ORIGINAL RESEARCH PAPER VOLUME-6 | ISSUE-8 | AUGUST - 2017 | ISSN No 2277 - 8179 | IF : 4.176 | IC Value : 78.46

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

PROGRESSIVE TENSIONED CLOSURE OF LARGE SKIN DEFECTS IN OPEN FRACTURES OF EXTREMITIES: A NOVEL LOW COST TECHNIQUE.

Orthopedics

Dr. Ashwani Ummat Associate Professor, Department of Orthopaedics, Maharishi Markandeshwar Institute of Medical Sciences and Research, Mullana, Ambala, Haryana, India

Dr. Sonia Kochhar Professor, Department of Physiology, Maharishi Markandeshwar Institute of Medical Sciences and Research, Mullana, Ambala, Haryana, India – Corresponding Author

Dr. Manjeet Singh Professor & HOD, Department of Orthopaedics, Maharishi Markandeshwar Institute of Medical Sciences and Research, Mullana, Ambala, Haryana, India

Dr. Harsimarjit Kaur Associate Professor, Department of Anatomy, Govt. Medical College, Patiala

Dr. Chetan Sharma PG Resident, Department of Orthopaedics, Maharishi Markandeshwar Institute of Medical Sciences and Research, Mullana, Ambala, Haryana, India

Dr. Shishir Kumar PG Resident, Department of Orthopaedics, Maharishi Markandeshwar Institute of Medical Sciences and Research, Mullana, Ambala, Haryana, India

ABSTRACT

Compound fractures of extremities can lead to infection, bone necrosis and other complications if the soft tissue cover is not given to the uncovered bone. We are describing a technique of closure of large skin defects using K-wires and SS wires utilizing the elastic stretching properties of the skin which can be done in centres where plastic surgeons are not available. This technique reduces the cost and duration of surgery for patients suffering from compound fractures.

Conclusion- Skin covering for Compound fractures can be given by making use of elastic properties of skin.

KEYWORDS:

compound fractures, elastic properties of skin

Introduction: Open fractures of the extremities are one of the commonest fractures encountered by orthopedic surgeons and often are difficult problem to handle(Doshi et al., 2017).They are usually contaminated, have tissue loss, and lack soft tissue coverage of bone especially in high velocity fractures. These open fractures are classified by Gustillo-Anderson into three types (Kim & Leopold, 2012). Type III Gustillo fractures are the most difficult to treat. They require multiple surgeries in the form of initial debridement and temporary stabilization of fracture, followed by a reconstructive procedure to cover the defect and then, most often, a definitive procedure to fix the fracture fragments(Iii & Swiontkowski, 2008),(Byrd HS et al,1985). The biggest problem in this line of management is the lack of availability of reconstructive surgeons, especially in smaller hospitals, where orthopedic surgeons, often having limited expertise in soft tissue cover of fractures, manage the wound coverage. The inadequate soft tissue cover over the bone, leads to infection, necrosis of bone and other attended complications. It is thus desirable to devise strategies to cover these wounds using the cheapest means and by simple techniques which can be managed by an average orthopedic surgeon.

Various methods utilizing the elastic stretching properties of the skin (Agache P.G. et al, 1980) have been used in the past to cover defects arising out of scalp injuries and infections [6], fasciotomy (Almekinders LC,1991),(Asgari MM & Spinelli HM,2000),(Berman SS et al,1994) tumor excision (Marrero GM & Dufresne RG Jr,1996) and burns. However, no consistent technique utilizing the elastic properties of the skin, for closure of large skin defects in open fracture of extremities exist. Also, propriety devices like STAR [r] are costly and not available in this country.

We are describing a technique of closure of large skin defects arising out of open fractures of the extremities, using K wires and gradual tightening of connected SS wires, to achieve closure of the wound gradually over 7-8 days. This technique is cheap, easy to use and can be used by any average surgeon to cover wounds of the extremities. This technique, after adequate studies, has the potential to be used at many other locations and for varied defects.

Material& Method

Five open fractures received in our hospital with Gustillo Anderson Grade III injuries (two IIIa and two IIIb fractures) were treated in our hospital with this technique. The patient characteristics are given in Table 1. One patient had a Comminuted tibial plafond fracture (IIIb), one a comminuted tibial shaft (IIIb), one patient had an elbow fracture (IIIa) and the last patient of Lisfranc's fracture dislocation (IIIa).

All patients underwent urgent wound debridement, temporary fracture stabilization with external fixator (except a patient of Lisfranc's Fracture, where the fracture was reduced and fixed with a temporary K wire) (Table 2), and application of skin tensioned closure device using two2mm K wires and20G SS wires.

Method of application of skin tensioned closure device

1. Thorough debridement of the wound was done.
2. The jagged wound was converted to an ellipsoid wound by excising excess skin (Figure 1).
3. Two 2mm Kirschner wires were inserted sub-dermal, parallel to both skin margins 2 cm away from the edge of the wound (Figure 2).
4. Four 20 G, SS wires were then passed through both sides of the wound margins, beyond the inserted K wires and then tightened slightly to bring the skin in slight opposition (Figure 2).
5. Temporary bone stabilization was carried out at that point. (Figure 3).
6. After 48 hours, the SS wires were progressively tightened, one turn per day to slowly bring the skin edges under apposition.
7. One week after complete wound apposition (Figure 4), definitive internal fixation of fractures was done (Figure 5).

All patients were evaluated for time taken for wound closure, any complications of wound, time required for carrying out definitive fixation and time for union of fractures. The requirement of any other ancillary procedure for wound closure was also documented.

Results

There were four males in the group and two female. The males were all less than 55 years of age (Patient 1,3,4&5: Table 1), whereas the female

with mid third tibia fracture was 71 years of age, obese, poorly controlled diabetic and a bidi smoker for 15 years (Patient 2: Table 1). None of the other patients had any known co-morbidities. It took seven days for closure of skin in three patients and eight days in one patient. In the elderly patient who had numerous co-morbidities, it took 13 days for the wound to close, but the wound margins had necrosed by then. This patient then underwent repeat wound debridement followed by a medial gastrocnemius rotation flap to cover the wound. She then underwent closed interlocking of nail one week after the healing of wound. All other patients underwent successful Open/closed Reduction and internal fixation of their fractures after wound healing.

The largest size of wound encountered in our patients was a 22X10 cms, in the patient of tibial plafond fracture (Patient 1: Table1 & 2). This large wound healed successfully in seven days. In the other three patients, where the wounds healed successfully, the wound were 10x10 cms and 8x6 cms and 12X10 cms(Patient 3,4&5. Table1 &2) which also healed in seven to eight days. All fractures in which the wound healed without complications (Patients 1,3,4&5, Table 2) healed between 10-12 weeks. The patient in whom the wound healing was delayed and required a muscle flap, had delayed fracture union and took 16 weeks for the fracture to unite (Patient 2: Table 3).

All results are summarized in Table 2.

Discussion

Open fractures of the extremities are one of the commonest fractures encountered by orthopedic surgeons and often are difficult problem to handle. Since these fractures are heavily contaminated, have extensivesoft tissue loss and lack coverage of bone, they require multiple surgeries in the form of initial debridement and temporary stabilization of fracture, followed by a reconstructive procedure to cover the defect and then, most often, a definitive surgery to fix the fracture. As most of these fractures are Type III Gustillo fractures and handled by orthopedic surgeons, the 'rate limiting step' in the management of these patients is the reconstruction of the skin defect. The inadequate soft tissue cover not only leads to osteomyelitis but also hampers the definitive treatment of the fracture, leading to infective non-unions and other undesirable results (Iii & Swiontkowski, 2008).

The skin is an elastic organ and can be stretched to a certain degree [r]. The reconstructive surgeons, since generations, have utilized this property of the skin in covering various kinds of defects. They have deployed various kinds of spacers to stretch the skin before surgery [r]. Other novel techniques utilizing the elastic properties of the skin to cover defects arising out of Moh's excision of Basal Cell Carcinomas of the face has been described by various authors (Marrero GM & Dufresne RG Jr,1996).

Commercially available devices like STAR (Sutured Traction Anchored Reel) (Cohen BH & Cosmetto AJ,1992),(McKenney MG et al,1996), utilize slow tensioning of the skin, with the help of SS wires and plastic shells attached to the skin, to cover various defects ranging from fasciotomy wound to surgical excision wounds. These devices utilize two plastic shells, one an anchoring shell and another a tightening shell, anchored to skin margins and connected to each other by SS wires. Gradual tightening of the wires by a reel present on the tightening shell causes slow closure of the wound over two to five days.

Surgeons have utilized K wires passed through the margins of the skin defect and connected by plastic fasteners, gradually tightened over time, to cover large defects arising out of trauma to the scalp (Sasidharan R & Serjiusajik MS,2012).

The use of an external fixator device, connected to an K wires have also been reported in literature (Ratnam BV,2015). In this report, the external fixator was gradually tightened to cover a large scalp defect arising after excision of a neurofibroma.

We have utilized the technique of wound closure, using gradually tightening of SS wires, in five patients of extremity fractures. All these patients had open fractures, GustilloIIIa or IIIb. After initial wound debridement, the defect was converted into an ellipsoid wound and 2 mm K wires were passed through the margins of the wound. These were connected to SS wires, which were gradually tightened from day two onwards. In all our patients, we had to resort to temporary fracture stabilization due to the nature of the fracture. In four of our patients we were able to achieve satisfactory wound coverage by day 7-8. One patient who was elderly, smoker and had multiple co-morbities had a poor outcome in the form of wound edge necrosis, which entailed a conventional flap cover.

Four of our patients underwent successful definitive fracture fixation 10-14 days after surgery, and their fractures healed satisfactorily. There was delayed union in the patient who had wound edge necrosis as we were able to carry out definite fracture fixation after a delay of four weeks.

We have found this an excellent and cheap method of wound closure in large wound defectsin open fractures in youngandmiddle-aged individuals. Since most of our patients were young this technique needs to be tested in elderly patients. One adverse outcome in our study was on a patient who had multipole co-morbidities and thus it needs to used with caution in such patients.

Conclusion

Progressive tensioned closure of large skin defects in open fractures of extremities, using K wires and SS wires, is not only cheap and easily reproducible and but also effective in covering large defects in open fractures of the extremities.

Table 1

	Fracture	Gustillo grading	Size of wound (cm)	Contamination	Sex	Age
Patient 1	Tibial Plafond	3b	22x10	++	M	40
Patient 2	Mid 1/3 Tibia	3b	12x10	++	F	71
Patient 3	Lisfranc's Grade 3	3a	8x6	+	M	54
Patient 4	Elbow fracture	3a	10x10	+	M	43
Patient 5	Mid 1/3 tibia	3b	12X10	+	M	50

Table 2

	EX Fix	Time to wound closure (days)	Definitive fixation	Time to union(weeks)	Complications
Patient 1	+	7	Screws+Rush Nail	10	Nil
Patient 2	+	13	Interlocking Nail	16	-Wound breakdown -Medial Gastrocnemius flap
Patient 3	-	8	Screws	10	Nil
Patient 4	+	7	Bi-pillar plating	12	Nil
Patient 5	+	7	Interlocking Nail	10	Nil

Figure 1. Wound at presentation of a patient of Tibial Plafond Fracture

Figure 2. Passage of K wires and SS wires

Figure 3. Temporary fixation using ankle spanning fixator

Figure 4. Progressive tightening leading to almost complete closure of wound.

Figure 5.Definitive fixation after complete wound closure

REFERENCES

1. Doshi, P., Gopalan, H., Sprague, S., Pradhan, C., Kulkarni, S., & Bhandari, M. (2017). Incidence of infection following internal fixation of open and closed tibia fractures in India (INFINITI): a multi-centre observational cohort study, 1–10. http://doi.org/10.1186/s12891-017-1506-4
2. Kim, P. H., & Leopold, S. S. (2012). Gustilo-Anderson Classification, 3270–3274. http://doi.org/10.1007/s11999-012-2376-6
3. Iii, W. W. C., & Swiontkowski, M. F. (2008). fractures, 42(4).
4. H. S. Byrd, T. E. Spicer, G. Cierney, 3rd(1985) Management of open tibial fractures Plast Reconstr Surg. ; 76(5): 719–730
5. P. G. Agache, C. Monneur , J. L. Leveque , and J. De Rigal (1980)Mechanical Properties and Young's Modulus of Human Skin in Vivo, Arch Dermatol Res 269, 221-232
6. Bandikatla Venkata Ratnam. (2015)A simple external tissue expansion technique based on viscoelastic properties of skin to attain direct closure of a large scalp defect: A case report Indian Journal of Plastic Surgery.;48(3);309-312
7. Almekinders LC(1991). Gradual closure of fasciotomy wounds. Orthopaedic Rev.;20:82.
8. Asgari MM, Spinelli HM. (2000) The vessel loop shoelace technique for closure of fasciotomy wounds. Ann Plast Surg;44:225-9.
9. Berman SS, Schilling JD, McIntyre KE, Hunter GC, Bernhard M. (1994)Shoelace technique for delayed primary closure of fasciotomies. The Am J Surg;167:435-6.
10. Marrero GM1, Dufresne RG Jr.] (1996) An intraoperative skin-stretching device to close wounds in Mohs defectsDermatol Surg. ;22(6):546-50.
11. Cohen BH1, CosmettoAJ. (1992)The suture tension adjustment reel. A new device for the management of skin closure.JDermatolSurgOncol. ;18(2):112-23.
12. McKenney MG, Nir I, martin L, Lentz K. (1996)A simple device for closure of fasciotomy wounds. Am J Surg;172:275-7.
13. Ramesh Sasidaran, MS, SerjiusAjik, Scalp Wound Closure with K wires(2012): An alternative easiermethod to scalp wound closure. MS Med J Malaysia ; 67(6):629-630.