or by flames from clothing (5).
Trauma is the leading cause of upper limb amputations, accounting for 80% of acquired amputations followed by cancer, tumours and vascular complications of diseases. (6) Amputation of a limb in case of trauma and tumour requires ligations of vessels just proximal to the surgical site (6). In the literature, the amputation rate reported in high-tension electrical burns range from 10% to 68%.(3)

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Electric current passes through the highly-resistant skin tissue and then spreads out through the underlying tissues with less resistance. Electric current passes more from least resistant tissue resulting in more injuries to tissues with the least amount of resistance. Therefore, skin burns can appear mild but the internal tissues and organs are severely damaged (7).

Blood vessels being one of the least resistant tissues suffer more damage leading to confusion to the level of amputation of a limb in the electric burn. In addition, there is progressive necrosis of tissue due to prolonged production of thromboxane induced by the electric current (4). Also, there are more chances of sepsis in electrically burnt patients. All the factors contribute to increased difficulty in the management of these patients and higher rates of limb amputations. Serial amputations/debridement of affected body parts are based clinically on the progression of necrosis but there are chances of more bleeding in these cases if ligation of the feeding vessel is not performed at the proximal site. With high ligation of vessels, the chances of bleeding post-operatively decrease. We do perform high ligation of vessels in all cases of electric burn patients requiring amputation.

Method and material: We, in our centre, follow the method of high ligation of arteries while performing limb amputations in electric burn patients. we performed high ligation of axillary artery in 4 cases, Brachial artery in 8 cases, and ulnar-radial artery in 4 cases during Sep 2019 till Sep 2021 in cases of electric burn patients. None of the patients had any vascular complications in the post-op period.

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Amputation level	No. of patients (n=16)	Artery ligated	Post-op Bleeding
Shoulder disarticulation and proximal arm level	4	Axillary artery	NIL
Elbow region	8	Brachial artery	NIL
Distal forearm level	4	Radial and ulnar artery	NIL

Discussion:

The amputation rate reported in the literature ranges from 10% to 68% in high-tension electrical injuries and thermal burns. Electric burns constitute 4%-6.5% of all burn cases in western world and 24.49% in India (1,2). Electrical burns are classified as high-voltage (>1000kilowatt) or low-voltage (<1000kilowatt). The effects of the electrical current depend on the type of current, its voltage, the resistance of the tissues, the strength of the current, the pathway taken by the current through the body, and the duration of contact. The pathway of the current follows the course of the least resistant tissues: firstly, blood vessels, nerves, and muscle, then skin, tendon, fat, and bone thus damage to longer segment of blood vessels is there in electric burn(8). this is the one reasonable point to do the high ligation while performing the amputation of the affected limb in electric burn patients. The septic conditions

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caused by electro trauma are a real danger of acute haemorrhage at the level where the extremity is amputated. Even if the amputation is performed on completely healthy tissue, tissue renecrotization and the microthrombi dissolving in the area can cause the release of the ligation of the arterial or venous stump and hence lead to bleeding and further complications (9).

This progressive necrosis of the tissue and the blood vessels requires serial amputations at higher levels and occasionally blows out of blood vessels which can even lead to mortality(10). To tackle this dreadful event of blow-out vessels, high ligation of affected arteries can be lifesaving.

We, in our centre, follow the method of high ligation of arteries while performing limb amputations in electric burn patients. we performed high ligation of axillary artery in 4 cases, Brachial artery in 8 cases, and ulnar-radial artery in 4 cases during Sep 2019 till Sep 2021 in cases of electric burn patients along with amputations at different levels as per area involved. Various approaches for high ligation of axillary arteries are there but incision over the deltopectoral groove gives a better and easier way of exposure and identification. we ligated the axillary artery and vein, with a separate incision, and then performed shoulder disarticulation. Infections are common in electric burn sites because of multiple contributing factors. Infection would be well tolerated if there are two different incisions for high ligation and those of disarticulation as there are no connection points.

The subclavian artery continues as an axillary artery from the lateral most border of the first rib. It terminates at the lower border of the teres major muscle and continues as the brachial artery. The pectoralis minor muscle divides the axillary artery into three parts. we prefer incision over deltopectoral groove for approach and ligation of the axillary artery which gives easy and quick access to the axillary artery. For brachial artery ligation, a longitudinal incision is made along with the pulsation of the vessel and after identification, the artery can be ligated. similarly, radial artery and ulnar artery can be identified and ligated.

Conclusion: High ligation of arteries in case of electric burn should be considered in all patients undergoing amputation of affected/burnt limb because of progressive necrosis and sepsis to prevent the risk of a blow out of the vessel. Approach from deltopectoral groove for axillary artery ligation should be preferred for easy and quick access to the artery.

Conflict of interest: The authors declare that they have no conflict of interest.

References :

1. Ehmer Al-Ibran, Mohammad Z R, Ali S, Syed M W, Kaneez A. Evaluation of electric burn injury cases admitted in burns centre, Karachi J Dow Uni Health Sci. 2012;6:82-5.
2. Srivastava, S., Kumari, H., Singh, A., & Rai, R. Epidemiology and outcomes of electric burn injury: a study of 768 patients in a high volume tertiary care centre of North India. Int J Community Med Public Health, 5(7), 2786-2790.
3. Tarim, A., & Ezer, A. Electrical burn is still a major risk factor for amputations. Burns. 2013;39(2):354–357.
4. Gajbhiye, A. S., Meshram, M. M., Gajaralwar, R. S., & Kathod, A. P. The management of electrical burn. The Indian journal of surgery. 2013;75(4), 278–283.
5. Capelli-Schellpfeffer M. Advances in the evaluation and treatment of electrical and thermal injury emergencies. IEEE Trans IndApp.1995;31:1147.
6. Maduri P, Akhondi H. Upper Limb Amputation. InStatPearls [Internet] 2021 Apr 7.

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7. Bounds EJ, Khan M, Kok SJ. Electrical Burns. In: StatPearls. StatPearls Publishing, Treasure Island (FL); 2021.
8. Docking, P. Electrical Burn Injuries - Accident and Emergency. 1999;7:70-6
9. Belba G., Zhuka K, Osmani X., Gedeshi .SHOULDER DISARTICULATION AFTER HIGH-TENSION ELECTRICAL BURNS: TECHNICAL PROBLEMS. Clinic of Plastic Surgery and Burns, Ann. Medit. Burns Club. 1993;6(2).
10. Cembraneli PN, Cavalcante JBDF, Cavalcante RBDF, et al. High voltage electrical burn resulting in upper limb amputation. Int Phys Med Rehab J.2020;5(1):64-5.