

## Case Series

# PERCUTANEOUS CERCLAGE WIRING IN COMMINUTED PATELLAR FRACTURES: A PROSPECTIVE CASE SERIES OF 35 PATIENTS

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Received : 05/01/2026  
Received in revised form : 20/02/2026  
Accepted : 07/03/2026

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DOI: 10.70034/ijmedph.2026.1.495

Source of Support: Nil,  
Conflict of Interest: None declared

Int J Med Pub Health  
2026; 16 (1); 2877-2887

### ABSTRACT

**Background:** Comminuted fractures of the patella are challenging injuries due to fixation having to restore the extensor mechanism, maintain articular congruity, facilitate early mobilization with minimal soft-tissue disruption. Open techniques may be associated with stiffness, symptomatic hardware, and wound complications. Percutaneous cerclage wiring is one of the minimally invasive solutions for selected comminuted fractures.

**Materials and Methods:** This survey of prospective cases examined 35 individuals with comminuted patellar fractures who underwent percutaneous cerclage wiring at Basaweshwara Teaching and General Hospital, Kalaburagi, between 1 June 2024 and 30 November 2025. Patients 15-70 years of age with closed fractures or Gustilo-Anderson type I open fractures were included. Patients who sustained Gustilo-Anderson type II/III injuries were excluded and polytrauma with the ipsilateral distal femur or proximal tibia, or severe systemic disease was excluded. All patients underwent percutaneous circumferential cerclage fixation with stainless steel wire via small peripatellar portals with fluoroscopic guidance. Rehabilitation after surgery highlighted early continuous passive motion, progressive range-of-motion exercises, and graded weight-bearing.

**Results:** The cohort included 30 men and 5 women. Road traffic accident was the predominant mode of injury. Union was reached in all 35 patients within 16 weeks with a mean time to union of 12.6 weeks. Mean final knee flexion was 132° (range, 120°-140°), and the mean Böstman score was 25.22/30. At follow-up, two patients suffered from superficial infection, two had implant breakage, and one elderly patient had osteoarthritic symptoms during follow-up. Most patients were back to regular work by 12-14 weeks.

**Conclusion:** Percutaneous cerclage wiring provided stable fixation, preservation of soft tissues, satisfactory functional recovery, and universal fracture union in this prospective series. The technique appears to be a practical minimally invasive option for selected comminuted patellar fractures, particularly when early mobilization and reduced surgical morbidity are desired.

**Keywords:** Patellar fracture, Comminuted patella, Percutaneous cerclage wiring, Minimally invasive fixation, Knee fractures, Extensor mechanism, Surgical management.

## INTRODUCTION

The patella is the largest sesamoid bone in the human body, and key to the knee extensor mechanism in increasing the lever arm of the quadriceps and contributing to efficient knee extension,

patellofemoral congruity, and load transmission across the anterior knee.<sup>[1,3-6]</sup> Patellar fractures make up around 1% of total skeletal fractures and, although relatively uncommon, may cause substantial impairment because failure to restore extensor continuity and articular congruity can lead to

stiffness, extensor lag, anterior knee pain, weakness, and post-traumatic patellofemoral degeneration.<sup>[1-8]</sup>

Most of these fractures happen after a direct blow to the anterior portion of the knee, sudden eccentric contraction of the quadriceps, or a combo of both these mechanisms.<sup>[1,3-6]</sup> It has been found that direct injury is more prone to stellate or comminuted type fractures, while indirect mechanisms produce transverse or pole avulsion injuries in a more typical mode.<sup>[3-6]</sup> Epidemiologic investigations have revealed that patellar fractures can be present across a wide age spectrum and potentially have a bimodal pattern, with high-energy trauma in younger adults and fragility-related fractures in older patients.<sup>[2,6]</sup>

The management of comminuted patellar fractures continues to be especially problematic. Treatment goals are anatomical or near-anatomical restoration of the articular surface, preservation of the patellar bone stock, reconstruction of the extensor mechanism, and sufficiently stable fixation to permit early mobilization.<sup>[1,3-9]</sup> Historically, modified tension-band wiring has been considered the standard for displaced transverse fractures, but its performance may be less satisfactory in highly comminuted injuries because multiple small fragments are difficult to control and wide exposure may further compromise soft tissues and fracture biology.<sup>[3-9]</sup> Contemporary reviews and systematic evidence syntheses also indicate that the literature remains heterogeneous, with no universally superior fixation method established for all fracture morphologies.<sup>[6,9]</sup> Imaging and fixation strategies have become increasingly refined by recent imaging and fixation approaches that have improved the management of these injuries. Computed tomography can enhance fracture classification and change the planning of operations in complex patterns.<sup>[10,11]</sup> Concurrently, alternative fixation techniques including plating, cannulated screw constructs, suture-based fixation, and cerclage techniques have also become increasingly noted, particularly for multifragmentary fractures.<sup>[4-6,12-15]</sup> One of the most favored choices of these is percutaneous cerclage wiring, which has relatively minor incisions that allow circumferential fragment control, preservation of peripatellar soft tissues, and may minimize wound morbidity but permit early rehabilitation.<sup>[12-14]</sup>

Matsuo et al. first described percutaneous cerclage wiring as a minimally invasive method of embedding the surrounding soft tissues within the fixation construct.<sup>[12]</sup> The success of the cerclage-based constructs for increasing union rates and functional outcomes has been reported in geriatric and comminuted fracture series.<sup>[13,14]</sup> In this setting, the current prospective case series was performed to assess the clinical, radiologic, and functional results of percutaneous cerclage wiring in 35 patients with comminuted patellar fractures from our institution.

## MATERIALS AND METHODS

This prospective exploration in which we enrolled 35 patients with comminuted fractures of the patella enrolled in Basaweshwara Teaching and General Hospital, Kalaburagi, between 01-06-2024 and 30-11-2025. There were 30 male and 5 female patients with a high male predominance. Eligible patients were 15-70 years old. Inclusion criteria were closed comminuted patellar fractures and Gustilo-Anderson type I open fractures (radiographic confirmation). Exclusion criteria were Gustilo-Anderson type II and III open fractures, bedridden or critically ill patients, and polytrauma patients with their associated ipsilateral distal femur or proximal tibia fractures.

The majority of injuries occurred after road traffic accidents, whereas self-fall was the other key mechanism. The study targeted functional restoration of the extensor mechanisms, early recovery of mobilization postoperatively, and complication due to this minimally invasive procedure.

**Clinical Findings:** Patients typically presented with painful swelling over the anterior aspect of the knee, localized tenderness, hemarthrosis, difficulty or inability to perform active knee extension, and restriction of knee movement. The clinical examination included assessment of local swelling, skin condition, palpable fracture gap where appreciable, extensor mechanism integrity, and distal neurovascular status. Systemic examination and routine pre-anesthetic assessment were performed in all patients. Although individual vital signs were not tabulated in the original dataset, all patients were clinically optimized for surgery following standard institutional protocol.

### Timeline

- Day of injury: Trauma to knee, emergency presentation, radiographic confirmation of comminuted patellar fracture
- Preoperative period: Clinical assessment, laboratory investigations, radiographs, anesthetic evaluation, informed consent
- Operative day: Percutaneous cerclage wiring under spinal anesthesia
- Postoperative day 1: Continuous passive motion initiated depending on fixation stability and bone quality
- Postoperative days 2-3: Brace in extension, early partial weight-bearing with crutches
- 2-4 weeks: Progressive active range-of-motion exercises; knee flexion advanced toward 90°
- 4 weeks onward: Progression to full weight-bearing
- Follow-up visits: 3 weeks, 6 weeks, 3 months, and 6 months
- 12-16 weeks: Clinical and radiological union achieved
- 12-14 weeks: Most patients resumed routine work
- 6 months: Final functional and radiographic assessment

**Diagnostic Assessment:** Patients underwent radiographic evaluation with anteroposterior and lateral views of the knee; skyline/axial views were obtained when needed. The preoperative investigations included complete hemogram, coagulation profile, blood glucose, renal function test, liver function test, erythrocyte sedimentation rate, prothrombin time, serum electrolytes, serology, blood grouping, urine routine examination, and chest radiograph.

The principal differential diagnoses included simple transverse patellar fracture, inferior pole patellar fracture, sleeve fracture, quadriceps or patellar tendon injury, and osteochondral fracture around the patellofemoral articulation. In the present series, radiological findings and clinical impairment of the extensor mechanism supported operative management for comminuted patellar fractures. The criterion for radiological union was at least 80% bridging of the fracture by bony trabeculae, and clinical union was defined by absence of pain and tenderness on passive manipulation.

#### Therapeutic Intervention

All procedures were performed under spinal anesthesia on the patient supine on a radiolucent table. Antibiotic prophylaxis by intravenous route was given 30 min prior to incision. A tourniquet was not used. The hematoma was aspirated from the suprapatellar portion using a 50 cc syringe under strict aseptic precautions. Closed reduction was subsequently performed using an extension of the knee and approximations of the fragments with a Weber clamp or towel clip.

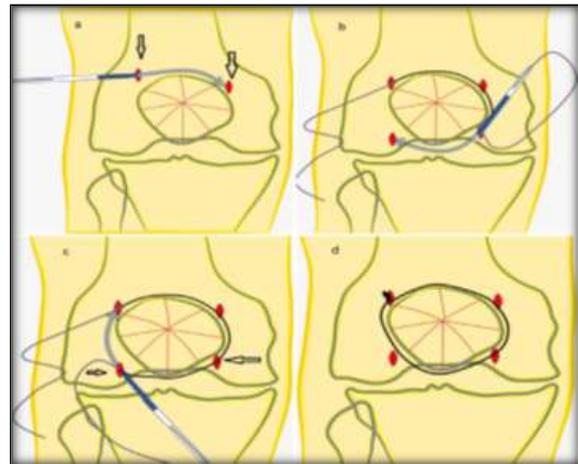
A 1 cm incision was made at the superolateral corner of the patella. A lumbar cannula or wire passer was placed through the quadriceps tendon from the superolateral to the superomedial corner with an inserted 16G or 18G stainless steel cerclage wire. The passer was then redirected along the medial border to the inferomedial corner, advanced through the patellar tendon along the inferior border to the inferolateral corner, and later along the lateral edge back to the superolateral entry point. The cerclage wire was tightened, and the knot was secured at the superolateral portal to compress the fracture fragments circumferentially. Reduction was confirmed by C-arm fluoroscopy, and the small portal incisions were closed primarily.



**Figure 1: General surgical instruments used for percutaneous cerclage wiring.**



**Figure 2: Lumbar cannula/wire passer used to shuttle the cerclage wire.**



**Figure 3: Schematic illustration of percutaneous cerclage wire passage around the patella: (A) superolateral to superomedial, (B) superomedial to inferomedial, (C) inferomedial to inferolateral, and (D) inferolateral to superolateral with final knot at the superolateral portal.**

**Postoperative Protocol:** The knee was immobilized in an extension brace for 2-3 days, followed by early partial weight-bearing with crutches. Continuous passive motion was started on postoperative day 1 based on construct stability and bone quality. Active range-of-motion exercises were initiated as early as possible, with progression to 90° of flexion and advancement to full weight-bearing by 4 weeks. Follow-up was conducted at 3 weeks, 6 weeks, 3 months, and 6 months for radiological and functional evaluation using the Böstman scoring system.



**Figure 4: Intraoperative patient positioning in supine posture on a radiolucent table.**



**Figure 5:** Skin entry portals at the superolateral, superomedial, inferomedial, and inferolateral corners of the patella.



**Figure 8:** Closure of all percutaneous portals.



**Figure 6:** Intraoperative image showing reduction and cerclage fixation



**Figure 9:** Immediate postoperative radiographs of the knee: anteroposterior, lateral, and skyline views.



**Figure 7:** Knot placement at the superolateral portal.

**Table 1: Baseline characteristics and overall outcomes of the 35-patient series**

Variable	Finding
Total number of patients	35
Study design	Prospective case series
Study period	01/06/2024 to 30/11/2025
Study centre	Basaweshwara Teaching and General Hospital, Kalaburagi
Sex distribution	30 males, 5 females
Age range	15-70 years
Main mode of injury	Road traffic accident
Other mode of injury	Self-fall
Fracture type	Comminuted patellar fractures
Inclusion	Closed fractures and Gustilo-Anderson type I
Exclusion	Gustilo-Anderson type II/III, bedridden/critically ill, polytrauma
Mean union time	12.6 weeks
Union achieved	35/35 patients
Final knee flexion	Mean 132° (range 120°-140°)
Mean Böstman score	25.22/30
Return to normal work	12-14 weeks in most patients
Complications	2 superficial infections, 2 implant breakage, 1 osteoarthritis

## CASES

### Case 1:

Mr Mallikariun, a 28-year-old man, sustained a comminuted patellar fracture from a road traffic accident. Radiographs revealed an AO classification 34C3 injury. Under spinal anesthesia, he underwent percutaneous cerclage wiring. At 12 weeks fracture union was reached. The final range of motion was 130°-140° and the clinical outcome was excellent. At 4 weeks, the wound had healed completely and he was ambulant with walking aid. By 3 months, active knee flexion was 80°-90° and at 6 months, he could flex 120°-130°, ambulate independently without symptoms, and squat comfortably.



Figure 10: Case 1 preoperative anteroposterior and lateral radiographs showing comminuted patellar fracture.



Figure 11: Case 1 immediate postoperative anteroposterior and lateral radiographs demonstrating reduction and cerclage fixation.



Figure 12: Case 1 radiographs at 6 months showing fracture union.



Figure 13: Case 1 clinical photograph at 4 weeks showing healed wound.



Figure 14: Case 1 clinical photograph at 3 months showing active knee range of motion.





**Figure 15: Case 1 clinical photograph at 6 months showing good flexion and squatting ability.**

**Case 2:** A 52-year-old man, Mr Devukumar sustained a comminuted patellar fracture from a road traffic accident. The fracture was identified as AO 34C3. He underwent percutaneous cerclage wiring under spinal anesthesia and achieved radiological union by 12 weeks. The final knee flexion was 120°-130°. There were no complications, and overall results were excellent. He achieved 90° active flexion at 2 weeks following suture removal; was weight-bearing with crutches at 2 weeks; performed straight-leg raising at 1 month; and achieved 110°-120° active flexion by 1 month.



**Figure 16: Case 2 preoperative anteroposterior and lateral radiographs.**



**Figure 17: Case 2 immediate postoperative anteroposterior and lateral radiographs.**



**Figure 18: Case 2 follow-up radiographs at 3 weeks including skyline view.**

**Case 3:** Mr Basavaraj, a 43-year-old man, presented with an AO 34C3 comminuted fracture of the patella. He underwent fixation under spinal anesthesia. Union was achieved at 12 weeks. Final knee range of motion was 120°-130°, with no recorded complications. The final outcome was excellent.



**Figure 19: Case 3 preoperative anteroposterior and lateral radiographs.**



**Figure 20: Case 3 immediate postoperative anteroposterior and lateral radiographs.**

**Case 4:** Mr Hallerao, a 70-year-old man, sustained a comminuted patellar fracture following self-fall. Radiographs demonstrated an AO 34C3 injury. He underwent percutaneous cerclage wiring under spinal anesthesia. Fracture union occurred by 14 weeks. Final knee flexion was 110°-120°. He developed osteoarthritic symptoms during follow-up, and the overall outcome was graded as good rather than excellent.



Figure 21: Case 4 preoperative anteroposterior and lateral radiographs.



Figure 22: Case 4 immediate postoperative anteroposterior and lateral radiographs.

Table 2: Summary of cases

Case	Patient	Age/Sex	Mode of Injury	AO Classification	Anesthesia	Union	Final ROM	Complications	Outcome
1	Mr Mallikariun	28/M	RTA	34C3	Spinal	12 weeks	130°-140°	Nil	Excellent
2	Mr Devukumar	52/M	RTA	34C3	Spinal	12 weeks	120°-130°	Nil	Excellent
3	Mr Basavaraj	43/M	Not specified	34C3	Spinal	12 weeks	120°-130°	Nil	Excellent
4	Mr Hallerao	70/M	Self-fall	34C3	Spinal	14 weeks	110°-120°	Osteoarthritic symptoms	Good

**Follow-up and Outcomes:** All patients were tracked clinically and radiologically at 3 weeks, 6 weeks, 3 months, and 6 months. Functional assessment was conducted using the Böstman scoring system. Union was achieved in all patients by 16 weeks, with a mean time to union equal to 12.6 weeks. Average final knee flexion was 132°, ranging from 120° to 140°. The average postoperative flexion arc after union was approximately 0-130°. Most patients resumed normal work by 12-14 weeks.

**Complications were limited:** Two patients developed superficial infection. Two patients had implant breakage, and in these cases the implant was removed at 6 months. One elderly patient had osteoarthritic symptoms, which correlated with a comparatively lower functional outcome. No nonunion was recorded.

## RESULTS

In the present case series of 35 patients with patellar fractures, males were more commonly affected than females, with a male-to-female ratio of 6:1. Road traffic accident was the predominant mode of injury. Right-sided fractures were more frequent than left-sided fractures. All patients achieved fracture union by 16 weeks, with a mean union time of approximately 12.6–13.2 weeks. The mean postoperative knee flexion was 132°, and most patients regained satisfactory functional outcome, with a mean Böstman score of 25.22/30.

Complications included two cases each of superficial infection and implant failure, and one case of osteoarthritic change.



Figure 23: Sex distribution of patients

**Demographic profile:** Of the 35 patients, 30 were male and 5 were female, giving a male-to-female ratio of 6:1, indicating a clear male predominance in this series [Figure 23].

The age distribution of the patients is shown in [Figure 24]. The highest number of patients belonged to the most commonly affected age group, followed by the adjacent age categories.

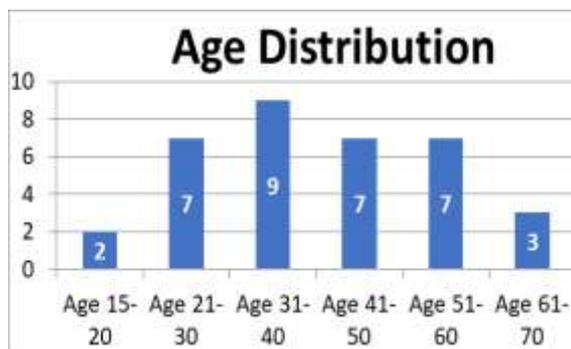


Figure 24: Age distribution of patients.

**Mode of injury:** The most common mechanism of injury was road traffic accident, followed by self-fall [Figure 25]. This suggests that high-energy trauma was the predominant cause of patellar fractures in the present study.



Figure 25: Mode of injury among patients with patellar fracture.

**Side of involvement:** Fractures were more common on the right side than on the left. Of the 35 patients, 25 patients (71.42%) had right-sided patellar fractures, whereas 10 patients (28.57%) had left-sided involvement [Table 3, Figure 26].

Table 3: Side of patellar fracture involvement

Side	No. of patients (n)	Percentage (%)
Right	25	71.42
Left	10	28.57
Total	35	100

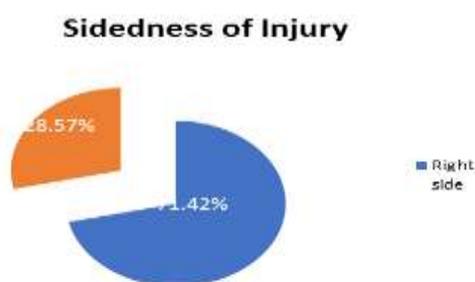


Figure 26: Side of involvement in patellar fractures.

**Range of motion and functional recovery:** Following clinical and radiological union, the average postoperative knee range of motion was 132° of flexion, with an overall range of 120° to 140°. The average flexion arc achieved was approximately 0°–130°. All patients were started on continuous passive motion (CPM) postoperatively, and all resumed their normal work activities by 12–14 weeks after surgery [Figure 27].

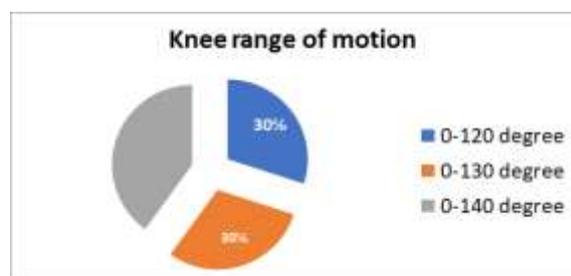


Figure 27: Postoperative knee range of motion achieved after union.

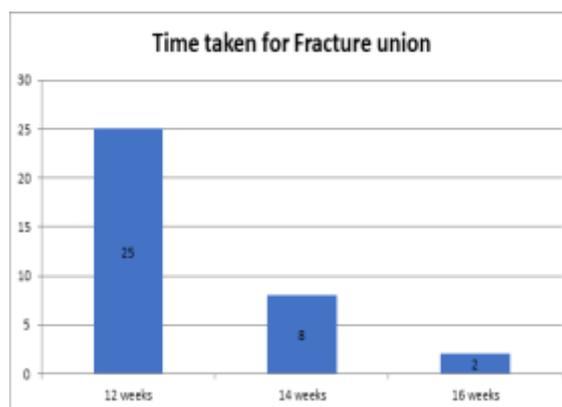


Figure 28: Time taken for clinical and radiological union.

**Fracture union:** The mean time to clinical and radiological union was 12.6–13.2 weeks postoperatively, with union achieved in all patients by 16 weeks. The minimum time to union was 12 weeks, while the maximum time observed was 16 weeks [Figure 28].

The criterion for radiological union was defined as at least 80% bridging of the fracture site by bony trabeculae.

The criterion for clinical union was defined as the absence of pain and tenderness at the fracture site on passive manipulation.

**Complications:** Complications were few. Two patients developed superficial infection, two patients had implant failure/breakage, and one patient developed osteoarthritic changes. Implant failure cases subsequently underwent implant removal at 6 months. Despite these complications, fracture union was achieved in all patients.

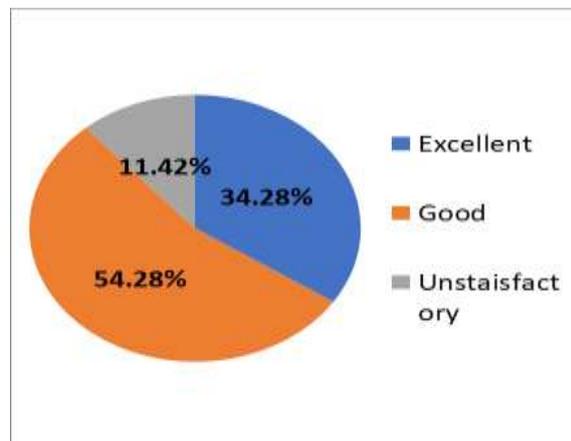
**Functional outcome according to Böstman score:** Functional outcome was assessed using the Böstman

scoring system. The mean Böstman score was 25.22 out of 30, indicating an overall good to excellent functional result. Based on grading, 19 patients

(54.28%) had good results, 12 patients (34.28%) had excellent results, and 4 patients (11.42%) had unsatisfactory results [Table 4, Figure 29].

**Table 4: Functional outcome according to Böstman score**

Grading	No. of patients (n)	Percentage (%)
Unsatisfactory	4	11.42
Good	19	54.28
Excellent	12	34.28
Total	35	100



**Figure 29: Functional outcome according to Böstman score.**

Overall, the present series demonstrated satisfactory fracture union, good postoperative knee mobility, and favorable functional outcomes in the majority of patients.

## DISCUSSION

The chief conclusion regarding this prospective series is that the percutaneous cerclage wiring was capable of achieving fracture union in all 35 patients, having a mean union time of 12.6 weeks, a mean final knee flexion of 132°, and a mean Böstman score of 25.22/30. These data indicate that the method could provide stable fixation and satisfactory functional recovery in selected comminuted patellar fractures. This is clinically relevant since comminuted injuries are among the most technically difficult patellar fractures to manage while the surgeon strives to preserve patellar bone stock and avoid morbidity, which can result from extensive open dissection.<sup>[1,3-6]</sup> The likely cause of these results is a combination of mechanical and biological factors. Circumferential cerclage enables a global containment of multiple small fragments and can spread compressive forces around the patella rather than relying on purchase in a paucity of focal structures alone.<sup>[12-14]</sup> The percutaneous approach preserves the structural integrity of the peripatellar soft tissues, retinaculum, and local vascular envelope for the maintenance of the physiological environments conducive to healing.<sup>[12]</sup> The soft-tissue-preserving approach may prove particularly useful in comminuted fractures, in which direct manipulation of fragments may increase the risk of devascularization.<sup>[1,5,6]</sup>

Findings of our study are in line with cerclage literature. Matsuo et al. reported satisfactory healing with percutaneous cerclage fixation in displaced patellar fractures and highlighted the importance of including the peripatellar soft tissues in the construct.<sup>[12]</sup> Zhai et al. subsequently detailed positive findings for geriatric AO/OTA 34-C fractures with closed reduction and percutaneous cerclage wiring, noting reliable union as well as useful restoration of knee motion.<sup>[13]</sup> Sun et al. similarly found modified cerclage wiring to be a safe and effective method for comminuted patellar fractures.<sup>[14]</sup> The current series thus contributes prospective institutional data that correlate well with historical observational findings of cerclage-driven fixation across multifragmentary configurations.<sup>[12-14]</sup> The current findings should also be situated against the broader backdrop of patellar fracture management. Standard tension-band procedures are still popular methods and serve well in simple displaced transverse fractures, although more recent reviews indicate significant drawbacks in comminuted patterns, including loss of fixation, prominent hardware, and the frequent need for secondary implant removal.<sup>[3-9]</sup> There is an increasing trend in comparative and review literature to tailor treatment of fixation technology to the fracture morphology, rather than using a single structure consistently for all the patterns.<sup>[3-6,8,9]</sup> This is particularly pertinent in AO/OTA 34-C injuries where multiplanar fragmentation and articular complexity frequently complicate classical constructs.<sup>[10,11]</sup>

A remarkable feature of this series is the rehabilitation profile. Patellar fixation necessitates early mobilization to diminish the extent of quadriceps wasting, arthrofibrosis, and prolonged functional limitation.<sup>[1,3-6]</sup> In our protocol, continuous passive motion was initiated on the first postoperative day when construct stability allowed, active range-of-motion exercises were introduced early, and most patients resumed normal work by 12 to 14 weeks. Such findings are also of clinical relevance and are closely correlated with the functional aims sought in modern reviews and postoperative outcome studies.<sup>[1,3-6,16]</sup>

The complication profile of our cohort was acceptable, yet not insignificant. Two patients developed superficial infection, two showed implant breakage, and one older patient had osteoarthritic symptoms. Importantly, no patient developed

nonunion. These observations are salient given the presence of modern systematic review evidence indicating that patellar fracture surgery may remain plagued by complications, particularly symptomatic hardware, reoperation, fixation failure, and infection.<sup>[15,17]</sup> Our series fits into that broad existing literature, particularly with regard to universal union, however it does not remove the risk profile of operative patellar fixation that we already know.<sup>[15,17]</sup> Imaging as a factor is additionally worth highlighting. Recent studies have suggested computed tomography and three-dimensional reconstruction that may improve interobserver reliability of fracture classification, and can alter treatment planning in complex patellar fractures.<sup>[10,11,18]</sup> Despite the reliance of the existing series on conventional radiographs and intraoperative fluoroscopic assessment, future studies incorporating routine CT-based classification may allow more precise stratification of fracture morphology and better comparison with alternative fixation methods.<sup>[10,11,18]</sup>

Comparison with other modern methods clarifies the position of percutaneous cerclage wiring. Plate fixation has become more widely used due to its possibility of strong fixation in very comminuted fractures and early reports of favorable radiological and functional outcomes in selected cases.<sup>[4-6,19]</sup> Cannulated screw constructs and hybrid suture methods are also becoming a more common option, especially for transverse or inferior-pole geometry.<sup>[6,20]</sup> However, plating generally requires wider exposure, while some suture or screw constructs are less applicable in diffuse circumferential comminution. Perhaps in this specific setting, percutaneous cerclage wiring may provide a pragmatic midway solution: it is minimally invasive, economical, technically reproducible, and suitable for fragmentary fractures in which preservation of soft tissues is a priority.<sup>[12-14]</sup>

There are limitations to this study. It is a single-centre case series without a control group, randomization, or formal comparative arm. The follow-up period of 6 months was adequate for examining union and early function but insufficient for full assessment of long-term patellofemoral arthritis, chronic pain, or implant-related symptoms. Finally, despite favorable clinical outcomes in general, the dataset did not contain a stratified analysis according to age, fracture burden, pre-existing degenerative change, or bone quality. This is why these limitations have implications that would qualify the study being taken as supportive observational evidence rather than definitive comparative proof.

But, the study has practical implications despite these limitations. It proves that percutaneous cerclage wiring can be utilized to reinstate extensor mechanism continuity, attain reliable union and support an early rehabilitation with acceptable morbidity in comminuted patellar fractures. Overall, our results indicate that this technique is a useful minimally invasive option in well-selected patients,

and highlight the necessity for larger comparative studies to be performed with plating, hybrid fixation and other morphology-specific strategies.<sup>[12-20]</sup>

## CONCLUSION

Percutaneous cerclage wiring was a successful method for the treatment of comminuted patellar fractures in this prospective series. In all 35 subjects the technique was successful achieving fracture union, stable fixation that was adequate for early mobilization, and satisfactory functional recovery as demonstrated with mean final knee flexion (132°) and mean Böstman score 25.22/30. The limited surgical exposure was associated with the preservation of soft tissues, minimization of morbidity, and rehabilitation. Whilst superficial infection and implant breakage were present in some patients, the complication profile was acceptable and no nonunion had occurred. Overall, the results indicate that percutaneous cerclage wiring is a practical, reliable intervention in selected comminuted patellar fractures, and more so for extensor mechanism preservation and early postoperative knee mobilization. It is to be verified whether this technique is effective long-term and compared with other types of fixation, by more comprehensive comparative studies with longer follow-up.

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