Tabari Biomedical Student Research Journal

OPEN ACCESS

REVIEW: Adjunctive Cerclage in Subtrochanteric Femur Fractures Treated With Long Cephalomedullary Nailing: A Narrative Review

Seyed Sadegh Shirdel

Sadegh Taheri

Abolfazl Ghadiry

Assistant Professor of Orthopedic Surgery, Orthopedic Research Center, Mazandaran University of Medical Sciences, Sari, Iran

Mohamadreza Daryaee

Assistant Professor, Department of Orthopedics, Golestan University of Medical Sciences, Gorgan, Iran

ARTICLE INFO

Submitted: 10 Oct 2025
Accepted: 28 Nov 2025
Published: 20 Dec 2025

Keywords:
Subtrochanteric Femur Fracture; Cerclage; Intramedullary Nailing; Cephalomedullary Nail; Fracture Reduction

Correspondences:
Abolfazl Ghadiry,
Assistant Professor of Orthopedic Surgery, Orthopedic Research Center, Mazandaran University of Medical Sciences, Sari, Iran.
Email:
abolfazl_ghadiry_70@yahoo.com
ORCID:
0000-0002-8244-0434

Citation:
Shirdel SS, Taheri S, Ghadiry A, Daryaee M. Adjunctive Cerclage in Subtrochanteric Femur Fractures Treated With Long Cephalomedullary Nailing: A Narrative Review. Tabari Biomed Stu Res J. 2025;7(4): 26-36 .

ABSTRACT

Subtrochanteric femur fractures are challenging injuries because of the high mechanical stresses across the subtrochanteric region and the deforming forces exerted by the surrounding muscles. Long cephalomedullary nailing is commonly used for operative fixation; however, obtaining and maintaining satisfactory reduction can be difficult, particularly in displaced, spiral, long-oblique, and comminuted fracture patterns. Adjunctive cerclage wiring or cable fixation has therefore been used to facilitate reduction and restore cortical contact before nail insertion. Nevertheless, concerns remain regarding additional soft-tissue dissection, periosteal blood supply, operative time, and blood loss.

This narrative review evaluates the available evidence regarding the use of adjunctive cerclage during intramedullary fixation of subtrochanteric femur fractures. Clinical comparative studies, case series, biomechanical investigations, and previous systematic reviews were considered, with particular attention to reduction quality, fracture union, nonunion, implant-related complications, reoperation, operative parameters, and functional outcomes. Current evidence most consistently suggests that cerclage-assisted fixation improves fracture reduction and may reduce residual displacement and varus malalignment. Several studies have also reported shorter healing times or favorable union outcomes; however, evidence that cerclage reduces nonunion, implant failure, or reoperation remains less consistent. Cerclage may increase operative time and blood loss in some series, while available comparative evidence has not demonstrated a consistent increase in infection or nonunion. The potential benefit appears to be greatest in unstable fracture patterns in which satisfactory alignment and medial cortical contact cannot be achieved by closed or percutaneous reduction alone. Therefore, adjunctive cerclage should be considered a selective reduction tool rather than a routine component of every subtrochanteric fracture fixation. Further prospective studies controlling for fracture morphology and injury severity are required to determine which patients derive the greatest benefit.

Introduction

Subtrochanteric femur fractures represent a technically demanding group of proximal femoral injuries. The subtrochanteric region is subjected to considerable bending and compressive forces, while the surrounding muscles produce characteristic displacement of the fracture fragments. The proximal fragment tends to flex, abduct, and externally rotate under the influence of the iliopsoas, hip abductors, and short external rotators, whereas the distal fragment is commonly adducted and shortened. These deforming forces can make satisfactory reduction difficult to obtain and maintain during fixation (1,2).

Intramedullary and cephalomedullary nails are widely used for the operative management of subtrochanteric fractures because of their load-sharing characteristics and favorable biomechanical position close to the mechanical axis of the femur (1). Nevertheless, successful fixation depends not only on the implant itself but also on the quality of fracture reduction. Residual varus alignment, fracture-site distraction, and loss of cortical contact can create an unfavorable mechanical environment and may contribute to delayed union, nonunion, or mechanical failure (1-3).

Despite these potential advantages, cerclage remains controversial. Traditional concerns include additional surgical exposure, injury to the periosteal circulation, soft-tissue stripping, increased operative time, increased blood loss, and potential injury to nearby vascular structures. Conversely, modern cerclage techniques can be performed through a limited open or percutaneous approach with minimal periosteal dissection, and several clinical studies have not demonstrated a clear increase in nonunion or infection associated with its use (5,8,9).

More recent comparative studies and meta-analyses have shifted the focus of the debate. Rather than asking whether cerclage is universally beneficial or harmful, current evidence suggests that its value may depend on fracture morphology and the ability to obtain an acceptable reduction without it. Studies have consistently identified improved reduction as one of the principal advantages of cerclage augmentation, whereas its influence on nonunion, reoperation, implant failure, and long-term functional outcomes remains less certain (8-13).

The purpose of this narrative review is therefore to summarize the available clinical and biomechanical evidence regarding the use of adjunctive cerclage during intramedullary fixation of subtrochanteric femur fractures, with particular emphasis on long cephalomedullary nails. The review focuses on fracture reduction, union and nonunion, implant-related complications, reoperation, perioperative outcomes, and the fracture patterns in which cerclage augmentation may be most clinically useful.

A focused narrative review of the available literature was performed to evaluate adjunctive cerclage fixation in subtrochanteric femur fractures treated with intramedullary or cephalomedullary nailing. Relevant publications were identified primarily through PubMed using combinations of the following terms: "subtrochanteric fracture," "subtrochanteric femur fracture," "cerclage," "cerclage wire," "cerclage cable," "intramedullary nail," "cephalomedullary nail," "long femoral nail," "fracture reduction," "union," and "nonunion." Reference lists of relevant articles and previous reviews were also examined to identify additional studies. The final literature search was performed on February 2026

Priority was given to comparative clinical studies evaluating intramedullary fixation with and without cerclage augmentation. Non-comparative clinical series were included when they provided relevant information regarding surgical technique, fracture reduction, union, complications, or long-term outcomes. Biomechanical investigations were considered to explain the mechanical rationale for medial cortical reconstruction and cerclage augmentation. Previous systematic reviews and meta-analyses were used to place individual clinical studies within the overall body of evidence.

Studies involving adult traumatic subtrochanteric femur fractures were considered most relevant. Studies exclusively evaluating pathological, metastatic, periprosthetic, or pediatric fractures were not considered central to the review. Particular attention was given to studies using long intramedullary or cephalomedullary nails. Evidence was narratively synthesized according to reduction quality, fracture healing, nonunion, mechanical complications, reoperation, perioperative outcomes, and potential indications for cerclage use.

The Challenges of Reduction in Subtrochanteric Femur Fractures

Closed reduction is generally preferred because it minimizes additional soft-tissue disruption and preserves the biological environment of the fracture. However, acceptable closed reduction cannot always be obtained. Long-oblique, spiral, comminuted, and markedly displaced subtrochanteric fractures may remain malaligned despite traction, manipulation, and percutaneous reduction techniques. In these circumstances, limited open reduction and temporary or definitive adjunctive fixation may be necessary to obtain satisfactory alignment before the intramedullary nail is inserted (3-6).

This finding is particularly relevant in the subtrochanteric region because the mechanical success of cephalomedullary fixation depends substantially on fracture alignment. The deforming forces generated by the iliopsoas, abductors, external rotators, and adductors make persistent translation and varus malalignment common technical challenges (1). Although the intramedullary nail provides a mechanically favorable load-sharing construct, its biomechanical advantage may be compromised when substantial fracture-site displacement or varus persists after fixation. The biomechanical study by Müller et al. supported the importance of restoring the medial hinge during intramedullary fixation (2). From this perspective, the principal role of cerclage is not to replace the stability provided by the nail, but to facilitate a mechanically favorable reduction before definitive fixation.

The Rationale for Adjunctive Cerclage During Cephalomedullary Nailing

Cerclage wire or cable fixation is one technique used to facilitate reduction. Rather than functioning as the principal fixation device, cerclage is usually applied as an adjunct to restore alignment, approximate displaced cortical fragments, reconstruct medial cortical support, and maintain the reduction during nail insertion. Early clinical series using cerclage in combination with long cephalomedullary nails reported satisfactory reduction and fracture healing in selected unstable subtrochanteric fractures (4-7).

Mechanical complications are of particular concern in subtrochanteric fractures because persistent varus alignment, fracture-site distraction, and deficient medial cortical support may increase the mechanical load transferred to the intramedullary implant.

Rather, its potential mechanical benefit appears to result primarily from improvement in fracture reduction, thereby allowing the cephalomedullary nail to function in a more favorable biomechanical environment.

Residual fracture gap may also be clinically relevant. Can et al. reported substantially smaller postoperative fracture gaps in patients receiving cable fixation and found an association between greater residual gap and longer union time (17). Although this observational relationship does not establish causality, it supports the broader principle that cortical apposition and reduction quality are important determinants of healing in subtrochanteric fractures.

How Cerclage Influences Fracture Reduction and Healing

Improvement in fracture reduction was the most consistently reported potential benefit of adjunctive cerclage.

Overall, the available comparative evidence suggests that the most reproducible advantage of cerclage is improved control of fracture alignment, cortical apposition, and residual displacement, particularly when satisfactory reduction cannot be obtained or maintained using closed or percutaneous techniques alone.

The effect of cerclage on fracture healing has been evaluated in both comparative and non-comparative studies. Although concerns have traditionally been raised regarding potential disruption of periosteal blood supply, contemporary clinical evidence has not consistently demonstrated impaired healing with limited-open or percutaneous cerclage techniques.

Taken together, the current literature suggests that cerclage may be associated with faster fracture healing in selected populations. However, the available evidence remains insufficient to conclude that adjunctive cerclage consistently prevents nonunion.

The importance of reduction quality may also explain the reported association between cerclage and faster fracture healing. Several clinical series have demonstrated satisfactory union following cerclage-assisted long cephalomedullary nailing (3,5,7). Kilinc et al., for example, reported complete union in 52 patients treated with long proximal femoral nails and cerclage, with a mean union time of 3.8 months (7). However, the absence of a control group in that study limits conclusions regarding comparative effectiveness. More importantly, comparative studies and pooled analyses have suggested shorter union times in cerclage-treated groups (14-19). This benefit is biologically plausible if cerclage improves cortical contact and reduces fracture-site gap, thereby improving the mechanical environment for secondary bone healing.

Clinical Evidence Supporting Cerclage-Assisted Fixation

The available literature consisted predominantly of retrospective comparative studies, supplemented by non-comparative clinical series, biomechanical investigations, and systematic reviews. Considerable heterogeneity was present among the studies with regard to fracture classification, patient age, nail design, cerclage technique, and outcome definitions. Moreover, cerclage was frequently used selectively in more displaced, unstable, or difficult-to-reduce fractures, introducing an important risk of confounding by indication. The principal comparative studies evaluating cerclage-assisted intramedullary fixation are summarized in Table 1.

Hoskins et al. evaluated subtrochanteric fractures treated with intramedullary fixation and reported improved reduction parameters in patients in whom cerclage was used as an adjunct (4). Their findings suggested that cerclage could assist in restoring alignment when satisfactory closed reduction was difficult to achieve.

Codesido et al. compared closed reduction with open reduction and cerclage wiring in elderly patients undergoing intramedullary fixation of subtrochanteric fractures. The cerclage group demonstrated better reduction quality, although the operative procedure required additional surgical exposure and operative time (6). These findings supported the use of limited open reduction when closed techniques left substantial displacement or malalignment.

Trikha et al. similarly evaluated percutaneous cerclage wiring in difficult subtrochanteric fracture patterns and reported that cerclage facilitated satisfactory reduction, particularly in long-oblique, spiral, and comminuted configurations in which maintenance of alignment was difficult (8).

At the pooled level, the meta-analysis by Hantouly et al. also supported an advantage of cerclage-assisted fixation in reduction-related outcomes, although the included studies were heterogeneous and included both subtrochanteric and reverse-oblique intertrochanteric fractures (14).

More recent studies have provided additional support for a fracture-pattern-specific approach. Bei et al. evaluated subtrochanteric fractures treated using long INTERTAN nails and reported more favorable reduction-related outcomes with titanium cable cerclage, including better maintenance of alignment (15). Guo et al., focusing specifically on irreducible spiral subtrochanteric fractures, reported a higher rate of anatomical reduction in the cerclage group (16).

Can et al. further highlighted the importance of cortical apposition. In their cohort of subtrochanteric fractures treated with cephalomedullary nails, patients receiving cable augmentation had smaller residual fracture gaps than those treated without cable fixation, and greater residual fracture gap was associated with longer time to union (17).

Kilinc et al. reported 52 patients treated with long proximal femoral nails and cerclage fixation. Complete union was observed in all patients, with a mean union time of approximately 3.8 months (7). However, because this study did not include a non-cerclage control group, the findings demonstrate the feasibility of satisfactory healing with cerclage rather than superiority over intramedullary nailing alone.

Comparative studies have provided more informative evidence. Guo et al. reported shorter union time and a lower nonunion rate in patients with irreducible spiral subtrochanteric fractures treated with cerclage-assisted intramedullary nailing (16). Similarly, Can et al. reported shorter union times in patients receiving cable fixation and demonstrated an association between residual fracture gap and prolonged healing (17).

The updated systematic review and meta-analysis by Oun et al. found a favorable effect of cerclage on time to union while failing to demonstrate a statistically significant difference in the overall incidence of nonunion between cerclage and non-cerclage groups (18).

Cai et al. subsequently evaluated Seinsheimer type III subtrochanteric fractures and reported a shorter mean healing time in patients treated with limited open reduction and steel cable cerclage compared with intramedullary nailing alone (19). These findings suggest that any improvement in healing may be mediated primarily through better reduction and cortical contact rather than through a direct biological effect of cerclage.

Mehta et al. evaluated outcomes of intramedullary nailing according to fracture morphology and reduction technique. In more unstable fracture configurations, patients treated with closed reduction alone experienced a greater frequency of mechanical complications and unplanned return to the operating theatre, whereas open reduction with cerclage was associated with more favorable radiographic healing in the most unstable subgroup (9).

Fauconnier et al. reported that cerclage use was associated with less residual displacement without a significant increase in reoperation or infection (10). These findings suggest that improved reduction does not necessarily occur at the expense of an increased revision burden.

Nevertheless, pooled evidence has not demonstrated a uniform reduction in mechanical complications. Oun et al. did not identify a consistent significant advantage of cerclage with regard to major outcomes such as implant failure, infection, or mortality (18). Therefore, cerclage should not be regarded as a technique that universally prevents mechanical failure.

Codesido et al. reported favorable quality-of-life and social-function outcomes in patients treated with open reduction and cerclage compared with closed reduction (6). However, because treatment allocation was not randomized, these findings should be interpreted cautiously.

Kilinc et al. evaluated long-term mobility and lower-extremity function following long proximal femoral nailing with cerclage. Although satisfactory long-term clinical outcomes were reported, the absence of a non-cerclage control group prevents direct attribution of these outcomes to cerclage augmentation (7).

Cai et al. reported better Harris hip scores at one and three months in the cerclage group, whereas the difference was no longer statistically significant at six months (19). This finding suggests that improved reduction and early stability may facilitate earlier functional recovery without necessarily producing a persistent long-term functional advantage.

Overall, current evidence does not provide strong support for superior long-term functional outcomes with routine cerclage use. The most reproducible benefits remain related to reduction quality and, in selected studies, earlier fracture healing.

Table 1. Summary of comparative studies evaluating adjunctive cerclage in subtrochanteric femur fractures treated with intramedullary fixation

Study	Design / N	Groups	Implant / fracture pattern	Main findings
Hoskins et al., 2015 (4)	Retrospective / 134	Cerclage vs no cerclage	IM fixation / subtrochanteric fractures	Better reduction with cerclage; no clear reduction in major complications.
Codesido et al., 2017 (6)	Prospective cohort / 90	30 cerclage vs 60 closed	Cephalomedullary nail / elderly fragility fractures	Better reduction and HRQoL; longer operative time; no significant difference in mortality or orthopedic complications.
Trikha et al., 2018 (8)	Retrospective / 48	21 cerclage vs 27 no cerclage	IM nail / long-oblique, spiral, comminuted fractures	Cerclage improved reduction in difficult patterns; operative time and blood loss were higher.
Mehta et al., 2019 (9)	Retrospective / 141	Open + cerclage vs closed	PFNA / Type I–III subtrochanteric fractures	In unstable fractures, fewer mechanical complications and better radiographic healing with cerclage-assisted open reduction.
Fauconnier et al., 2020 (10)	Retrospective / 115	23 cerclage vs 92 no cerclage	IM nail / subtrochanteric fractures	Less residual displacement; no significant increase in reoperation or infection; longer surgery.
Rehme et al., 2021 (11)	Retrospective / 260	72 cerclage vs 188 no cerclage	Cephalomedullary nail / trochanteric-subtrochanteric fractures	Similar radiographic healing; functional outcome favored cerclage in available follow-up; strong selection bias.
Liu et al., 2022 (12)	Retrospective / 68	27 cerclage vs 41 clamp/closed	IM nail / unstable subtrochanteric fractures	Better reduction and medial support with cerclage; differences reported in operative and union time.
Bei et al., 2024 (15)	Retrospective / 68	41 cerclage vs 27 no cerclage	Long INTERTAN / failed closed reduction	Better reduction and less varus loss; greater blood loss; no significant difference in final Harris score.
Guo et al., 2024 (16)	Retrospective / 69	34 cerclage vs 35 no cerclage	IM nail / irreducible spiral fractures	Higher anatomical reduction rate, shorter union time, and lower nonunion with cerclage.
Can et al., 2025 (17)	Retrospective / 75	No cable vs 1–2 vs 3–4 cables	Cephalomedullary nail / subtrochanteric fractures	Smaller residual fracture gap and shorter union time with cable augmentation.
Cai et al., 2025 (19)	Retrospective / 60	30 cerclage vs 30 no cerclage	IM nail / Seinsheimer III fractures	Shorter healing time and better early functional recovery; complication rate not significantly different.

When Is Cerclage Most Useful?

Another important observation is that the effect of cerclage may depend on fracture morphology. Guo et al. specifically investigated irreducible spiral fractures and demonstrated favorable outcomes with cerclage augmentation (16). Cai et al. focused on Seinsheimer type III fractures and reported shorter healing time and better early functional recovery with cable-assisted fixation (19). Bei et al. studied patients treated with long INTERTAN nails and found favorable reduction-related outcomes and less loss of varus alignment with cable augmentation (15). These studies support a selective rather than routine approach to cerclage use.

Taken together, current evidence does not support routine cerclage application in every subtrochanteric fracture. When acceptable reduction can be achieved and maintained using closed or minimally invasive techniques, additional circumferential fixation may provide limited benefit while increasing procedural complexity. Conversely, when persistent varus, translation, fracture-site distraction, loss of medial cortical contact, or recurrent displacement during nail insertion remains despite appropriate reduction maneuvers, limited-open cerclage-assisted reduction appears to be a reasonable option.

Accordingly, the clinically relevant question may not be whether cerclage should be used in subtrochanteric fractures in general, but rather which fractures require cerclage to achieve an acceptable reduction. Based on the available evidence, difficult long-oblique and spiral fractures, selected comminuted fractures with loss of medial cortical support, and fractures that cannot be adequately reduced or maintained using closed techniques appear to represent the most rational indications. Nevertheless, this interpretation is based predominantly on retrospective evidence and should not be regarded as a definitive treatment guideline.

Balancing the Benefits and Risks of Cerclage

The improvement in reduction associated with cerclage must be balanced against the additional surgical steps required for wire or cable placement.

Codesido et al. reported a longer operative procedure in patients undergoing open reduction and cerclage compared with closed reduction (6). Fauconnier et al. also observed increased surgical duration associated with cerclage fixation (10).

Trikha et al. reported greater operative time and blood loss in patients treated with percutaneous cerclage (8). Similarly, Bei et al. reported greater intraoperative blood loss in patients receiving titanium cable augmentation despite favorable reduction-related outcomes (15).

These findings are consistent with the meta-analysis by Hantouly et al., which demonstrated increased operative time and blood loss with cerclage-assisted fixation despite advantages in reduction and healing-related outcomes (14). The updated meta-analysis by Oun et al. reached a similar overall conclusion, identifying improved reduction and shorter union time at the cost of greater operative time and blood loss (18).

Interpretation of these findings requires caution because cerclage is frequently selected for fractures that are intrinsically more difficult to reduce. Consequently, at least part of the increase in operative time and blood loss may reflect fracture complexity rather than the cerclage procedure alone.

Importantly, available comparative evidence has not demonstrated a consistent increase in infection associated with cerclage use (10,18). This suggests that limited-open or percutaneous cerclage can be performed without a major increase in infectious complications when unnecessary soft-tissue disruption and periosteal stripping are avoided.

The traditional concern regarding cerclage has focused on the possibility of compromising fracture biology through additional exposure, periosteal stripping, or disturbance of local blood supply. However, contemporary techniques generally involve limited-open or percutaneous approaches rather than extensive circumferential dissection. In the series by Kilinc et al., reduction was achieved through a small incision with blunt dissection and without deliberate periosteal stripping before cerclage application and long PFNA insertion (7). Clinical evidence has also failed to demonstrate a consistent increase in deep infection or nonunion associated with carefully performed limited-open reduction.

These findings highlight the principal trade-off associated with cerclage. Improved reduction may be obtained at the expense of additional operative manipulation.

Comparative studies and recent meta-analyses have reported greater operative time and blood loss in cerclage-treated groups (8,10,14,18). This additional burden should not be ignored, particularly in elderly or medically vulnerable patients. However, interpretation requires caution because difficult fracture patterns are likely to require longer operative times even when cerclage is not used.

Why the Current Evidence Remains Inconclusive

Nevertheless, shorter time to union should not be interpreted as proof that cerclage universally prevents nonunion. The updated meta-analysis by Oun et al. found advantages in reduction quality and healing duration but did not demonstrate a statistically significant overall reduction in nonunion (18). Individual studies have reported stronger effects in selected fracture populations. Guo et al., for example, reported improved anatomical reduction, shorter union time, and a lower nonunion rate in irreducible spiral subtrochanteric fractures treated with cerclage (16). Similarly, Panteli et al. found that anatomical reduction achieved with cerclage in fractures requiring open reduction was associated with favorable healing outcomes (13). These findings suggest that the benefit of cerclage may be greatest when it corrects an otherwise unacceptable mechanical reduction.

An important consideration in interpreting the available literature is confounding by indication. Cerclage is rarely applied randomly. Surgeons are more likely to use it in displaced, comminuted, long-oblique, spiral, or otherwise difficult-to-reduce fractures. Consequently, patients in cerclage groups may initially have more mechanically challenging injuries than those successfully managed with closed reduction. Rehme et al. demonstrated this issue, as cerclage was used disproportionately in more complex fracture configurations (11). This selection bias makes simple comparisons of complication rates between cerclage and non-cerclage groups difficult to interpret and represents one of the major limitations of the current evidence.

Functional outcomes remain less certain. Some studies have demonstrated better early or intermediate functional scores following cerclage-assisted reduction (6,11,19), whereas differences at later follow-up have not always persisted. Cai et al., for example, reported better early Harris hip scores in the cerclage group, while the difference was no longer statistically significant at six months (19). Therefore, the available evidence is stronger for radiographic reduction and healing-related outcomes than for a sustained long-term functional advantage.

Several limitations should be considered when interpreting the findings of this review. First, most clinical studies evaluating cerclage augmentation are retrospective and non-randomized. Consequently, treatment allocation is strongly influenced by fracture morphology, displacement, surgeon preference, and intraoperative reduction difficulty.

Second, substantial clinical heterogeneity exists among the published studies. Some investigations exclusively evaluate true subtrochanteric fractures, whereas others include reverse-oblique intertrochanteric or mixed trochanteric-subtrochanteric fractures. Fracture classifications, nail designs, cerclage materials, reduction techniques, and postoperative rehabilitation protocols also vary considerably.

Third, definitions of acceptable reduction, fracture union, delayed union, nonunion, and mechanical failure are not standardized across studies. Functional outcomes are similarly heterogeneous, with different scoring systems and follow-up intervals limiting meaningful direct comparisons.

Fourth, several studies reporting favorable outcomes with cerclage are uncontrolled case series. Although these studies provide useful information regarding feasibility, surgical technique, and safety, they cannot establish superiority over intramedullary nailing without cerclage.

Finally, this article is a narrative review rather than a formal systematic review. Therefore, its findings should be interpreted as a structured clinical synthesis of the available literature rather than as a quantitative estimate of treatment effect. Future prospective comparative studies should stratify patients according to fracture morphology, use standardized criteria for reduction and union, and report both radiographic and patient-reported functional outcomes.

Practical Considerations for Selective Cerclage Use

A selective intraoperative strategy is appropriate. Closed and percutaneous reduction maneuvers should be attempted first, with particular attention to coronal alignment, fracture-site distraction, rotation, and medial cortical contact. If persistent varus, translation, a residual gap, or recurrent displacement during nail insertion remains, limited-open cerclage-assisted reduction may be used to restore and maintain cortical apposition before definitive cephalomedullary fixation (1,7,8,17).

Cerclage should be passed with careful protection of the surrounding soft tissues and kept close to bone. Extensive circumferential periosteal stripping should be avoided, and the wire or cable should be positioned so that it does not obstruct nail passage or create unintended fragment displacement. The number and location of cerclages should be determined by fracture morphology rather than applied routinely. In elderly or medically vulnerable patients, the expected reduction benefit should be weighed against additional operative time and blood loss (8,10,14,18).

Current Knowledge Gaps and Future Directions

The most important knowledge gap is the absence of adequately powered prospective comparative trials that stratify patients by fracture morphology and preoperative reduction difficulty. Existing studies use heterogeneous definitions of acceptable reduction, union, nonunion, and mechanical failure, which limits cross-study comparison and prevents precise fracture-specific indications from being established (14,18).

Future studies should compare a selective cerclage algorithm with closed or percutaneous reduction alone, use standardized radiographic measures of varus, translation, cortical contact, and residual gap, and report time to union, nonunion, implant failure, reoperation, blood loss, operative time, infection, and patient-reported function. Longer follow-up and cost-effectiveness analyses are also needed to determine whether improved reduction produces durable clinical benefit.

Conclusion

Adjunctive cerclage wire or cable fixation can be a useful reduction technique in selected subtrochanteric femur fractures treated with long intramedullary or cephalomedullary nails. The most consistent advantage demonstrated in the current literature is improved fracture reduction, particularly with respect to cortical apposition, residual displacement, and varus alignment. Some studies and pooled analyses also suggest a shorter time to union.

Current evidence does not justify routine cerclage use in every subtrochanteric fracture, nor does it establish a consistent reduction in nonunion, implant failure, reoperation, or long-term functional impairment. Cerclage may also increase operative time and blood loss.

Therefore, its use should be selective. When satisfactory alignment and cortical contact can be achieved and maintained using closed or minimally invasive reduction techniques, additional cerclage is generally unnecessary. In contrast, adjunctive cerclage may be particularly valuable in displaced long-oblique or spiral fractures, selected comminuted patterns with deficient medial cortical support, and fractures in which acceptable reduction cannot otherwise be obtained or maintained.

Overall, the available evidence supports viewing cerclage primarily as a reduction adjunct that complements, rather than replaces, stable cephalomedullary fixation. Higher-quality prospective comparative studies are required to define fracture-specific indications and determine whether improved reduction translates into clinically meaningful long-term benefits.

Acknowledgments

The authors have no specific acknowledgments to declare.

Authorship

All authors meet the ICMJE authorship criteria.

Conflicts of interest

The authors declare that they have no conflicts of interest related to this work.

Funding

This research received no specific grant or financial support from any funding agency in the public, commercial, or not-for-profit sectors.

Disclosure of Generative AI Use

During the preparation of this work, the authors used AI to assist with language editing, and readability. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

References

1. Kasha S, Yalamanchili RK. Management of subtrochanteric fractures by nail osteosynthesis: a review of tips and tricks. Int Orthop. 2020;44(4):645-653.

2. Müller T, Topp T, Kühne CA, Gebhart G, Ruchholtz S, Zettl R. The benefit of wire cerclage stabilisation of the medial hinge in intramedullary nailing for the treatment of subtrochanteric femoral fractures: a biomechanical study. Int Orthop. 2011;35(8):1237-1243.

3. Kennedy MT, Mitra A, Hierlihy TG, Harty JA, Reidy D, Dolan M. Subtrochanteric hip fractures treated with cerclage cables and long cephalomedullary nails: a review of 17 consecutive cases over 2 years. Injury. 2011;42(11):1317-1321.

4. Hoskins W, Bingham R, Joseph S, Liew D, Love D, Bucknill A, et al. Subtrochanteric fracture: the effect of cerclage wire on fracture reduction and outcome. Injury. 2015;46(10):1992-1995.

5. Persiani P, Noia G, de Cristo C, Graci J, Gurzì MD, Villani C. A study of 44 patients with subtrochanteric fractures treated using long nail and cerclage cables. Musculoskelet Surg. 2015;99(3):225-230.

6. Codesido P, Mejía A, Riego J, Ojeda-Thies C. Subtrochanteric fractures in elderly people treated with intramedullary fixation: quality of life and complications following open reduction and cerclage wiring versus closed reduction. Arch Orthop Trauma Surg. 2017;137(8):1077-1085.

7. Kilinc BE, Oc Y, Kara A, Erturer RE. The effect of the cerclage wire in the treatment of subtrochanteric femur fracture with the long proximal femoral nail: a review of 52 cases. Int J Surg. 2018;56:250-255.

8. Trikha V, Das S, Agrawal P, M A, Kumar Dhaka S. Role of percutaneous cerclage wire in the management of subtrochanteric fractures treated with intramedullary nails. Chin J Traumatol. 2018;21(1):42-49.

9. Mehta NJ, Goldsmith T, Lacey A, Reddy G, Selvaratnam V, Ramakrishnan M. Outcomes of intramedullary nailing with cerclage wiring in subtrochanteric femoral fractures. Strategies Trauma Limb Reconstr. 2019;14(1):29-33.

10. Fauconnier S, Van Lieshout M, Victor J. Evaluation of cerclage wiring in the treatment of subtrochanteric fractures. Acta Orthop Belg. 2020;86(1):28-32.

11. Rehme J, Woltmann A, Brand A, von Rüden C. Does auxiliary cerclage wiring provide intrinsic stability in cephalomedullary nailing of trochanteric and subtrochanteric fractures? Int Orthop. 2021;45(5):1329-1336.

12. Liu D, Liu HZ, Ma ML, Zhou N, Wang H. The clinical efficacy of minimally invasive clamp-assisted reduction and open reduction with wire cerclage for unstable subtrochanteric fractures. J Healthc Eng. 2022;2022:5340504.

13. Panteli M, Vun JSH, West RM, Howard AJ, Pountos I, Giannoudis PV. Management of subtrochanteric femur fractures: is open reduction associated with poor outcomes? Eur J Trauma Emerg Surg. 2022;48(3):1759-1768.

14. Hantouly AT, Salameh M, Toubasi AA, Salman LA, Alzobi O, Ahmed AF, et al. The role of cerclage wiring in the management of subtrochanteric and reverse oblique intertrochanteric fractures: a meta-analysis of comparative studies. Eur J Orthop Surg Traumatol. 2023;33(4):739-749.

15. Bei M, Xiao Y, Xu Y, Chen Y, Cao Q, Zhao C, et al. Enhanced outcomes in femoral subtrochanteric fractures using long INTERTAN nails with titanium cable cerclage: a retrospective analysis. Med Sci Monit. 2024;30:e944383.

16. Guo YH, Song ZL, Zheng HY, Gao J, Lin YY, Liu

Z, et al. Intramedullary nailing for irreducible spiral subtrochanteric fractures: a comparison of cerclage and non-cerclage wiring. Chin J Traumatol. 2024;27(5):305-310.

17. Can Fİ, Gültaç E, Kılınç RM, Kılınç CY. The effect of cable fixation on union time in subtrochanteric femur fractures treated with cephalomedullary nailing. Northwestern Med J. 2025;5(1):1-8.

18. Oun A, Abdelaziz O, Elhois IS, Al-Badaineh M, Zinhom K, Jabrieh G, et al. Intramedullary nailing with and without cerclage in subtrochanteric fractures: an updated systematic review and meta-analysis. BMC Musculoskelet Disord. 2025;26:798.

19. Cai H, He X, Zhang Z, Chen P, Wang R, Fang Q, et al. Clinical outcomes of limited open reduction and intramedullary nailing with steel cable cerclage in Seinsheimer III femoral subtrochanteric fractures. Front Med (Lausanne). 2025;12:1618583.