Role of percutaneous cerclage wire in the management of subtrochanteric fractures treated with intramedullary nails

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ABSTRACT

Purpose: Cerclage wire application has emerged as a potential therapeutic adjunct to intramedullary nailing for subtrochanteric fractures. But its popularity is plagued by the concern of possible negative effect on fracture zone biology. This study was intended to analyze the clinico-radiological outcome and complications associated with cerclage wire application.

Methods: Retrospective analysis was performed on all the subtrochanteric fractures operated with intramedullary nailing between January 2012 and January 2016. After exclusion, 48 patients were available with an average follow-up of 20.8 months. Long oblique, spiral, spiral wedge or comminuted fracture configurations with butterfly fragments were particularly considered for cerclage wire application, which was employed by percutaneous cerclage passer in 21 patients. Assessment was done in terms of operation time, blood loss, quality of reduction, neck-shaft angle, follow-up redisplacement, union time, complications, and final functional evaluation by Merle d’Aubigne-Postel score.

Results: Average operation time and blood loss were significantly higher in cerclage group (p < 0.05). However, cerclage use substantially improved quality of reduction in terms of maximum cortical displacement (p = 0.003) and fracture angulation (p = 0.045); anatomical reduction was achieved in 95.23% of cases as compared to 74.07% without cerclage. Union time was shorter, although not statistically different (p = 0.208), in cerclage group. Four patients in non-cerclage group developed non-union, 2 of them had nail breakage. No infection or any other implant related complications were reported with cerclage use.

Conclusion: Minimally-invasive cerclage wire application has proved to be beneficial for anatomical reconstruction in difficult subtrochanteric fractures, whenever applicable, without any harmful effect on fracture biology.

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Introduction

Subtrochanteric fractures continue to pose a management dilemma in Orthopaedic Traumatology. Despite recent technological advances and improvement of implant, potential risks of delayed union, nonunion, malunion, and implant failure challenge attainment of good results in these difficult fractures. The fundamental basis of these complexities is attributed to certain anatomic and mechanobiologic peculiarities of this region. Subtrochanteric area is subject to highest compressive and tensile stresses in human skeleton which threaten stability, and therefore, risk implant failure. Decreased contact area, less vascularity of cortical bone, and strong deforming muscular forces acting in this region further add to the woes. Intramedullary (IM) nailing has arguably emerged as the standard treatment methodology achieving union rate in upto 95% of cases. Fundamental tenets of managing these fractures with nails are restoration of alignment, rotation and length, and stable fixation. Various reduction techniques have evolved to combat the deforming forces, such as; percutaneous joysticking with Schanz pin, bone hook, Hoffman retractors, ball spike pusher. However, achieving and maintaining reduction by closed means is often difficult. Afsari et al recommended judicious use of minimally invasive clamp-assisted reduction during nailing; even so, fracture may 'spring open' after clamp release causing decrease bone-to-bone contact, therefore, risking the
development of complications. Cerclage wiring to restore and maintain reduction has emerged lately as a reasonable adjunct to salvage difficult fracture pattern. Although, the concept of cerclage wiring of fracture is not new, its potential application in periprosthetic and complex femoral fracture has been encouraging.\textsuperscript{5,7} Debate is still on as to the risk of violating the principle of biologic internal fixation in case of cerclage use. However, favourable reports in literature of cerclage use in subtrochanteric fractures are a portent of its usefulness.\textsuperscript{5-12}

Against this backdrop, we intended to study the critical role of minimally invasive cerclage wire application in difficult subtrochanteric fractures, with particular emphasis on clinicoradiological outcome, and complications as compared to fractures managed without cerclage wiring.

**Materials and methods**

All subtrochanteric fractures operated in our level I trauma centre between January 2012 and January 2016 were retrospectively evaluated. Ethical clearance was obtained before initiating the study from Institutional Review Board. One hundred and ten patients were traced during the stipulated time frame. Fractures were classified according to the AO/OTA classification.\textsuperscript{13} Patients aged <75 years, isolated subtrochanteric fractures of long oblique, spiral or spiral wedge, comminuted configuration were included in this study; whereas, patients with pathological fracture, segmental fracture (AO/OTA type 32 C2.1), fractures associated with biphosphonates use, type II/III open fracture, associated with other lower limb or hip fracture or previous operations around hip were excluded. We also excluded patients whose subtrochanteric fractures were operated with other implants other than IM nails. Also transverse or short oblique fractures (AO/OTA type 32 A3.1), which are not deemed amenable for cerclage wire assisted reduction, were excluded. After exclusion, we had 61 patients, among these, 13 patients were lost to follow up, and thus finally 48 patients were taken for analysis.

Upon arrival in emergency department, all patients were evaluated and managed according to the Advanced Trauma Life Support (ATLS) protocol, and were kept on upper tibial skeletal traction till the time of operation.

**Ethical approval**

Ethical approval was granted by institute review board (IEC/NP-Q3/95/2016, dated January 2nd, 2016). All procedures performed in this study involving human participants were in accordance with the ethical standard of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standard.

**Surgical procedure**

All operative procedures were performed in supine position on fracture table by different surgeons of the same unit, and statically locked cephalomedullary nails or reconstruction nails were used in all the cases. Before prepping and draping, and surgeon scrubbing, closed reduction was attempted by manual pressure under fluoroscopy. In cases where satisfactory reduction was achieved by manual pressure, operation was proceeded with standard ante-parallel manipulation. One or two cerclage wire was employed based on the fracture geometry. Percutaneous cerclage passer device (DePuySynthes\textsuperscript{5}) was used to execute the procedure without additional trauma to soft tissue envelope. This device consists of two dividable forceps with cannulation inside it for safe passage of wire. After attaining satisfactory reduction, cerclage wire was tightened around it to maintain the reduction after ensuring correct rotation, length by direct palpation of fracture site, and/or by fluoroscopic visualization. Achieving anatomic or near anatomic reduction with cerclage was found to effect satisfactory and facile execution of nailing procedure (Fig. 1). After completion of procedure, wound was washed and closed in layers without putting any drain.

**Post-operative protocol**

The day following operation, patients were made to mobilize in bed, and range-of-motion (ROM) was initiated. Depending upon the stability of reconstruction, immediate toe-touch or partial weight bearing protocol, according to operating surgeons’ discretion and within the realm of medical safety, was commenced with assistance of walker or cane for the initial 8–12 weeks; which progressed to full weight bearing after clinical and radiological confirmations of signs of progressive union.

**Follow-up and outcome evaluation**

Post-operative radiographs were evaluated for grading quality of reduction in both frontal and sagittal plane by an independent observer in radiology department. Reduction was judged based on maximum cortical displacement and angulation at fracture site on antero-posterior (AP) and lateral radiographs, which was grades as either good (both angulation <10° and maximum cortical displacement <4 mm), acceptable (either angulation <10° or maximum cortical displacement <4 mm), and poor (both angulation >10° and maximum cortical displacement ≥4 mm).\textsuperscript{12} Limb length discrepancy (LLD) was evaluated by comparing with the opposite normal limb, and/or by standing full length scanogram (>1 cm LLD was considered significant). Union was defined as visible callus formation and obliteration of fracture line on ¾ cortices on both AP and lateral radiographs, and absence of pain with weight bearing. Neck-shaft angle was measured on post-operative radiograph and compared with the uninjured hip. Reduction was judged to be a varus malreduction when the angle of uninjured hip was ≥5° compared to the operated hip.\textsuperscript{14} All patients were called telephonically or by letter for final follow-up evaluation in the outpatient department. At last follow-up, variables evaluated were patients’ mobility status, gait, activity of daily living, resumption of pre-injury activity level, need for any assistive device, nonunion, malunion, subsequent displacement of fracture reduction from immediate post-operative position (>5 mm was considered significant), implant failure and other implant related complications (screw cut-out, breakage, or pull-out), infection, and reoperation. Functional outcome assessment was done by modified Merle d’Aubigne-Postel scoring system.\textsuperscript{15,16}

**Statistical analysis**

Statistical assessment was performed using SPSS v16 software. Continuous data were summarized as mean and standard deviation (SD), or median and range; whereas categorical data were summarized as frequencies and percentage. Comparison among
Fig. 1. Pre-operative radiograph (A) in a 50 year-old-lady following fall from height. Cerclage wire assisted reduction was performed through a small lateral incision by percutaneous cerclage passer device (DepuySynthes®). It consists of two dividable forceps which is passed ventral and dorsal to the fracture, and clamped outside. SS wire is passed through the cannulation inside the forceps (B). Reduction achieved and cerclage loop was tightened around the fracture (C). Anatomic reduction facilitated accurate localization of entry portal (D, E) for intramedullary (IM) nailing. Head-neck screw was inserted through the same incision (F). Post-operative antero-posterior (AP) and lateral radiographs (G) showing stable anatomical reduction.
categorical variables was performed using Chi-Square test; for continuous data, independent t-test was used if variables were normally distributed, otherwise Mann-Whitney test was employed. Statistical significance was set as p value < 0.05.

Results

Complete clinical and radiologic follow-up for an average of 20.8 months (range 13–32 months) were available of 48 patients; 27 of whom were operated without the use of cerclage wire, and the rest 21 patients with one or two cerclage wires depending on the fracture configuration. Overall, there were no statistically significant differences as to the baseline demographic factors between the two groups (Table 1). Patients were operated after a median delay of 2 days. Mean operation time was found to be significantly longer in cerclage group (104.47 ± 14.53 min vs 87.59 ± 18.77 min; p = 0.001); likewise, significantly higher blood loss was encountered in patients operated with application of wires (median blood loss 200 ml vs 150 ml; p = 0.004). Application of cerclage wire significantly affected the quality of reduction achieved in terms of maximum cortical displacement and fracture angulation (p value 0.003 and 0.045 respectively). Twenty patients (95.23%) were adjudged to have achieved post-operative good reduction, and 1 patient (4.76%) had acceptable reduction in cerclage group (Figs. 2 and 3). Whereas, 20 patients (74.07%) had good reduction, 3 (11.11%) acceptable reduction, and rest 4 patients (14.81%) had demonstrated poor reduction without cerclage. Overall, 44 patients were adjudged to have healed satisfactorily; however, after carefully scrutinizing patients’ files and regular follow-up radiological records, it was found that mean union time was shorter in cerclage group (17.14 ± 3.29 weeks vs 18.15 ± 2.13 weeks), albeit there was no statistically significant difference (p = 0.208). Mean baseline neck-shaft angle of the uninjured hip was 135.92° ± 22.8° and 135.28° ± 16.4°; follow-up neck-shaft angle of the operated hip was 133.02° ± 3.68° and 134.4° ± 2.39°, in non-cerclage and cerclage group respectively. Comparison of differences between uninjured and operated hip neck-shaft angle was found to be favourble in cerclage group (p = 0.011). Varus reduction (>5°) was observed in 6 (22.22%) patients in non-cerclage group, 2 of them had uneventful union; whereas, 1 patient (4.76%) operated with cerclage wire showed varus reduction, albeit, that patient had uneventful fracture union.

Complication

Four (14.81%) patients developed non-union in non-cerclage group, 2 (7.41%) of them had presented with nail breakage one year after operation; in both the patients nail failed at its weak point below the site of head-neck lag screw insertion. Two of them were operated with autogenous iliac crest bone grafting alone; for the other 2 patients with implant failure, nail removal and fixation with angled-blade plate, and autogenous iliac crest bone grafting was done. On the contrary, only 1 patient in cerclage group demonstrated clinical and radiologic signs of delayed-union; dynamization of nail was done after 3 months, and after 6 months of index operation, this patient was found to have union. No significant fracture re-displacement or implant related complications were seen in cerclage group. Higher frequency of LLD (>1 cm) was also noted in non-cerclage group; 4 (14.81%) patients vs 1 (4.76%) patient. None of the patients developed superficial or deep infection, wound related or any other implant related complications. No complications were also noticed during passage of wire. Apart from these complications, most of the patients were able to ambulate independently, and returned to their preinjury activity level except for few older patients aged >70 years old, who continued to used support of cane or crutch during ambulation. At final follow-up, average Merle d’Aubigné-Postel was 15.15 and 16.85 in non-cerclage and cerclage group respectively. Perioperative data and results are summarized in Table 2.

Discussion

Better understanding of anatomical and mechano-biological attributes have led to improved treatment paradigm in subtrochanteric fractures; however, it is apparent that closed reduction with nailing alone might not be the optimal option in every case; failure to achieve and maintain close bone-to-bone contact, and more importantly medial cortical continuity, might lead to sinister complications. Shukla et al noted that malreduced fracture with persistence of varus deformity increases the chance of non-union and implant fatigue fracture, and increases post-operative hospital stay. The statistics that only 21% patients with varus reduction returned to their pre-op mobility status as compared to 60% in the neutral group is quite alarming.

In a bid to optimize outcome, there has been renewed interest in the use of cerclage wire or cable in difficult subtrochanteric fractures. Apart from its excellent ability to anatomically reduce the fracture, it increases the overall construct stability and strength, and minimizes fixation failure. Fracture reduction before starting nailing procedure helps substantially to accurately localize the starting point of nail, which is of paramount importance. Furthermore, it is postulated to have added benefit of substantial reduction of radiation exposure to surgeons. Biomechanical study by Müller et al noted that additional wire cerclage significantly reduced osteosynthesis failure (100 vs 10%) after IM nailing of subtrochanteric fractures (p = 0.037). The beneficial effect is attributed to the preservation and maintenance of biomechanically important medial cortical buttress by cerclage in complex fractures, which facilitate fracture healing. Our observations also underscore the benefits of wire cerclage; anatomic reduction was achieved in 95.23% of cases as opposed to 74.07% without cerclage use. Additional cerclage wire application significantly outperformed non-cerclage group in terms of maximum cortical displacement and fracture angulation (p < 0.05). Higher frequency of varus reduction were reported without cerclage wire (22.22% vs 4.76%), and 2 (7.41%) patients in non-cerclage group presented with implant failure, whereas none of the patients had any implant related complications in cerclage group. Much of the controversies about the use of cerclage wire use stem from the concern of its plausible effect on fracture zone vitality. At a time, when contemporary fracture treatment has entered the era of indirect reduction and “biological internal fixation”, cerclage use raises the lingering question as to whether it is worthy to compromise biology to achieve anatomic reduction.

### Table 1
Baseline demographic characteristics of study patients.

| Variables                              | Non-cerclage | Cerclage | p value |
|----------------------------------------|--------------|----------|---------|
| Age (mean ± SD) in years               | 50.52 ± 18.03| 49.19 ± 18.16| 0.80    |
| Sex (%)                                |              |          |         |
| Male                                   | 14 (51.85)   | 9 (42.85) | 0.57    |
| Female                                 | 13 (48.14)   | 12 (57.14)|         |
| Fracture classification (%)            |              |          |         |
| 32 A1.1                                | 5 (18.51)    | 10 (47.61)| 0.40    |
| 32 A2.1                                | 6 (22.22)    | 2 (9.52)  |         |
| 32 B1.1                                | 7 (25.92)    | 10 (47.61)|         |
| 32 C1.1                                | 9 (33.33)    | 5 (23.8)  |         |
| Neck-shaft angle of the uninjured hip (mean ± SD, °) | 135.92 ± 2.28 | 135.28 ± 1.64 | 0.28 |

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Earlier it was argued that cerclage use could possibly devitalize bone fragments by strangulating blood supply and prevent extension of periosteal callus. However, histological studies have put forth that multiple vessels nourishes the osteoperiosteal layer in circumferential fashion, rather than the old belief of being in longitudinal direction; hence one or two well spaced cerclage wire/cable would have minimal effect on blood circulation. In support of this, recent experimental and cadaveric studies did not find any deleterious effect of cerclage on bone blood supply. Kennedy et al had cautioned against overzealous use of cerclage cable, as they observed 1 nonunion in their series of 17 patients, where 4 cables were used. Our results are also in close agreement to those previously reported (Table 3). Union time, albeit not statistically significant, was shorter in cerclage group ($17.14 \pm 3.29$ weeks vs $18.15 \pm 2.13$ weeks; $p = 0.208$); it is speculated that better fracture reduction accorded by cerclage use seemed to facilitate fracture healing.

Fig. 2. Pre-operative radiographs in a 26-year-old male following road traffic accident (A). Percutaneous cerclage wire assisted reduction and IM nailing was performed (B). AP and lateral radiographs (C, D) one and half years post-operatively depicting satisfactory fracture reduction, and alignment with complete bony healing.
healing. Only 1 delayed union was observed in a case of comminuted subtrochanteric fracture operated with cerclage use, which later healed uneventfully following dynamization of the nail; whereas, 4 (14.81%) patients in non-cerclage group developed non-union. We had used percutaneous cerclage passer (DepuySynthes®) for all patients without directly visualizing the fracture and additional soft-tissue or periosteal stripping, and employed one or maximum two cerclage wire depending on fracture geometry. Moreover, in most of the patients we were able to apply wire through the same incision for proposed head-neck implant, or by slightly prolonging it (Fig. 1). We feel that the success in our series is because of our endeavour to respect fracture biology.

One potential pitfall with cerclage use is that, it increases operation time and blood loss; significantly higher average operation time.

Table 2
Summarized depiction of perioperative data and results.

| Parameters                                      | Non-cerclage group | Cerclage group       | p value |
|-------------------------------------------------|--------------------|----------------------|---------|
| Delay of operation (range, d)                   | 2 (0–5)            | 2 (0–6)              | 0.9     |
| OT time (SD, min)                               | 87.59 (18.77)      | 104.47 (14.53)       | 0.001   |
| Blood loss (range, ml)                          | 150 (100–350)      | 200 (150–360)        | 0.004   |
| Maximum cortical displacement (range, mm)       | 3.5 (0–8)          | 1.5 (0–5)            | 0.003   |
| Angulation (range, °)                           | 5 (0–12)           | 1 (0–10)             | 0.045   |
| Reduction (%) Good                              | 20 (74.07)         | 20 (95.23)           | 0.11    |
| Acceptable                                      | 3 (11.11)          | 1 (4.76)             |         |
| Poor                                            | 4 (14.81)          |                      |         |
| Neck-shaft angle                                | 133.02 (3.68)      | 134.4 (2.39)         | 0.14    |
| Neck-shaft angle of operated hip (SD, °)        | 1.0 (0–10)         | 1.0 (0–8)            | 0.011   |
| Varus reduction (>5%, %)                        | 6 (22.22)          | 1 (4.76)             | 0.11    |
| Redisplacement at follow-up (>5 mm, %)          | 4 (14.81)          | 1 (4.76)             |         |
| LLD (>1 cm, %)                                  | 4 (14.81)          |                      |         |
| Union time (SD, week)                           | 18.15 (2.13)       | 17.14 (3.29)         | 0.208   |
| Reoperation                                      | Bone grafting in 2 patients; broken nail removal and angle-blade plate insertion with bone grafting in 2 patients. | Dynamoization of nail in 1 patient |
| Mean Merle D’aubigne score (SD)                 | 15.15 (3.13)       | 16.85 (1.01)         | 0.02    |

LLD, Limb length discrepancy.

a data presented as median value and range.

b data presented as mean value ± SD.

Fig. 3. 32-year-old man sustained subtrochanteric femur fracture following fall from height (A). Post-operative radiographs (B, C) after cephalomedullary nailing with additional cerclage wire showing anatomic reduction and stable construct. Two years Post-operative radiographs revealing uneventful healing of fracture in satisfactory alignment (D, E). Patient regained excellent function and resumed pre-injury activity level (F, G).
injury is there during the passage of cerclage wire. We did not experience with this technique, these operative variable could method for cerclage. It is argued that cable technology is stronger, percutaneous cerclage passer device is valuable in this regard as it stripping and increase surgery time might increase the risk of hardware and underlying bone, thereby reducing interference with osteo-periosteal vascular supply; at the same time it provides different wire diameters, is purported to reduce biological impact on bone as it is postulated to decrease contact area between

Table 3

| Study                | Patients and methods                                                                 | Results                                                                 | Complications                                                                 | Comment                                                                 |
|----------------------|--------------------------------------------------------------------------------------|------------------------------------------------------------------------|------------------------------------------------------------------------------|------------------------------------------------------------------------|
| Kennedy MT et al5   | 17 patients; Dall Miles cables were used; average 18 months follow-up                | 15 united; no cases of malunion; average score of LEFS 48.2             | One nonunion, required second procedure of bone grafting.                    | They argued against overzealous use of cerclage cable, and advised just one, or a maximum of two. Cerclage use is not harmful; no apparent increase in reoperation rate. |
| Ban I et al5         | 60; follow-up 1 year                                                                  | Anatomic reduction in 24; in 26 other patients total cortical displacement <10 mm was achieved | 6 patients sustained subsequent displacement >5 mm; 4 reoperation-one each due to deep infection, technical failure during osteosynthesis, screw cut out, and new fracture following a new fall | One case of distal locking screw fracture, 2 cases of serous discharge | Optimize greater trochanteric starting point |
| Tomas J et al10      | 12; follow-up 1 year                                                                  | All 12 cases united; no cases of LLD, varus collapse, rotational or angular deformity>5°; 92% patients regained previous level of ambulation | One patient had 1 cm shortening; no infection, malunion, nonunion, or implant related complications | In 92% patients fracture displacement <3 mm; 92% patients regained previous level of function; median Merle d’Aubigne-Postel score16.9 | |
| Kim JW et al11       | 12; follow-up minimum 1 year                                                          | All 12 healed; in 11 cases acceptable alignment was achieved; all returned to pre-injury activity level; median Merle d’Aubigne-postel score16.9 | One patient had 1 cm shortening; no infection, malunion, nonunion, or implant related complications | In 92% patients fracture displacement <3 mm; 92% patients regained previous level of function; median Merle d’Aubigne-postel score16.9 | |
| Hoskins W et al12    | 135 patients; reduction achieved closed in 69, open in 46, and open with cerclage wire in 20 patients; mean follow-up 4 months | Cerclage wire use improved fracture displacement (3.2 mm vs. 8.8 mm), angulation, and quality of reduction (p < 0.05). | No cases with a cerclage wire had returned to theatre, compared with 15.2% of cases of open reduction, and 8.8% of cases managed closed; if cerclage wire was not used the major complication rate was 11.4%. | In 92% patients fracture displacement <3 mm; 92% patients regained previous level of function; median Merle d’Aubigne-postel score16.9 | |
| Our study            | 48 patients; cerclage wire was used in 21 of them; average follow-up 20.8 months     | Improved quality of reduction with cerclage wire (anatomic reduction in 95.23% vs 74.07%); low incidence of varus reduction (4.76% vs 22.22%); shorter union time in cerclage group | 4 non-unions in non-cerclage group, 2 of them had implant failure; only 1 delayed union with cerclage wire use, which united after dynamization; no infection or any other complications associated with cerclage use. | Cerclage wire use is not detrimental; however, it increases operation time and blood loss. | |

LDD, Limb length discrepancy; LEFS, Lower Extremity Functional Scale.

(104.47 ± 14.53 vs 87.59 ± 18.77 min; p = 0.001), and blood loss (200 vs 150 ml; p = 0.004) was recorded with cerclage wire application. Mingo-Robinet et al expressed concern that more soft-tissue stripping and increase surgery time might increase the risk of infection; however, none of the patients in our series had any superficial or deep infection. Surprisingly, we had achieved shorter operation time and less blood loss when using cerclage wire compared to what was previously reported. We believe, as we gain more experience with this technique, these operative variable could be improved further. Although reportedly rare, risk of major vascular injury is there during the passage of cerclage wire. We did not experience any such complications in our series; it is presumed that percutaneous cerclage passer device is valuable in this regard as it eases satisfactory passage and prevent inadvertent trajectory of wire.

Substantial debate is ongoing as to the optimal device or method for cerclage. It is argued that cable technology is stronger, maintains better tension, and therefore, effect better performance. Of late, development of braided cerclage wire, which consists of different wire diameters, is purported to reduce biological impact on bone as it is postulated to decrease contact area between hardware and underlying bone, thereby reducing interference with osteo-periosteal vascular supply; at the same time it provides better stability. Recently a biomechanical study by Lenz et al further adds to the conundrum; they did not recommend braided wire for cerclage, and noted that cable provides better fixation strength than wire, and strength can be enhanced further by double looping the cerclage. We did not use cable and used wire cerclage in all our cases; our primary focus for cerclage use was to accomplish better fracture reduction and supplement IM nail for fixation. Prospective comparative studies could possibly elucidate the lingering issue of wire versus cable cerclage.

The main downside of our study is its retrospective nature; evaluation was based on retrospective database analysis, sample size was small, follow-up was not controlled, and possibility of underreporting of complications cannot be overlooked. However, the strength of this study lies in its comparative analysis with a cohort of patients whose fractures were operated without cerclage wire. Furthermore, we have utilized standard approach of percutaneous cerclage application, and used standard sets of measurements for assessment of fracture reduction and validated scoring system for outcome evaluation. We strive to achieve optimal reduction; henceforth we keep a low threshold for minimally invasive percutaneous clamp-assisted reduction, and/or cerclage wire application, whenever deemed applicable.

It therefore, can be concluded that properly executed and judicious use of percutaneous cerclage in difficult subtrochanteric fractures improves fracture reduction, increases construct strength, decreases complications, and has no deleterious effect on fracture healing; though it increases operation time and blood loss. Cerclage is not suitable for all subtrochanteric fractures; fractures with long oblique, spiral geometry, and spiral wedge or comminuted fracture with butterfly fragments can benefit substantially from additional cerclage application. It is critical for a surgeon to get a comprehensive pre-operative fracture evaluation and planning, and to set a balance between anatomical and biological fixation to envisage optimal outcome.

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