Section: General Surgery

Original Research Article

A PROSPECTIVE & RETROSPECTIVE, OBSERVATIONAL STUDY COMPARING THE EFFICACY OF CABLE TIE WITH SECONDARY SUTURING IN EXTREMITY NECROTIZING FASCIITIS

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ABSTRACT

Background: Managing necrotizing fasciitis (NF) and other severe extremity wounds remains a challenge in surgical practice due to the complexity of wound healing and the risk of complications. Traditional wound closure methods, such as secondary suturing (SS) and split-thickness skin grafting (SSG), are widely employed but are associated with several limitations, including prolonged hospital stays, increased postoperative pain, and a higher risk of infection. Dynamic wound closure using cable ties (CT) has emerged as a novel and cost-effective alternative, offering gradual approximation of wound edges, which may enhance recovery and reduce complications. However, there is limited research comparing the efficacy of cable ties with traditional methods like secondary suturing. The primary aim of this study is to compare the efficacy of dynamic closure using cable ties versus secondary suturing in extremity linear wounds arising after debridement done for necrotizing fasciitis wounds. **Materials and Methods:** This was a prospective-retrospective, comparative, observational study involving 60 patients who fulfilled the inclusion criteria, with granulated fasciotomy wounds in patients who are operated for extremity necrotizing fascitis. The study was done for period of two years in a tertiary care hospital in Mumbai. Patients were divided into two groups: Group A (n=30) received dynamic closure with cable ties, and Group B (n=30) underwent secondary suturing. These patients were taken for study in an alternate manner, first group A then group B and third patient was group A and so on. Outcome measures were: wound size reduction, postoperative pain (measured using the Visual Analog Scale), secondary infection rates, and hospital stay duration. Wound size was measured at baseline (Day 0) and on Days 7, 14, 21, and 28. Pain assessments were conducted on Days 1 and 15. Secondary infection rates and the need for repeat procedures were also recorded. Statistical analysis was conducted using independent t-tests and chi-square tests, with significance set at $p<0.05$. **Result:** Patients in the cable tie (CT) group had significantly shorter hospital stays (mean 9.45 ± 5.35 days) compared to those in the secondary suturing (SS) group (mean 14.0 ± 5.78 days; p=0.003). Postoperative pain levels were also lower in the CT group, with a mean Visual Analog Scale (VAS) score of 3.96 ± 1.92 on Day 1 compared to 6.26 ± 1.82 in the SS group (p=0.000). By Day 15, the pain score in the CT group had further reduced to 1.66 ± 1.41, while the SS group had a mean score of 2.66 ± 1.51 (p=0.020). Wound size reduction was comparable between the two groups across all time points, with no significant differences observed ($p>0.05$). Similarly, there was no significant difference in secondary infection rates or the need for repeat procedures between the two groups ($p>0.05$). **Conclusion:** The results of this study suggest that dynamic closure using cable ties provides a practical and beneficial alternative to secondary suturing for the management of extremity

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wounds. Patients treated with cable ties experienced significantly shorter hospital stays and lower levels of postoperative pain, without any increase in infection rates or the need for additional procedures. These findings indicate that dynamic closure with cable ties is an effective method for improving patient outcomes in cases of complex extremity wounds. Future studies should explore the long-term effects of cable tie closure and assess its applicability in other wound types.

INTRODUCTION

Necrotizing fasciitis (NF) is a life-threatening, rapidly progressing bacterial infection of the deep fascia, with secondary necrosis of the subcutaneous tissues. It is considered a surgical emergency due to the high mortality rates associated with delayed diagnosis and treatment. Necrotizing fasciitis is typically caused by polymicrobial infections, involving bacteria such as Streptococcus pyogenes, Staphylococcus aureus, and various Gram-negative species.[1] The management of these large wounds poses significant challenges. Traditional wound closure techniques such as secondary suturing (SS) and split-thickness skin grafting (SSG) have long been the gold standards for wound management after debridement. But they are associated with infections, long hospital stay, increased post operative pain and delayed functional recovery.[2]
Furthermore, the extended healing time required for large wounds, particularly in extremities, delays patient rehabilitation and return to normal activities. These limitations have driven the search for innovative wound closure methods that can expedite healing while reducing pain and hospitalization.
In recent years, emerging techniques for wound closure have focused on dynamic wound management strategies. One such approach is dynamic wound closure using cable ties (CT), which offers a novel method for approximating wound edges gradually, allowing for controlled, tension-free closure over time. The ability to gradually tighten the wound over time helps reduce mechanical tension on the wound edges, promoting better tissue adaptation and reducing the risk of dehiscence or breakdown.

Aims

The primary aim of this study is to compare the efficacy of dynamic closure using cable ties versus secondary suturing in extremity linear wounds arising after debridement done for necrotizing fasciitis wounds. The key outcomes evaluated include wound size reduction, postoperative pain, infection rates, and the duration of hospital stay. By assessing these variables, this study seeks to determine whether dynamic closure offers significant clinical benefits over conventional suturing techniques.

MATERIALS AND METHODS

This was a prospective-retrospective, comparative, observational study involving 60 patients who fulfilled the inclusion criteria, with granulated fasciotomy wounds in patients who are operated for extremity necrotizing fascitis. The study was done for period of two years in a tertiary care hospital in Mumbai. Patients were divided into two groups: Group A (n=30) received dynamic closure with cable ties, and Group B (n=30) underwent secondary suturing. These patients were taken for study in an alternate manner, first group A then group B and third patient was group A and so on. Outcome measures were: wound size reduction, postoperative pain (measured using the Visual Analog Scale), secondary infection rates, and hospital stay duration. Wound size was measured at baseline (Day 0) and on Days 7, 14, 21, and 28. Pain assessments were conducted on Days 1 and 15. Secondary infection rates and the need for repeat procedures were also recorded. Statistical analysis was conducted using independent t-tests and chi-square tests, with significance set at $p<0.05$.

Inclusion and Exclusion Criteria

Inclusion criteria Included

- Patients aged 18 years and older.
- Granulated fasciotomy wounds measuring 5–15 cm in width and around 30 cm in length.
- Patients able to provide informed consent.

Exclusion criteria Included

- Uncontrolled diabetes mellitus (DM) or peripheral vascular disease (PVD).
- Coagulopathy, renal failure, or active infection.

Surgical Procedure

In Group A, Nylon cable ties were placed along both the edges of the wound around 1.5 cm lateral to the skin edge perpendicular to the wound,2 skin staples was used to secure this cable tie in some cases if required. Similar cable ties were placed at approximately 2 cm intervals serially to cover the whole length of the wound. Cable ties were looped up orderly to decrease wound sizes and progressively tightened by four clicks every 24 hours until full closure was achieved. Some large wounds required freshening of edges with secondary suturing as the edges were thickened and cosmetically not appearing good. A suction drain was applied for larger wounds to manage exudate.
In Group B, patients underwent secondary suturing after wound granulation. Both groups received daily wound dressings and antibiotics (Augmentin 625 mg, twice daily) for seven days.

Group A

Outcome Measures

Primary outcome measures included:

1. Wound Size Reduction – Measured at baseline and on Days 7, 14, 21, and 28.

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2. Postoperative Pain – Assessed using the Visual Analog Scale (VAS) on Days 1 and 15.
3. Secondary Infection Rates – Monitored postoperatively.
4. Hospital Stay Duration – Measured from surgery to discharge.

Statistical Analysis: Data was analyzed using SPSS software (version 18). Descriptive statistics were used to summarize demographic and clinical data. Independent t-tests and chi-square tests were used to compare continuous and categorical variables, respectively. A, p-value of <0.05 was considered statistically significant.

RESULTS

Demographics: Sixty patients participated in the study, with 30 in each group. The mean age of participants was 45.6 years (SD = 11.5), and the majority (75%) were male. There were no significant differences in baseline demographic characteristics between the two groups (p>0.05).

Wound Size Reduction: Both groups showed similar rates of wound size reduction over the 28-day observation period. No statistically significant difference was found between Group A and Group B in terms of wound size reduction at any time point (p>0.05). [Table 1]

Postoperative Pain: VAS scores were significantly lower in Group A compared to Group B on both Day 1 and Day 15. On Day 1, patients in the cable tie group reported a mean VAS score of 3.96 ± 1.92, while those in the secondary suturing group reported a mean score of 6.26 ± 1.82 (p=0.000). By Day 15, the VAS score for Group A had decreased to 1.66 ± 1.41, compared to 2.66 ± 1.51 in Group B (p=0.020). [Table 2]

Hospital Stay: The duration of hospital stay was significantly shorter in Group A compared to Group B. The mean hospital stay for patients in the cable tie group was 9.45 ± 5.35 days, while patients in the secondary suturing group had a mean stay of 14.0 ± 5.78 days (p=0.003).

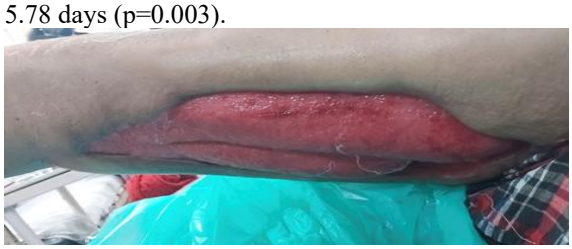

Figure 1: Granulating wound over posterior aspect of thigh around 35 × 20cm.

Figure 2: Application of Cable tie

Figure 3: The Cable Tie are gradually approximated

Figure 4: Final approximation of cable Tie with freshening of wound edges and secondary suturing

Table 1: Wound Size Reduction Over Time

Time Point (Days)	Group A (Cable Ties)	Group B (Secondary Suturing)	p-value
Day 0 (Baseline)	8.5 ± 2.1 cm	8.3 ± 2.3 cm	0.78
Day 7	6.2 ± 1.9 cm	6.5 ± 2.0 cm	0.65
Day 14	4.5 ± 1.8 cm	4.7 ± 1.9 cm	0.58
Day 21	3.2 ± 1.5 cm	3.5 ± 1.6 cm	0.44
Day 28	1.5 ± 0.8 cm	1.8 ± 0.9 cm	0.33

Table 2: Postoperative Pain (VAS Scores).

Time Point (Days)	Group A (Cable Ties)	Group B (Secondary Suturing)	p-value
Day 1	3.96 ± 1.92	6.26 ± 1.82	0.000
Day 15	1.66 ± 1.41	2.66 ± 1.51	0.020

DISCUSSION

Many techniques and materials have been recommended for delayed primary closure wounds, such as rubber bands, surgical strips, and C wires.[3,4] Cable ties made of nylon are the most popular, easily available, and low-cost suture materials. Nylon cable ties provide 8 to 25 kg of traction force, depending on their diameter, to maintain suitable tension. Nylon cable ties are also available in a wide variety of lengths, which can be used to close wounds of any size. Ties can also be used in isolation or connected in a series to expand suture length.[5] Cable ties are placed around the wound edges and tightened incrementally over

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several days, allowing the skin to stretch and adapt as the wound gradually closes. This slow approximation reduces the tension on the wound and surrounding tissues, minimizing the risk of dehiscence and promoting faster wound healing.

Apart from nylon cable ties there are several commercially available devices, such as Sure Closure, ARBA, Derma Close, Dyna Close, Derma Clip, and Top Closure. Depending on the ratio of traction force to skin tension, these are divided into 2 categories: shoelaces and individual traction devices.[5] Most wound closing devices are individual traction devices, whereas DermaClose uses the shoelace technique.[6]Superclosure and ARBA are invasive whereas Dynaclose and Dermaclip are less invasive using adhesive dressing to tape on the skin edges.[7-12]The counter force to skin traction from adhesion dressing is limited. They are designed to close a wound with a gap of less than 2 cm, not a fasciotomy wound of the extremities.[12] TopClosure has a similar mechanism as nylon cable ties.[12] Both devices require skin staples or sutures for fixation on the skin and installation of the polymer strap. Nylon cable ties have many advantages over such commercial products. Nylon cable ties are inexpensive and easily sterilized. There are available in a wide variety of lengths and diameters, making them suitable for different tension requirements along any wound edge of the human body, which is not the case for commercial products.[5] Moreover, nylon cable ties can be used to immobilize other medical devices or as a medical device, such as a self-retractor and tourniquet.[13]

The procedure details are mentioned in the methodology. The Pictures of the procedure are mentioned here [Figure 1-4].

One of the primary outcomes measured in our study was wound size reduction, an essential indicator of the effectiveness of any wound closure technique. Both the cable tie (CT) group and the secondary suturing (SS) group showed comparable wound size reduction over the 28-day observation period. This finding suggests that dynamic closure with cable ties is just as effective as secondary suturing in promoting wound healing. The mechanism underlying the effectiveness of dynamic closure techniques lies in the gradual approximation of wound edges. In cable tie closure, the wound edges are tightened incrementally over several days, allowing the skin and underlying tissues to adapt to the tension without being subjected to sudden, excessive stress.[2] This gradual tightening reduces the risk of wound dehiscence and breakdown, promoting even and consistent closure. In contrast, secondary suturing often involves closing the wound in a single procedure, which can place greater mechanical stress on the wound site and surrounding tissues, particularly in larger wounds. While our study did not find a statistically significant difference in wound size reduction between the two groups, the comparable outcomes suggest that cable ties are a viable alternative to secondary suturing, particularly in cases where reducing postoperative pain and hospital stay is a priority.

One of the most significant advantages of dynamic wound closure using cable ties, as demonstrated in our study, is the reduction in postoperative pain. Patients treated with cable ties reported significantly lower Visual Analog Scale (VAS) pain scores on both Day 1 and Day 15 compared to those treated with secondary suturing. Pain management is a critical component of wound healing, as excessive pain can delay recovery, limit patient mobility, and increase the need for analgesics, which carry their own risks, including opioid dependence and side effects.

Another key finding of this study was the shorter hospital stay observed in patients treated with cable ties. On an average, patients in the cable tie group were discharged five days earlier than those in the secondary suturing group, a statistically significant difference. This result aligns with previous studies, such as those by Low et al., which found that dynamic closure techniques are associated with faster recovery times and shorter hospital stays. Reducing the length of hospital stay has important implications for both patient outcomes and healthcare systems. From a patient perspective, shorter hospital stays improve quality of life by allowing for earlier discharge and recovery in the comfort of the home environment, less chance of hospital-acquired infections, which can further complicate recovery and lead to longer-term health issues.[2] From a healthcare system perspective, shorter hospital stays reduce the financial burden associated with prolonged hospitalization, freeing up hospital resources for other patients and reducing overall healthcare costs.

Infection prevention remains a primary concern in the management of open wounds, particularly in cases of necrotizing fasciitis, where the risk of secondary infections is high. This study found no significant difference in secondary infection rates between the cable tie and secondary suturing groups, suggesting that cable ties are just as safe as traditional suturing methods in terms of infection control. Abigail Garcia et al. in their case series study to explore the efficacy of plastic bands in closure of fasciotomy wounds and open fracture II, IIIA, IIIB reported that Wound closure was achieved in nine patients within 5-10 days with good result. With mean closure time(days)= 10.8 days, wound infection in 1 patient, additional intervention in 1 patient, length of hospital stay was 38.5 days. They concluded that it's a cheap and effective method.[14]

In a study done by Geertruida A. M. et al. thirteen consecutive patients having extremity compartment syndrome with fasciotomy wounds were included for Ty-Rap closing system. All wounds were closed using the Ty-Rap closing system that was applied at the surgical procedure. The mean time from the operation to complete closure of the wound was 6.3

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days (range, 1–14 days), and the mean time from the operation to removal of the Ty-Raps was 15.7 days (range, 4 –23 days). They found the procedure was low cost, general availability was good and procedure was effective and were well tolerated by their patients with a minimal need for secondary procedures[15]. Hsieh, Chiung Huia also had same conclusions for their forearm compartment wound closure by Nylon cable tie primary closure of fasciotomy wounds.[5]

The findings of our study have several important implications for clinical practice. Dynamic wound closure with cable ties offers a practical, cost-effective alternative to secondary suturing, particularly in cases where reducing hospital stay and postoperative pain is critical. By promoting faster recovery and improving patient comfort, cable ties can enhance the overall quality of care provided to patients with extremity wounds. Additionally, the ease of use and cost-effectiveness of cable ties make them an appealing option for wound management in resource-limited settings where access to more expensive wound closure techniques may be restricted.

However, while this study provides valuable insights into the benefits of cable tie closure, further research is needed to fully understand its long-term outcomes and potential applications in other wound types. Larger, multicenter studies with extended follow-up periods would help to validate these findings and explore additional benefits, such as reduced scarring, improved aesthetic outcomes, and cost savings for healthcare systems. Additionally, future research should examine the use of cable ties in different patient populations, including those with chronic wounds, diabetic ulcers, or other complex wound types, to determine whether the benefits observed in this study can be generalized to other clinical settings.

CONCLUSION

Dynamic wound closure using cable ties offers a viable, patient-friendly alternative to secondary suturing for the management of extremity wounds. The significant reduction in hospital stay duration and postoperative pain observed in this study, coupled with comparable infection rates and low rates of repeat procedures, highlights the potential of cable ties to enhance patient outcomes and improve the efficiency of wound management. As research on dynamic closure techniques continues to evolve, cable ties are likely to play an increasingly prominent role in the future of surgical wound management.

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