



## Outcome of Ankle Syndesmotic Injury Fixation by Suture Endobutton: A Prospective Interventional Study at NITOR

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### Abstract

**Background:** The distal tibiofibular syndesmosis connects the lower leg bones and supports the ankle joint. When this structure is injured, often due to ankle fractures, it can cause long-term problems that require surgical repair. Two common methods of surgery are screw and suture-button fixation, with the latter showing better results in recent studies. The aim of this study was to evaluate the outcome of suture-endobutton fixation for acute ankle syndesmotic injury. **Material & Methods:** This study followed 24 patients with acute ankle syndesmotic injury who underwent suture endobutton fixation at NITOR, Dhaka, from May 2019 to August 2021. The patients were observed for 24 weeks and their outcomes were evaluated by the AOFAS score and radiological analysis together with reported complications. **Results:** The study involved 24 patients with acute ankle syndesmotic injury who underwent surgery. The patients were mostly male 19 (79.17%), had PER type of injury 23 (95.83%), and injured by RTA 12 (50.00%) or twisting force 10 (41.67%). According to the AOFAS score, at the final follow up 12 (50%) patients had an excellent outcome, 08 (33.33%) patients had a good outcome, 3 (12.5%) patients had a fair outcome, and 1 (4.2%) patient had a poor outcome. **Conclusions:** The aim of this study was to evaluate the outcome of suture-endobutton fixation for acute ankle syndesmotic injury. From this study it can be concluded that suture endobutton fixation is an effective treatment option for acute syndesmotic injuries of ankle.

**Keywords:-** Suture-endobutton, AOFAS Score, Ankle syndesmosis, Ankle mortise, Ankle injuries.

## INTRODUCTION

The distal tibiofibular syndesmosis is essential for preserving ankle stability, and it is necessary for appropriate weight transmission and, eventually, for walking. In the distal leg, the syndesmosis consists of two bones and the four ligaments that connect them. This complex stabilises the ankle mortise by securing the fibula in the fibular notch.<sup>[1]</sup>

Approximately 13% of all patients with ankle fractures suffers from syndesmotic injuries. These are more common in pronation and external rotation injuries and in approximately 20% of the ankle fractures requiring operative fixation.<sup>[2]</sup> But, symptomatic distal tibiofibular syndesmotic injuries and injuries associated with ankle fractures are usually treated by surgical fixation.<sup>[3,4]</sup> As misdiagnosed or inadequately treated syndesmotic injuries lead to persistent ankle pain, functional disability, and early osteoarthritis, it is essential to acquire accuracy and maintenance of syndesmotic reduction when treating ankle fractures associated with syndesmotic injuries.<sup>[5]</sup>

If treated operatively, 2 different procedures are commonly used: insertion of a syndesmotic screw and suture-button fixation.<sup>[6,7,8]</sup> Though screw fixation is the traditional method for the treatment of syndesmotic injury, some significant issues should be considered, such as screw loosening, breakage, discomfort, reoperation to remove the screw and loss of reduction due to early implant removal.<sup>[9]</sup>

Alternatively, fixation with a suture-button allows physiological micro movement between the distal tibia and fibula.<sup>[10]</sup> This also enables

early postoperative weight bearing and adequate reduction of the syndesmosis.<sup>[11]</sup> Besides, another surgical procedure is avoided resulting in significant reduction in cost and complications for the patient.<sup>[12]</sup> Over the past few years, syndesmotic injuries, mostly associated with bony or further ligament lesions, were treated more commonly with the suture-button fixation system and have shown promising postoperative outcome in short-term follow up.<sup>[13]</sup>

This study sought to assess the effect of suture-endobutton fixation on the function of the ankle after acute syndesmosis injury.

## Objectives

### General Objective

- To evaluate the outcome of fixation of ankle syndesmotic injury by suture endobutton.

### Specific Objectives

- To assess the functional outcome of syndesmosis fixation by AOFAS score.
- To ascertain radiological outcome at final follow up.
- To find out procedure related complications.

## MATERIAL AND METHODS

This prospective interventional study was conducted at the National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh, from May 2019 to August 2021. Prior permission was taken from Institutional Review Board, 28th May, 2019, National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR), Dhaka, Bangladesh to conduct this study. Due to the COVID-19 pandemic, the study population

consisted of 24 patients who completed the final follow-up. Patients with acute syndesmosis diastasis injury of ankle were enrolled for the study. The patients were informed about the aims, objectives, procedures, risks and benefits of the study and gave written consent. The surgeries were performed after proper counseling and anesthesia fitness. The patients were followed up at 3, 6, 9, 12, and 24 weeks postoperatively. The outcome measures were wound status, ankle joint mobility, infection, pain, deformity, fracture healing, syndesmosis reduction, and functional outcome assessed by the American Orthopaedic Foot and Ankle Society (AOFAS) score after operation. The data were processed and analyzed using SPSS (22) and Microsoft. Qualitative data presented on categorical scale was expressed as frequency and corresponding percentage. Quantitative data was presented as mean and standard deviation (SD). P value was measured by paired t test (one tailed) and less than 0.05 is taken as significant.

### Inclusion criteria

- Male or female patients in age group between 18-60 years.
- Patients present with acute (within 3 weeks) syndesmotoc diastasis injury of ankle that was radiologically determined by-
  - ❖ Tibiofibular clear space (TFCS) more than 5.0 mm on the anteroposterior or mortise radiographs,
  - ❖ Medial clear space (MCS) more than superior clear space or 6.0 mm on the anteroposterior radiographs,
  - ❖ Tibiofibular overlap (TFOL) less than 6.0 mm on the anteroposterior radiograph or less than 1.0 mm on the mortise radiographs.

### Exclusion criteria

- Infection.
- Bilateral syndesmotoc injuries.
- Pathological fracture.
- Multiple injuries in the same limb.
- Patients with major psychiatric disorders.

Operative procedure and postoperative care After giving spinal anesthesia, the patients were kept in supine position with a sand bag underneath the buttock on the affected side. A tourniquet was applied in the thigh followed by adequate prepping and draping. At first the associated fractures were fixed according to the standard AO philosophies of osteosynthesis. Spontaneous reduction of ankle syndesmotoc diastasis usually ensues after open reduction and internal fixation (ORIF) of malleolar fractures. Syndesmotoc injuries were assessed with hook test or cotton test intraoperatively after fracture fixation. The syndesmosis was stabilized with a spiked bone forceps after fracture fixation while keeping the ankle dorsiflexed if diastasis remains disrupted. This was followed by drilling a tibiofibular tunnel parallel to and proximal to the joint line by 2-5 cm in a direction that is 30° postero-anterior in the horizontal plane from fibula to tibia. These steps were performed under guidance of fluoroscopic image intensifier. Afterwards, the polyester braided Ethibond was looped by folding and loaded on to the suture passage device passed through this tunnel and retrieved from the medial aspect of the tibia. Then the polyester threaded loop was delivered through the middle two holes of endobutton. Thereafter again with the use of suture passage device the polyester loop was passed and retrieved from the lateral aspect of the fibula. After that all threads of the

polyester were assembled on to the second endobutton (two threads on each hole).By pulling the threads, both endobuttons were flushed against the bone or the fracture fixation plate (if the tunnel is made through the plate hole). Finally, the threads were knotted tightly together on the lateral endobutton when satisfactory syndesmotic reduction is achieved.



**Photograph 1:** Passing looped suture through tibiofibular tunnel



**Photograph 2:** Suture loaded on both endobuttons



**Photograph 3:** Pre operative and post operative X ray pictures

Postoperatively, in all patients ankle was immobilized in a posterior plaster splint with the ankle in neutral position and kept elevated by keeping pillow underneath leg and ankle maintained for the first 48-72 hours. Antibiotics were prescribed according to the local hospital guidelines. Adequate sedatives and analgesics were given to all patients. Drain was removed at 2nd post-operative days. Stitches were removed 10-14 days post operatively. The patients were advised non weight bearing crutch ambulation for 6 weeks. Active and passive motion was permitted as soon as the wounds were healed. After wound healing patients were discharged after being advised about limb care and regular follow up at three (03) weekly intervals for the first six weeks and thereafter at monthly intervals till fracture healing. On each visit, wound status, ankle joint mobility, any infection, pain at the ankle, any deformities assessed. Besides, radiograph was taken at each visit to follow progression of fracture healing, maintenance of syndesmotic reduction. Full weight bearing was allowed at six weeks onwards. The patients were advised to continue physiotherapy to increase muscle strength and range of ankle and knee joints motion.

## RESULTS

This prospective interventional study was conducted at the National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR). Twenty-four cases were selected for the study. Data were collected with a structured questionnaire, and the results are described in the following tables and figures.



[Table 1] shows the demographic and clinical variables of the study patients. The patients had a mean age of  $34.66 \pm 1.83$  years and were mostly male 19 (79.17%), and businessmen or service holders 6 (25.00%) each. The most common causes of injuries were RTA 12 (50.00%) and twisting force 10 (42.67%). The most common type of injury was PER 23 (95.83%). The right side 13 (54.17%) was slightly more affected than the left side 11 (45.83%). There is significant improvement in the radiological parameters at the final follow up as evidenced by a mean tibiofibular overlap of

$6.58 \pm 0.43$  mm, a tibiofibular clear space of  $4.32 \pm 0.63$  mm and a medial clear space of  $3.14 \pm 0.41$  mm [Table 2]. 2(8.3%) patients developed superficial wound infections, and 1(4.2%) patient developed deep wound infections over the medial malleolus. There was 1 (4.2%) case of failed stabilization of the syndesmosis [Table 3]. According to the AOFAS score, at the final follow up 12 (50%) patients had an excellent outcome, 08 (33.33%) patients had a good outcome, 3 (12.5%) patients had a fair outcome, and 1 (4.2%) patient had a poor outcome [Table 4].

**Table 1:** Demographic and clinical variables of the study population (N=24).

Variable	Frequency	Percentage
Age (years)		
18-20	1	4.17%
21-30	9	37.50%
31-40	8	33.33%
41-50	5	20.83%
51-60	1	4.17%
Total	24	100.00%
Mean Age	$34.66 \pm 1.83$	
Range	19-51	
Gender		
Male	19	79.17%
Female	5	21.83%
Occupation		
Businessman	6	25.00%
Service holder	6	25.00%
Housewife	5	20.80%
Student	3	12.50%
Farmer	2	8.30%
Day laborer	1	4.20%
Plumber	1	4.20%
Aetiology		
Twisting Force	10	41.67%
RTA	12	50.00%
Sports	2	8.33%
Mechanism of injury		



PER	23	95.83%
PA	1	4.17%
Side of injury		
Right	13	54.17%
Left	11	45.83%

**Table 2:** Radiological outcome of the study subjects (N=24).

Parameters	Preoperative	24 weeks post-operative	P value
	Mean±SD (mm)	Mean±SD (mm)	
Tibiofibular overlap (mm)	4.32±0.70	6.58±0.43	0.0357
Tibiofibular clear space (mm)	6.79±0.43	4.32±0.63	0.0277
Medial Clear space (mm)	6.04±.44	3.14±0.41	0.0332

**Table 3:** Complications of the study subjects (N=24).

Complications	Frequency	Percentage (%)
Superficial infection	2	8.33%
Deep infection	1	4.17%
Failed stabilization	1	4.17%
No Complication	20	83.33%
Total	24	100.00%

**Table 4:** Functional Outcome by AOFAS scoring of study subjects (N=24).

AOFAS Score Grade	24 weeks post-operative		
	Frequency	AOFAS score	%
Excellent (90-100)	12	1080	50.00%
Good (80-89)	8	695	33.33%
Fair (70-79)	3	224	12.50%
Poor <70	1	48	4.17%
Total	24	2047	100.00%
Mean ± SD	85.29±9.41		
Range	48-90		

## DISCUSSION

A total of 24 subjects were included in this study based on predefined enrollment criteria. The aim of this study was to determine the outcome of the patients treated with suture endobutton fixation for acute syndesmotic instability of ankle.

Among 24 (37.50%) patients, maximum patients were in 21-30 years age group, 8

(33.33%) patients in 31 - 40 years, 5 (20.83%) patients in 41 to 50 years and 1 (4.17%) patient in both 11 years to 20 years and 51 years to 60 years age group. The mean age was 34.66±1.83years. A study conducted by Imam and his colleagues found that the mean age of patients was 38.2 (18-55) years at the time of surgery.<sup>[4]</sup> Another review study conducted by van Dijk and his colleagues among 1938 ankles found the average age of the study population

28.5 years ranging from 12 to 66 years.<sup>[13]</sup> This indicates that this injury is evident on younger population. Among the study cases, 19 (79.17%) were male and 5 (21.83%) were female. The male female ratio was 19:5. This indicates that this type of injury is more common in males who were more involved in outdoor activities. Kim and his colleagues conducted a comparative study between suture endobutton fixation and screw fixation. In their study 75% population were male and 25% population were female which matched with this result.<sup>[5]</sup> Occupation of the study patients demonstrates that most of the cases were businessmen 6 (25.00%) and service holders 6 (25.00%) which was 6 each. Other occupants were housewives 5 (20.80%), students 3 (12.50%), farmers 2 (8.30%). Day labourer and plumber were 1 (4.20%) in each group. These findings are compatible with a study conducted by Weening and his colleagues. 88% of the population in their study belongs to sedentary workers which is true for our study as businessmen, service holders and housewives all lead a sedentary lifestyle.<sup>[14]</sup> Among 24 cases, 12 cases had ankle injuries due to RTA (50%), 10 (42%) cases had those injuries due to twisting force and 02 (8%) cases had ankle injuries due to sports. A study showed that road traffic accidents constitute significant portion of the injury which is around 63%.<sup>[5,15]</sup> This finding is also similar with our study. Among 24 cases, 23 (95.83%) had ankle injuries due pronation external rotation-PER force and only 1 (4.17%) injury was due to pronation abduction -PA force. DeGroot and his colleagues also noted pronation external rotation injuries as the most common cause of syndesmotoc rupture. In their study, 54% of the ankle syndesmotoc injuries

were due to pronation external rotation force.<sup>9</sup> Among 24 cases, 13 (54.17%) cases had ankle injuries in the right side and 11 (45.83%) injuries were in the left side.

Preoperative mean tibiofibular overlap was  $4.32 \pm 0.70$  mm, tibiofibular clear space was  $6.79 \pm 0.43$  mm and medial clear space was  $6.79 \pm 0.43$  mm. There is significant improvement in post-operative period as evidenced by postoperative tibiofibular overlap of  $6.58 \pm 0.43$  mm ( $P=0.03657$ ), tibiofibular clear space of  $4.32 \pm 0.63$  mm ( $P=0.0277$ ) and medial clear space of  $3.14 \pm 0.41$  mm ( $P=0.0332$ ). Imam and his colleagues also had an almost similar change of TFO, TFCS and MCS. Their study showed that MCS significantly decreased from 8.8 (6.7-12.8) mm pre-operatively to 3.2 (range 2.6 - 4.1) mm at two years post-operatively ( $P=0.04$ ).<sup>[1]</sup> Similarly, The TFCS significantly decreased from a mean of 9.2 mm (6.9- 11.8) pre-operatively to a mean of 4.2 mm (range 3.3-5) at two years post-operatively ( $P=0.05$ ) and the TFO in the AP view significantly improved from a mean of 2 (0-5) mm preoperatively to a mean of 8 (7-9) mm postoperatively ( $P=0.02$ ).

Among 24 patients, 2 (8.33%) developed superficial infection, which was managed by non-operatively by doing pus for C/S, changing antibiotic according to sensitivity and regular dressing. 1 (4.17%) patient developed deep infection which was managed by implant removal after radiological healing had been achieved. There was 1 (4.17%) case of failed stabilization. Revision was performed with a repeat of the suture-endobutton fixation to restore anatomical reduction at 20<sup>th</sup> week. No further surgery was required as complete healing was achieved. Imam and his colleagues

reported 2 cases (4.20%) of superficial wound infection and 2 cases (4.20%) of failed stabilization among 48 cases.<sup>[1]</sup> So, our study shows a slightly higher rate of procedure related complications particularly superficial and deep wound infection among the cases.<sup>[1]</sup>

According to the AOFAS Score, >89 was termed excellent, 80-89 was good, 70-79 was fair and <70 was termed poor outcome. In 24 weeks follow up 12 (50.00%) patients had excellent outcome, 8 (33.33%) patients had good outcome, 3 (12.50%) patients had fair outcome and 1 (4.17%) patient had poor outcome. The average AOFAS score in 24 weeks follow up was 85.29±9.41. The AOFAS score also improved significantly in a study from 32.4 (range 21.3-37.2) preoperatively to 94.5 (range 84-98) at 2 years post-surgery (P=0.004).<sup>1</sup> Another study showed that postoperative mean AOFAS score was 88.8(range 67-98) at a mean follow up of 14 months.<sup>16,17</sup> The higher scores showed in their studies were related to the longer follow up period compared to that of our study.<sup>[16]</sup>

### Limitations of the study

This study had some limitations. It did not compare suture-endobutton fixation with

syndesmotic screw, another method for fixation of ankle syndesmotic injury. It followed up the patients for 24 weeks, which may not show the long-term outcome and complications. It was done in a single center, which may affect the generalizability and applicability of the results.

### CONCLUSIONS

This study shows that there is excellent to good functional outcome in majority of the patients in a consecutive series of 24 suture endobutton fixation for acute ankle syndesmotic injuries with a 24 weeks follow-up. The radiological parameters also improved significantly after suture button fixation which implies that adequate syndesmotic reduction has been achieved by this procedure. There were procedure related complications in one-sixth of the patients, particularly postoperative superficial and deep wound infection and failed stabilization of the syndesmosis. Hence, it can be concluded that suture endobutton fixation is an effective method for the treatment of acute syndesmotic injuries of ankle.

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