Case Series

A CASE SERIES ON USING CABLE TIES SKIN STRETCHING FOR CLOSURE OF LARGE WOUNDS

Anandi A[1], G.Rangarajan[2], E. Emerson Shadrach William[3]

[1]*Professor, General Surgery Postgraduate, Department of General Surgery, Government Stanley Medical College & Hospital, Chennai, India.*
[2]*Assistant Professor, General Surgery Postgraduate, Department of General Surgery, Government Stanley Medical College & Hospital, Chennai, India.*
[3]*General Surgery Postgraduate, Department of General Surgery, Government Stanley Medical College & Hospital, Chennai, India*

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Corresponding Author:
Dr. G.Rangarajan,
Assistant Professor, General Surgery Postgraduate, Department of General Surgery, Government Stanley Medical College & Hospital, Chennai, India.
Email: drranga_ mythu@hotmail. com

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ABSTRACT

Background: Large wound closure remains a surgical challenge, especially in settings with limited resources. Traditional techniques like grafts or flaps may be costly, technically demanding, and associated with complications. Skin-stretching techniques harness the viscoelastic and creep properties of skin to achieve delayed primary closure. **Objectives:** To evaluate the feasibility, effectiveness, and safety of using sterile nylon cable ties as a cost-effective method for skin stretching and closure of large wounds.
Materials and Methods: A prospective case series was conducted in the Department of General Surgery, Government Stanley Medical College & Hospital, Chennai from January 2025 to April 2025. Five patients with large, healthy wounds post-debridement or fasciotomy were included. Sterile cable ties were applied across wound margins and progressively tightened 1–3 mm daily. Wounds were monitored for approximation, healing, complications, and functional outcomes.
Results: Complete wound closure was achieved in 4 out of 5 patients. In one case, partial closure was followed by secondary suturing. No cases of skin necrosis or compromised limb function were observed. The average wound approximation rate ranged from 2 to 3.2 mm/day. The technique allowed wound healing with preserved sensation and mobility, and minimal scarring.
Conclusion: Cable tie-based skin stretching is a safe, economical, and effective method for closing large wounds. It offers a viable alternative to commercial skin-stretching systems in low-resource settings and warrants further study.
Keywords: Wound closure, Skin stretching, Tissue expansion, Cable ties, Viscoelasticity, Mechanical creep, Low-cost surgery.

INTRODUCTION

The principle of stretching wound margins for primary wound closure is commonly practiced and used for various skin defects, leading at times to excessive tension and complications during wound closure.[1] Different surgical techniques, skin stretching devices, and tissue expanders have been utilized to address this issue. Extensive skin defects, generally caused by trauma, burns, high-tension wounds, tumor excision, electric burns, post-fasciotomy wounds, and large flap donor zones, have emerged as a widespread issue faced by numerous surgeons.[2] Achieving primary closure on substantial skin defects on the trunk and limbs of patients is often challenging due to a lack of sufficient skin. In addition, different techniques have been used to close large skin defects, such as skin grafts, local flaps, tissue stretching, skin expansion, free flaps, and secondary surgery closure. Still, closing large wounds presents limitations, including risks of complications like infection, necrosis, wound gaping, delayed healing, and poor aesthetic outcomes.[3]
Biomechanical characteristics that define skin include creep, extensibility, viscoelasticity and stress relaxation. The term “creep” describes the ability of the skin to extend under stretching at continuous tension. Viscoelasticity includes viscosity and elasticity, where elasticity describes the characteristic that the deformation due to stress loads can be temporary if the stress is rapidly relieved, whereas viscosity describes the permanent deformation that

results when stress is maintained.[4] As the direct result of creep, “stress relaxation” indicates that if skin is stretched over a constant distance, the amount of tension that is required to keep the skin stretched will slowly decrease over time. Based on these principles, skin-stretching systems have been designed to exploit the potential afforded by these biomechanical characteristics to realize the primary closure of large skin defects within a short time.[5]

By exerting a mechanical load on skin stretchers, one edge of the wound can be progressively drawn towards the opposite side, resulting in complete wound closure. This case series utilizes cable ties to apply consistent mechanical pressure on the skin, facilitating the closure of large wounds. Many commercial wound closure systems discussed in the literature are expensive for patients.[6] Therefore, we have implemented a simple and cost-effective novel technique using cable ties for dressing large wounds. This creative approach demonstrates how simple, unusual tools can be repurposed for effective surgical care. By utilizing the mechanical properties of commonly available materials, like cable ties, surgeons can achieve controlled skin approximation without the need for complex instruments. The method supports gradual closure while maintaining tissue viability and encourages innovation in low-resource surgical practice.

MATERIALS AND METHODS

This case series was undertaken in the department of general surgery of Government Stanley Medical College & Hospital, Chennai. The duration of these studying these cases was 4 months extending from January 2025 to April 2025. Written and informed consent were obtained from all subjects before enrolment in the study. The primary material used in this study for stepwise wound closure was sterilized plastic cable ties. These ties were connected by inserting the free end of one into the locking case of the next, forming a flexible strip of the required length. After thoroughly cleaning the wound with an antiseptic solution, the prepared cable tie strips were applied perpendicular to the wound edges and spaced approximately 1 to 1.5 centimeters apart to ensure even distribution of tension. The wound was then covered with moist gauzes and a non-compressive dressing to promote optimal healing conditions.

Tightening of the cable ties began 24 hours after application and was carried out daily. Each day the ties were tightened gradually by 1 to 3 millimeters to allow slow approximation of the wound edges. Excessive tension that could impair perfusion or damage tissue was carefully avoided. This process continued until complete wound closure was achieved. Sufficient time was allowed for proper healing before removing the ties. This technique proved to be simple, effective, and economical for managing large wounds.

Inclusion Criteria

- Adults (≥18 years) with large, healthy granulating wounds post-debridement or fasciotomy
- No active infection and adequate surrounding skin for stretching
- Provided informed consent and agreed to daily follow-up

Exclusion Criteria

- Infected or necrotic wounds
- Poor skin quality, ischemia, or peripheral vascular disease
- Uncontrolled comorbidities (e.g., diabetes) or unfit for regular follow-up.

Case 1

A 56-year-old female patient had abscess over the right hand palmar aspect. Incision and drainage was performed, and cable tie dressing were applied on 7th day post drainage when the wound became healthy. Complete wound approximation was achieved by 7th day after application of cable ties and upon subsequent tightening. Cable ties were removed on the 12th day. Complete wound healing was achieved on 20th day. Hand movements and sensation was intact.

Day 1 Before and after approximation

Day 6 Day 7 Day 12

Figure 1: From Cable Tie Application to Complete Closure: Progressive Skin Stretching and Healing of a Right Palmar Abscess Incision

Figure 2: Cable Tie–Mediated Delayed Primary Closure of a Traumatic Right Knee Laceration: Debridement, Gradual Tightening, and Definitive Suturing.

Case 2

A 17-year-old male presented to the emergency department with a traumatic laceration over the right knee, measuring approximately 5 × 4 × 1 cm. Initial management included thorough wound debridement and application of tagging sutures (Fig. 1). However, by the third day post-admission the overlying skin flap showed signs of necrosis. Repeat debridement was performed under local anesthesia, resulting in a raw wound bed of approximately 4 × 3 × 1 cm.

On the fifth day of admission, the wound appeared clean and granulating, and a decision was made to initiate delayed primary closure using sterilized nylon cable ties. The ties were applied perpendicularly across the wound margins and tightened gradually each day to approximate the wound edges without compromising tissue viability.

By the seventh day after application, complete wound approximation was achieved. On day 14, the cable ties were removed and definitive skin closure was performed using 2-0 Ethilon sutures. Complete wound healing was noted by day 20. The patient maintained full knee joint mobility and intact sensation throughout recovery, with no signs of infection or functional limitation.

Case 3

A 50-year-old male was admitted with cellulitis of the right leg, which progressed to compartment syndrome requiring emergency fasciotomy. The fasciotomy wounds were managed with daily dressings, and by the 5th postoperative day, the lateral fasciotomy site appeared clean, granulating, and suitable for delayed primary closure.

Sterilized cable ties were applied perpendicularly across the wound edges with approximately 1–1.5 cm spacing. Daily tightening of the ties by 1–3 mm was initiated to allow gradual skin approximation while preserving tissue perfusion.

By the 9th day after application, complete wound approximation was achieved. On the 13th day, the cable ties were removed, and final closure was completed using 2-0 Ethilon interrupted sutures. Wound healing was complete by day 19. The patient retained full limb movement and normal sensation throughout the recovery period. No skin necrosis, infection, or functional deficit was observed.

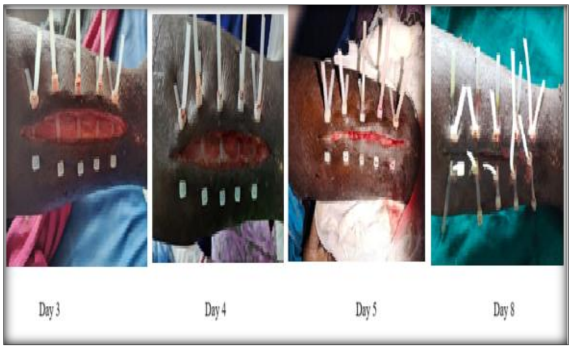

Figure 3: Stepwise Cable Tie–Assisted Skin Expansion and Delayed Closure of a Right Leg Fasciotomy Wound in Compartment Syndrome

Case 4

A 32-year-old male was admitted with cellulitis of the left forearm, which progressed to compartment syndrome necessitating fasciotomy. The procedure was performed over the dorsal aspect of the forearm. By the 3rd postoperative day, the wound showed healthy granulation and was deemed suitable for delayed primary closure.

Sterilized cable ties were applied perpendicularly across the fasciotomy wound with even spacing, and the wound was covered with moist gauze and a non-compressive dressing. Gradual approximation was achieved by tightening the ties daily by 1–3 mm, ensuring no compromise to skin perfusion.

By the 7th day post-application, complete approximation of the wound edges was achieved. The cable ties were removed on day 13, and final closure was done with 3-0 Prolene sutures. Complete healing was noted by day 15. The patient maintained full range of motion and intact sensation throughout. No complications such as infection or skin necrosis were observed.

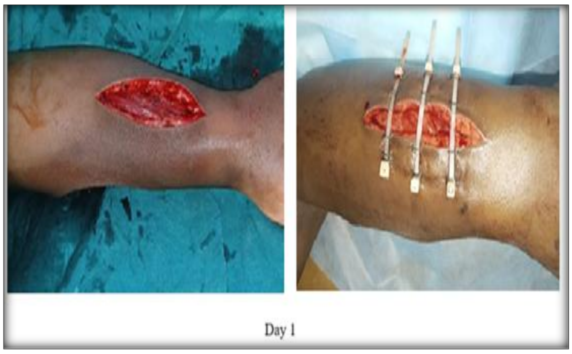

Figure 4: Controlled Cable Tie Skin Stretching and Final Suture Closure of a Dorsal Left Forearm Fasciotomy Wound

Case 5

For the same patient described in case 4, 9 days after the application of cable ties on the dorsal fasciotomy wound and approximation was achieved, cable tie dressings were applied on the volar fasciotomy wound as shown in the picture below. partial wound approximation was achieved by 9th day after application of cable ties. Cable ties were removed on the 13th day and tagging skin sutures were applied with 2-0 ethilon and significant reduction in wound size was achieved on 15th day. Range of movements and sensation was intact. No skin necrosis observed.

Figure 5: Sequential Cable Tie Approximation of Dorsal and Volar Forearm Fasciotomy Wounds with Partial Closure and Secondary Suturing

In this case series time to achieve wound edge approximation ranged from 7 to 11 days. Cable ties remained in place for 12 to 16 days. Complete healing was documented between days 19 and 22 post-application. No cases of skin or flap necrosis were noted. Sensory function remained intact in all patients during and after treatment. This indicated preservation of neurovascular integrity throughout the approximation process (Table 1).

Table 1: Timeline of Wound Closure and Healing

Case	No. Days to achieve approximation	Total No. Days cable ties applied	Days to achieve Complete healing	Skin/flap necrosis observed	Sensations
1	7	12	20	nil	Intact
2	7	14	20	nil	Intact
3	9	13	19	nil	Intact
4	9	13	19	nil	Intact
5	11	16	22	nil	Intact

All five patients retained full range of motion throughout the treatment. Wound lengths across the approximating edges ranged from 18 mm (Case 4) to 35 mm (Case 5). The rate of wound approximation per day varied from 2.0 mm/day to 3.18 mm/day, with a mean approximation rate of 2.53 mm/day across all cases. The fastest approximation was observed in Case 5 (3.18 mm/day), and the slowest in Case 4 (2.0 mm/day) (Table 2).

Table 2: Functional and Approximation Efficiency Outcomes Among Five Patients Treated with Cable Tie-Based Wound Closure

Case	Range of movements	Length in mm across the approximating edges of wound	Wound Approximation In Mm Achieved Per Day	Average Wound Approximation In Mm Achieved Per Day
1	Intact	20	2.85	2.53257
2	Intact	19	2.71	
3	Intact	19	2.11	
4	Intact	18	2	
5	intact	35	3.18	

DISCUSSION

Cable ties are essentially nylon strips equipped with an integrated gear rack and a small case containing a ratchet at one end. When the other end of the tie is pulled through the case past the ratchet, it can only be tightened further due to the gear rack mechanism. Therapeutic use of nylon ties has been reported as early as 19767 and has since been used for the internal fixation of (periprosthetic) femur fractures8 and even anal fistula,[9] Like any other closure device, it makes use of creep and stress relaxation for enabling wound closure.

The advantages of using cable ties for closure of wounds are that they are easily available and affordable. Moreover, there is less incidence of ischemia, necrosis, or donor site morbidity. Its use facilitates gradual wound closure while enabling simultaneous infection management and regular wound care.[10]

Various techniques can treat large gaping wounds secondary to trauma, fasciotomy, or debridement wounds, like secondary healing, split-thickness skin grafting, and delayed primary closure. Skin grafting or flap covers of the wound can end up in poor cosmesis, with prolonged hospital stay or donor site morbidity.[11] Our experience in this study is that delayed primary closure of the wound results in normal skin coverage of the wound area, offering better protection and intact sensation of the area, with intact limb function and better cosmetic outcome.

Since fasciotomy wounds do not exhibit true skin or soft tissue deficiency, they are more appropriate for treatment through mechanically assisted delayed primary closure. Wiger et al that this method is a safe treatment option, without causing neuromuscular compromise to the affected limb.[12]

There are numerous reported techniques for delayed primary closure of fasciotomy wounds all harnessing the visco-elastic properties of the skin. We now describe our experience with the cable ties for the delayed primary wound closure. This method was developed due to an improved understanding of the mechanical creep properties of the skin, which allow the underlying tissues to be significantly stretched beyond their natural extensibility within a relatively short period. Additionally, when tension is applied in cycles with relaxation periods between loads, it is possible to achieve much greater elongation beyond the skin's intrinsic extensibility capabilities. Similar advantages of delayed primary closure of fasciotomy wounds have also been reported by the authors such as et al,[13] and et al.[14]

The process of tissue stretching consists of tightening the cable ties, pausing until the tension has been resolved, and then retightening the ties to apply the appropriate tension. The tissue stretching process involves tightening the cable ties, pausing until the tension is resolved, and then retightening the ties to apply the necessary tension. The stretching cycle is immediately stopped if there are any signs of compromised skin viability, such as skin pallor, tautness, or persistent local pain.[15]

Our series includes 5 patients with wounds as a result of various modalities that were treated with the cable tie devices. Successful delayed primary wound closure was achieved in 4/ all 5 patients (80%). In one case, the device was removed before the wound was fully approximated, and the wound tagging sutures were applied and was left for secondary healing. Notably, the final wound area was about < 20% of the original wound size.

The techniques for applying the cable ties differed between the cases, and different results were observed. In group 1 (cases 1, 2, and 3), the cable ties were inserted through a small incision parallel to the wound edge, about 1cm away, and positioned under the skin flaps being approximated. In group 2 (cases 4 and 5), the cable ties were applied over the wound and skin flaps using skin staplers.

In group 1, the disadvantages faced were the raw area and scars at the sites of insertions, while it gave room for applying increased pressure compared to group 2. Whereas, in group 2, the advantage was less scar and raw area formation at the site of securing the cable ties.

CONCLUSION

Cable ties can be regarded as a feasible alternative to existing skin expansion systems in resource-limited environments. Additional research is necessary to comprehensively assess this method for various types and locations of wounds.

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